Savitribai Phule Pune University

(Formerly University of Pune)

First Year B.Sc. Program in Physics

(Faculty of Science & Technology)

F.Y.B.Sc. (Physics)

To be implemented from Academic Year 2024-2025

Table of Contents

Sr. No.	List of Contents	Page Number
	Abbreviations used	2
1	Introduction to Undergraduate Degree Course in Physics	3
2	Programme Duration and Exit Options	3-4
3	Programme Objectives	4
4	Programme Outcomes (PO)	4-6
5	Programme Structure (PS)	6
6	Teaching-Learning Process (TLP)	6-7
7	Assessment Methods (AM)	7
8	Scheme of Examination	8-9
List of Courses		
9	List of Discipline Specific Core (DSC) Courses (Major Core)	10-11
10	List of Discipline Specific Elective (DSE) Courses (Major Elective)	11
11	List of Vocational Skill Courses (VSC)	11
12	List of Indian Knowledge System (IKS) Courses	11
13	List of Minor (MN) Courses	12
14	List of Generic Elective (GE))/Open Elective (OE) Courses	12
15	List of Skill Enhancement Courses (SECs)	12
16	List of Value Education Courses (VEC)	13
17	List of Ability Enhance Courses (AEC)	13
18	List of Co-curricular Courses (CC)	13
Syllabus of Courses		
19	Syllabus of Discipline Specific Core (DSC) Courses (Major Core)	14-24
20	Syllabus of Generic Elective (GE))/Open Elective (OE) Courses	25-32
21	Syllabus of Skill Enhancement Courses (SECs)	33-49
22	Syllabus of Value Education Courses (VEC)	50-56
23	Syllabus of Co-curricular Courses (CC)	57

Abbreviations Used

- PO : Programme Outcomes
- PS : Programme Structure
- TLP : Teaching-Learning Process
- AM : Assessment Method
- DSC : Discipline Specific Core
- DSE : Discipline Specific Elective
- OE : Generic Electives
- OP : Open Electives
- VSC : Vocational Skill Courses
- SEC : Skill Enhancement Courses
- VSC* : Vocational Skill Courses
  (Can be given as advanced practical course related to major)
- AEC : Ability Enhancement Courses
- IKS : Indian Knowledge System
- VEC : Value Education Courses

- OJT : On Job Training (Internship/ Apprenticeship)
- FP : Field projects
- CEP : Community engagement and service
- CC : Co-curricular Courses
- RM : Research Methodology
- RP : Research Project

1) Introduction to Undergraduate Degree Course in Physics:

As per the recommendations of UGC-F-2022, the undergraduate (UG) degree course in Physics is a 6-semester course spread over 3-academic years **OR** 8-semester course spread over 4-academic years. The Teaching Learning Process (TLP) is students' centric. It involves both theory and practical components. It offers a flexibility of programme structure while ensuring that the student gets a strong foundation in the subject and gains in-depth knowledge. Besides the DSCs (Major Core), a student has options courses from the syllabus comprising of DSEs (Electives), Minor, OE/GEs, SECs, AECs, RPs, RMs, OJT, FP, CEP, IKSs, VECs, CCs and VSCs. Hence, this will be bring out the interdisciplinary as well as multidisciplinary approach and adherence to innovative ways within the curriculum framework. It also allow a students' maximum flexibility in pursuing his/her studies at the undergraduate (UG) level to the extent of having the liberty to eventually design the degree with multiple exit options. Students have these exits options depending upon the needs and aspirations of the student in terms of his/her goals of life, without compromising on the teaching learning, both in qualitative and quantitative terms. This will suit the present day needs of students in terms of securing their paths towards higher studies or employment.

2) Programme Duration and Exit Options:

The minimum credit to be earned by a student per semester is 18-credits and the maximum is 26 credits. However, students are advised to earn 22-credits per semester. This provision is meant to provide students the comfort of the flexibility of semester-wise academic load and to learn at his/her own pace. However, the mandatory number of credits which have to be secured for the purpose of award of Undergraduate Certificate/Undergraduate Diploma/Appropriate Bachelor's Degree in Physics are listed in Table-1.

Table-1: List of award of Undergraduate Certificate/ Undergraduate Diploma/Appropriate Bachelor's Degree in Physics

S. No.	Type of Award	Stage of Exit	Mandatory Credits to be Secured for the Award
1	Undergraduate Certificate in Physics	After successful completion of Semester II	**44** and an additional 4 credits core NSQF Course/Internship
2	Undergraduate Diploma in Physics	After successful completion of Semester IV	**88** and an additional 4 credits core NSQF Course/Internship
3	Bachelor of Science Physics	After successful completion of Semester VI	**132**
4	Bachelor of Science Physics (Honours)	After successful completion of Semester VIII	**176**
5	Bachelor of Science Physics (Honours with Research)	After successful completion of Semester VIII with minimum 28 GE credits in Discipline-2 (Minor)	**176**

a) Major Discipline (Physics) : A student pursuing four-year undergraduate programme in Physics (Core course) shall be awarded B.Sc. Honours degree with Major in Physics on completion of VIII Semester, if he/she secures in Physics at least 50% of the total credits i.e., at least 88 credits in Physics out of the total of 176 credits. He/she shall study 20 DSCs and at least 2 DSEs of Physics in eight semesters.

b) Minor Discipline (Discipline-2): A student of B.Sc. (Hons.) Physics may be awarded Minor in a discipline, other than Physics, on completion of VIII Semester, if he/she earns minimum 28 credits from seven GE courses of that discipline

3) Programme Objectives :

The undergraduate (UG) degree course in Physics aims to provide:

a) Knowledge and skills to undertake higher studies/research in physics and related interdisciplinary areas thereby enabling students' employment/entrepreneurship.
b) Critical and analytical thinking, scientific reasoning, problem-solving skills, communication skills and teamwork.
c) Competence and skill in solving both theoretical and applied physics problems.
d) In-depth knowledge in physics through understanding of key physical concepts, principles, theories and their manifestations.
e) Exposure to the latest advances in physics, allied disciplines and research.
f) A conducive learning environment to ensure cognitive development of students.
g) Sufficient subject matter competence and enable students to prepare for various competitive examinations such as UGC-CSIR NET/JRF, GATE, GRE, IIT-JAM, and Civil Services Examinations.
h) Moral and ethical awareness, leadership qualities, innovation and life-long learning.
i) Multicultural competence and multilinguism.

4) Program Outcomes :

Physics program outcomes aim to produce physics graduates with a strong foundation in physical principles, scientific inquiry, critical thinking, and problem-solving, as well as effective communication, laboratory, and research skills. The learning outcomes of the undergraduate degree course in physics are as follows:

a) Role of Physics :

The students will develop awareness and appreciation for the significant role played by physics in current societal and global issues. They will be able to address and contribute to such issues through the skills and knowledge acquired during the programme. They will be able identify/mobilize appropriate resources required for a project, and managing a project through to completion, while observing responsible and ethical scientific conduct, safety and laboratory hygiene regulations and practices.

b) Physical Principles:

Understand and apply fundamental physical principles to analyze and solve problems in various contexts.

c) Research Skills :

The course provides an opportunity to students to hone their research and innovation skills through internship/apprenticeship/project/community-outreach/dissertation/Entrepreneurship/Academic-Project. It will enable the students to demonstrate mature skills in literature survey, information management skills, data

analysis, and research ethics. Physics research skill useful to design, conduct, and present original research projects, demonstrating skills in literature review, methodology, and data analysis.

d) Scientific Inquiry :

Design, conduct, and present experiments/investigations to answer scientific questions and test hypotheses.

e) Hands-on/ Laboratory Skills :

Comprehensive hands-on/ laboratory exercises/ demonstrate proficiency will impart analytical, computational and instrumentation skills. The students will be able to demonstrate mature skills for the collation, evaluation, analysis and presentation of information, ideas, concepts as well as quantitative and/or qualitative data.

f) Problem-Solving:

Apply physical principles and mathematical tools to solve complex problems in physics and related fields.

g) In-depth disciplinary knowledge :

The student will acquire comprehensive knowledge and understanding of the fundamental concepts, theoretical principles and processes in the main and allied branches of physics. The core papers will provide in-depth understanding of the subject. A wide choice of elective courses offered to the student will provide specialized understanding rooted in the core and interdisciplinary areas.

h) Interdisciplinary Approach:

Apply physical principles to understand and address challenges in other disciplines, such as engineering, biology, and environmental science.

i) Communication and IT Skills :

Various DSCs, DSEs, SECs, GEs and AECs have been designed to enhance student's ability to write methodical, logical and precise reports. The courses will, in addition, guide the student to communicate effectively through oral/poster presentations, writing laboratory/ project reports and dissertations. Several IT based papers in DSCs, DSEs, SECs and AECs will enable students to develop expertise in general and subject specific computational skills. Students can effectively communicate physical concepts, results, and ideas through written, oral, and visual means.

j) Critical and Lateral Thinking :

The programme will develop the ability to apply the underlying concepts and principles of physics and allied fields beyond the classrooms to real life applications, innovation and creativity. A student will be able to distinguish between relevant and irrelevant facts and information, discriminate between objective and biased information, apply logic to arrive at definitive conclusions, find out if conclusions are based upon sufficient evidence, derive correct quantitative results, make rational evaluations, and arrive at qualitative judgments according to established rules. Critically evaluate physical phenomena, arguments, and data to form informed conclusions.

k) Ethical Practice:

Demonstrate awareness of ethical considerations in scientific research, data management, and professional conduct.

***l*) Lifelong Learning:**

Stay up-to-date with advancements in physics and related fields, fostering a culture of continuous learning and professional development.

5) Programme Structure :

The detailed Credit framework of undergraduate degree programme in Physics is provided in Table 2.

Table-2: Credit framework of undergraduate degree programme in Physics.

Level /Difficulty	Sem	Subject-1				Subject-2	Subject-3	GE/ OE	SEC	IKS	AEC	VEC	CC	Total
4.5/100	I	2(T)+2(P)				2(T)+2(P)	2(T)+2(P)	2(T)	2(P)	2(T) Generic	2(T)	2	-	22
	II	2(T)+2(P)				2(T)+2(P)	2(T)+2(P)	2(P)	2(P)	-	2(T)	2	2	22
Exit Option: Award of UG Certificate in Major with 44 credits and an additional 4 credits core NSQF Course/Internship OR Continue with Major and Minor. **Continue Option:** Student will select one subject among the (Subject-1, Subject-2, and Subject-3) as major and another as minor and third subject will be dropped.														
Level /Difficulty	**Sem**	**Credits related to major**				**Minor**		**GE/ OE**	**SEC**	**IKS**	**AEC**	**VEC**	**CC**	**Total**
		Discipline Specific Core (DSC) **Major Core**	Discipline Specific Elective (DSE) **Major Elective**	**VSC**	**FP/ OJT /CEP**									
5.0/200	III	4(T)+2(P)	-	2(T/P)	2 (FP)	2(T)+2(P)	-	2(T)	-	2(T) Major Subject Specific	2(T)	-	2	22
	IV	4(T)+2(P)	-	2(T/P)	2(CEP)	2(T)+2(P)	-	2(P)	2(P)	-	2(T)	-	2	22
Exit Option: Award of UG Diploma in Major and Minor with 88 credits and an additional 4 credits core NSQF Course/Internship OR Continue with Major and Minor.														
5.5/300	V	8(T)+4(P)	2(T)+2(P)	2(T/P)	2 (FP/ CEP)	2(T)	-	-	-	-	-	-	-	22
	VI	8(T)+4(P)	2(T)+2(P)	2(T/P)	4(OJT)	-	-	-	-	-	-	-	-	22
Total 3 Years		44	8	8	10	18	8	8	6	4	8	4	6	132
Exit Option: Award of UG degree in Major with 132 credits OR Continue with Major and Minor.														
6.0/400	VII	6(T)+4(P)	2(T)+2(P)	-	4(RP)	4(T)(RM)	-	-	-	-	-	-	-	22
	VIII	6(T)+4(P)	2(T)+2(P)	-	8(RP)	-	-	-	-	-	-	-	-	22
Total 4 Years		64	16	8	22	22	8	8	6	4	8	4	6	132
Exit Option: Award of UG Honours with Research Degree in Major and Minor with 176 credits. **-OR-**														
6.0/400	VII	10(T)+4(P)	2(T)+2(P)	-	-	4(T)(RM)	-	-	-	-	-	-	-	22
	VIII	10(T)+4(P)	2(T)+2(P)	-	4(OJT)	-	-	-	-	-	-	-	-	22
Total 4 Years		72	16	8	14	22	8	8	6	4	8	4	6	132
Exit Option: Award of UG Honours Degree in Major and Minor with 176 credits.														

6) Teaching-Learning Process :

a) The undergraduate programme in Physics is designed to provide students with a sound theoretical background, practical training in all aspects of physics and research.
b) It will help them develop an appreciation of the importance of physics in different contexts.
c) The programme includes foundational as well as in-depth courses that span the traditional sub disciplines of physics.
d) Along with the DSCs there are DSEs, GEs, SECs, AECs and VACs which address the need of the hour.
e) Physics courses will be delivered through the conventional chalk and talk method, laboratory work, projects, case studies, field work, seminars, hands-on training/workshops in a challenging, engaging,

and inclusive manner that accommodates a variety of learning styles and ICT enabled teaching-learning tools (PowerPoint presentations, audio visual resources, e-resources, models, software, simulations, virtual labs, etc.).

f) Students will be encouraged to carry out short term projects and participate in industrial and institutional visits and outreach programmes.

g) Students will be introduced to scientific reasoning and discovery, innovative problem-solving methodologies, online quizzes, surveys, critical analysis etc. to develop convergent and divergent thinking abilities.

h) The laboratory training complements the theoretical principles learned in the classroom and includes hands-on experience with modern instruments, computational data analysis, modelling, error estimation and laboratory safety procedures.

i) Different pedagogies such as experiential learning, participative learning, project-based learning, inquiry-based learning and ICT pedagogy integration instruction (blended and flipped learning) will be adopted wherever possible.

j) Students will be encouraged to work in groups to develop their interpersonal skills like communication and team work.

k) Students' diligent and active participation/ engagement in industrial visits / internships / academic projects / dissertations will lay a strong foundation for a successful career in academics, industry, research, entrepreneurship and community outreach.

7) Assessment Methods :

The primary objective of assessment will be to assess the learning outcomes of the course in tune with the broad outcomes of strengthening core theoretical knowledge base, practical laboratory skills, and research. Assessment will be based on continuous evaluation (MCQs, Short Questions (SQ), Class Test (CT), Seminar, Presentation (PPT), Group Discussion (GD), Quiz, Assignment, Tutorials, etc.) and end of semester examination of Savitribai Phule Pune University, Pune.

(i) Internal Assessment or Continuous Evaluation:

During a semester, students' mastery of the various learning outcomes as described in the syllabus will be assessed through MCQs, Short Questions (SQ), Class Test (CT), Seminar, Presentation (PPT), Group Discussion (GD), Quiz, Assignment, Tutorials, etc. Each theory paper and practical paper will have 15 marks for internal assessment. The critical analysis of internal assessment or continuous evaluation outcomes will provide opportunities to improve the teaching-learning process by focusing on the areas that need conceptual strengthening, laboratory exposure or design of new experiments, and research.

(ii) End of Semester University Examinations:

The summative end-semester university examinations will be conducted for both theory and practical courses. Besides internal assessment, each theory paper and each practical paper will be of 35 marks for end of semester examination of the university.

8) Scheme of Examination :

The total marks for a 2-credits course is 50.

- Theory Paper of 02 Credits:
  - o Internal Exam (15 M) + University Theory Exam (35 M) = Total 50 M
  - o Duration: For Internal exam = 40 Min. and for University Exam = 02 hours.
- Practical Paper of 2 Credits:
  - o Internal Exam (15 M) + University Practical Exam (35 M) = Total 50 M
  - o Duration: For Internal exam = 40 Min. and for University Exam = More than 04 hours.

Internal exam will be conducted by particular college/institutes at the end of each semester.

External exam will be conducted by Savitribai Phule Pune University, Pune at the end of each semester.

Note:

a) Each semester comprises of 15 weeks.
   (12 weeks Actual Teaching + 3 weeks for Continuous Internal Evaluation).

b) One Credit of the Theory is equal to15 clock hours (Teaching 1 hour per week for each credit).
   (12 hours Actual Teaching + 3 hours Continuous Internal Evaluation – Assignments, Tutorials, Practice, Problem solving sessions, Group discussion, Seminars and Unit Tests.)

c) One Credit of Practical = 30 clock hours (2 Contact hours per credit per week)
   (24 hours' Actual Table work + 6 hours for journal competition, and Continuous Internal Evaluation of each practical).

d) Practical for each course comprises of 02 Credits = 60 clock hours.
   - Minimum 12 laboratory/ Filed sessions of 04 clock hours must be conducted in one semester.
   - In case of short practical, two practical's should be conducted in one session.
   - Each practical of 04 clock hours in the laboratory should consist of table performance for concerned practical, careful observations, calculation, writing results and conclusion, and submission of practical in written form.
   - Pre-laboratory reading and post laboratory assignments should be given on each practical as a part of continuous internal evaluation.

Pattern for Internal Theory Assessment: (15 Marks)

Que-1: Choose correct option (MCQs) (10-MCQs with Multiple Options) – 5 marks

Que-2: Answer the following questions (Short answer questions) (any 5 out of 7) – 5 marks

Que-3: Answer the following questions (Short answer Definition/Problems/Diagram) (any 5 out of 7)–5 marks

Pattern for External Theory Assessment: (35 Marks)

Que-1: Answer the following questions (Short answer/Definition/Problems/Diagram, etc.) (any 5 out of 7)–**5 marks**

Que-2: A) Answer the following questions (Long answer questions) – **6 marks**

i) ----------

ii) ----------

B) Answer the following questions (Long answer questions/Problems) – **4 marks**

i) ----------

ii) ----------

Que-3: A) Answer the following questions (Long answer questions) – **6 marks**

i) ----------

ii) ----------

B) Answer the following questions (Long answer questions/Problems) – **4 marks**

i) ----------

ii) ----------

Que-4: Write a short notes on following. (any 4 out of 6) –**10 marks**

a) ----------

b) ----------

c) ----------

d) ----------

e) ----------

f) ----------

*****

List of Courses

Note: Every theory/practical subject has 2 credits.

9) List of Discipline Specific Core (DSC) Courses (Major Core)

Major Core (Semester-I) (4 Credits) (2T+2P)

Semester I

PHY-101-T : Fundamental of Physics-I
PHY 102-P : General Physics Lab-I

Major Core (Semester-II) (4 Credits) (2T+2P)

Semester II

PHY-151-T : Fundamental of Physics-II
PHY-152-P : General Physics Lab-II

Major Core (Semester-III) (6 Credits) (4T+2P)

Semester III

PHY 201 MJ : Mathematical Physics-I
PHY 202 MJ : Electronics
PHY 203 MJP : General Physics Lab-III

Major Core (Semester-IV) (6 Credits) (4T+2P)

Semester IV

PHY 251 MJ : Waves and Oscillations
PHY 252 MJ : Optics-I
PHY 253 MJP : General Physics Lab-IV

Major Core (Semester-V) (12 Credits) (8T+4P)

Semester V

PHY 301 MJ : Mathematical Physics-II
PHY 302 MJ : Solid State Physics-I
PHY 303 MJ : Electrodynamics-I
PHY 304 MJ : Classical Mechanics
PHY 305 MJP : General Physics Lab-V
PHY 306 MJP : General Physics Lab-VI

Major Core (Semester-VI) (12 Credits) (8T+4P)

Semester VI

PHY 351 MJ : Atomic and Molecular Physics-I
PHY 352 MJ : Quantum Mechanics-I
PHY 353 MJ : Statistical Mechanics-I
PHY 354 MJ : Nuclear Physics-I
PHY 355 MJP : General Physics Lab-VII
PHY 356 MJP : General Physics Lab-VIII

Major Core (Semester-VII) (10 Credits) (6T+4P)

Semester VII

PHY 401 MJ : Atomic and Molecular Physics-II
PHY 402 MJ : Solid State Physics-II
PHY 403 MJ : Electrodynamics-II
PHY 404 MJP : General Physics Lab-IX
PHY 405 MJP : General Physics Lab-X

Major Core (Semester-VIII) (10 Credits) (6T+4P)

Semester VIII

PHY 451 MJ : Quantum Mechanics-II
PHY 452 MJ : Statistical Mechanics-II
PHY 453 MJ : Nuclear Physics-II
PHY 454 MJP : General Physics Lab-XI
PHY 455 MJP : General Physics Lab-XII

10) List of Discipline Specific Electives (DSE) Courses (Major Electives)

Semester V : **4 Credits. (2T+2P)**

PHY 310 MJ : Thin films Technology
PHY 311 MJP : Special Physics Lab-I

Semester VI : **4 Credits. (2T+2P)**

PHY 360 MJ : Lasers Technology
PHY 361 MJP : Special Physics Lab-II

Semester VII : **4 Credits. (2T+2T/P)**

PHY 410 MJ : Radiation Physics
PHY 411 MJP : Special Physics Lab-III

Semester VIII : **4 Credits. (2T+2T/P)**

PHY 460 MJ : Energy Studies
PHY 461 MJP : Special Physics Lab-IV

11) List of Vocational Skill Courses (VSC): (Each semester: 2 Credits) (T/P)

Semester-III

PHY 221 VSC : Introduction to Computational Physics-I

Semester-IV

PHY 271 VSC : Introduction to Computational Physics-II

Semester-V

PHY 321 VSC : Solar PV System: Installation, Repairing, and Maintenance

Semester-VI

PHY 371 VSC : Electric Vehicle Technology

12) List of Indian Knowledge System (IKS) Courses : (Each semester:2 Credits) (T)

Semester.-I

Generic

Semester.-III

PHY 201 IKS : India's Contribution to Physics

13) List of Minor (MN) Courses :

Semester-III : (4 Credits) (2T+2P)

PHY 241 MN : Basic Mathematical Physics

PHY 242 MNP : Basic Physics Laboratory I

Semester-IV : (4 Credits) (2T+2P)

PHY 291 MN : Electricity and Magnetism

PHY 292 MNP : Basic Physics Laboratory II

Semester-V : (2 Credits) (T)

PHY 341 MN : Concepts of Modern Physics

Semester-VII : (4 Credits) (T)

PHY 441 MN : Research Methodology

14) List of Generic Elective (GE)/Open Elective (OE) Courses :

Semester-I : Select any **one** subject for **2-credits (T)**

OE-101-PHY-T : Physics of Daily Life

OE-102-PHY-T : Biological Physics

Semester-II : Select any **one** subject for **2-credits (P)**

OE-151-PHY-P : LED Light Repairing and Maintenance

OE-152-PHY-P : Maintenance and Repairing of Physics Lab equipment

Semester-III : 2-credits (T)

OE-221-PHY-T : Renewable Energy for daily Life

Semester-IV : 2-credits (P)

OE-271-PHY-P : Li-Battery Storage, Repairing and Maintenance

15) List of Skill Enhancement Courses (SECs) :

Note : **Each semester** for **2(P)**-credits

Semester-I : Select any **one**

SEC-101-PHY-P : Experimental Skills in Physics

SEC-102-PHY-P : Physics of Water Filtration Systems

SEC-103-PHY-P : Renewable Energy and Energy Harvesting

SEC-104-PHY-P : Programming for Physical Applications (C++ / Python)

Semester-II : Select any **one**

SEC-151-PHY-P : Numerical Techniques in Physics

SEC-152-PHY-P : Introduction to Laser and Fibre Optics

SEC-153-PHY-P : Radiation Safety

SEC-154-PHY-P : Basic Lab Electric devices and Circuits

Semester-IV: Select any **one**

SEC-251-PHY-P : Basic Instrumentation Skills

SEC-252-PHY-P : Sensors and Detection Technology

SEC-253-PHY-P : Introduction to Physics of Devices

SEC-254-PHY-P : Data Analysis and Statistical Methods

SEC-255-PHY-P : Technical Circuit Drawing

16) List of Value Education Courses (VEC): 2-Credits (T)

Semester-I : Select any **one**

VEC-101-T : Environment Education-I (As per University)

Semester-II: Select any **one**

VEC-151-T : Environment Education-II (As per University)

17) List of Ability Enhance Courses (AEC): 2-Credits (T)

Semester-I: Select any **one**

AEC-101-ENG : English

Semester-II: Select any **one**

AEC-151-ENG : English

Semester-III: Select any **one**

AEC-231-HIN : Hindi

AEC-232-MAR : Marathi

Semester-IV: Select any **one**

AEC-281-HIN : Hindi

AEC-282-MAR : Marathi

18) List of Co-Curricular Courses (CC): 2-Credits

Semester-II: Select any **one**

Select from University Bucket e.g. NSS, NCC, Yoga, etc……

Semester-III: Select any **one**

Select from University Bucket e.g. NSS, NCC, Yoga, etc……

Semester-IV: Select any **one**

Select from University Bucket e.g. NSS, NCC, Yoga, etc……

** **
rbb

Syllabus of Courses

19) Syllabus of Discipline Specific Core (DSC) Courses (Major Core)

Major Core (Semester I) (4 Credits) (2T+2P)

Semester-I

F.Y.B.Sc. (Physics) (Sem-I)

PHY-101-T : Fundamentals of Physics-I

Lectures: 30 hrs **(Credits-02)**

A) Course Objectives: - This course aims to introduction of Mechanics.

1) Explain the concept of center of mass of systems of individual particles and of continuous distributions of matter, explain the principle of momentum conservation. Describe the difference between inelastic and elastic collisions.
2) Describe the rotational motion of rigid bodies using the concepts of angular velocity and acceleration, rotational inertia, torque, and the rotational analog of Newton's law.
3) Explain the relation between pressure and force. Explain why some objects float and others sink. Express conservation of mass and energy for fluids through the continuity equation and Bernoulli's equation.
4) Introduce basic concept and principles in Physics.
5) Introduce applications of basic Physics concept and principles for modern life.

B) Course Outcomes (CO): - Upon completion of this course student will able to

1) Articulate and apply the principle of conservation of mechanical energy to solve real life problems. Show the relation between force and energy using potential-energy curves.
2) Understood the concept of center of mass and find out center of mass of systems of individual particles and of continuous distributions of matter. Apply principle of momentum conservation to systems of particles. Apply the appropriate conservation laws to analyze real world problems.
3) Calculate the rotational inertias of objects with sufficient symmetry by summing or integrating. Solve problems that involve both linear and rotational motion. Calculate rotational kinetic energy, and explain its relation to torque and work.
4) Understand relation between pressure and force; calculate pressure as a function of depth in liquids. Determine quantitatively the position of floating objects and the apparent weight of submerged objects. Use the continuity equation and Bernoulli's equation to solve problems involving fluid dynamics.
5) Understand basic principles in Physics.
6) Applications of physics principles to resolve community problems.
7) Develop advanced thinking in future life style.
8) Apply Knowledge of Physics principles in day today life

C) Instructional Design: -

1) Lecture method 2) Tutorial method 3) Use of Computer

D) Evaluation Strategies

1) Descriptive written exam 2) Assignments 3) Seminars, Oral, Viva.

E) Prerequisites:

1. **Algebra and trigonometry:** Basic foundation in algebra and trigonometry
2. **Calculus:** Basic background of Calculus
3. **Physics Fundamentals:** Knowledge about the basic physical quantities and their SI and CGS unit system along with dimensions

F) Course Contents: - **Lectures: 30 hrs**

Module - 01	**Rotational Dynamics**	**10 H**
	1.1 Torque, Angular Velocity and Angular Acceleration. (Revision) 1.2 Principle of Conservation of Angular Momentum. 1.3 Centre of Mass in uniformly distributed object. (Revision) 1.4 Statement of parallel axis and perpendicular axis theorem. 1.5 Moment of Inertia and Radius of gyration. 1.6 Calculation of moment of inertia for solid cylindrical, and spherical. 1.7 Kinetic Energy of Rotation 1.8 Rolling Motion on inclined plane 1.9 Moment of Inertia of a Flywheel Numerical Problem	
Module - 02	**Fluid Mechanics**	**06 H**
	i) Fluid Statics 2.1 Definition of a Fluid. 2.2 Pressure, Absolute Pressure and Gauge Pressure. (Revision) 2.3 Variation of Pressure with Depth. 2.4 Pascal's Laws (Statement) 2.5 Buoyancy and Archimedes Principle. (Statement) Numerical Problem **ii) Fluid Dynamics** 2.6 Equation of Continuity. 2.7 Bernoulli's Theorem.(Statement) 2.8 Application Based on Bernoulli's Equation: Torricelli's Theorem and Venturimeter.(only theory) 2.9 Viscosity, Viscous force and Effect of Temperature. (Revision) 2.10 Stokes' Law and Terminal Velocity. 2.11 Surface Tension, Surface Energy and angle of contact. (Revision) 2.12 Excess Pressure Inside liquid drop and Soap Bubble. 2.13 Determination of Surface Tension by Jaeger's Method. Numerical Problem	
Module - 03	**Atomic Spectra**	**08H**

	3.1 Inadequacy of classical physics, 3.2 Brief Review of Black body Radiation, 3.3 Photoelectric effect, (Statement) 3.4 Compton Effect, (Statement) 3.5 Dual nature of radiation wave nature of particles, 3.6 Atomic spectra, 3.7 Line spectra of hydrogen atom, 3.8 Ritz Rydberg combination principle, (only principle) 3.9 Alpha Particle Scattering, (Review) 3.10 Rutherford Scattering Formula, (Revision) 3.11 Rutherford Model of atom and its limitations. Numerical Problem	
Module - 04	**Atomic Models**	**07H**
	4.1 Bohr's Model of Hydrogen atom, 4.2 Explanation of atomic spectra, 4.3 Correction for finite mass of the nucleus, (Revision) 4.4 Bohr correspondence principle, 4.5 Limitations of Bohr model, 4.6 Discrete energy exchange by atom, 4.7 Frank Hertz Experiment, 4.8 Sommerfeld's modification of Bohr's Theory (Review) Numerical Problem	

Activities: Conduct **any one** classroom activity during class lecture for each module.

Module 1: Rotational Dynamics

Activity 1: Linear velocity of rotating objects.

Compare velocities of solid sphere, solid cylinder, hollow sphere and hollow cylinder on inclined plane.

Activity 2: Exploring Rotational Dynamics with Spinning Tops

Explain principle of rotational dynamics through hands on experiment with spinning top.

Activity 3: Spinning Wheel Challenge

Apply concepts of rotational dynamics, specifically related to angular velocity and angular acceleration.

Module 2: Fluid Mechanics

Activity 1: Sticky and non-sticky liquid

Demonstrate viscosity using sticky or non-sticky liquids.

Activity 2: Mixture of Sticky and non-sticky liquid

Mix non sticky liquid to the sticky liquid in defined quantities and measure viscosity. Find out viscosity is increasing or decreasing with increase of non-sticky liquid concentration.

Activity 3: Surface Tension

- Spread of oil on water
- Formation of water droplets with different surface tensions on various leaves
- Floating Needle
- Soap-powered boat

- Soap film Interference Pattern
- Explain surface tension using soap solution and piece of paper

Module 3: Atomic Spectra

- Line spectra of hydrogen atom
- Photoelectric effect
- Compton Effect,
- Scattering of particles
- Black body Radiation

Module 4: Atomic Models

- Correction for finite mass of the nucleus
- Discrete energy exchange by atom
- Frank Hertz Experiment

Reference Books:

1. Richard Wolfson, "Essential UNIVERSITY PHYSICS" 2nd Ed., Pearson Education, Inc., 2012.
2. David Halliday, Robert Resnick, and Jearl Walker, "Fundamentals of Physics", 9th Ed., 2011.
3. H.C Verma, "Concept of Physics Part – I", Bharati Bhawan Publication, 2021.
4. Hugh D. Young and Roger A. Freedman, "University Physics With Modern Physics", 14th Ed., Pearson Education, 2017.
5. David Kleppner, Robert Kolenkow, "An Introduction to Mechanics (SIE)", 1st Ed., McGraw Hill Education, 2017.
6. Surface Tension by C. V. Boys, https://www.gutenberg.org/ebooks/33370
7. Concepts of Modern Physics: A Beiser (6th ed., McGraw Hill, 2003)
8. Intermolecular and Surface Forces by Jacob N. Israelachvili
9. Problems in Physics: P. K. Srivastava, Wiley Eastern Ltd.
10. Mechanics-M. Das, P. K. Jena and R.N. Mishra (Srikrishna Publications)
11. Mechanics: D. S. Mathur, Revised by P. S. Hemne, S. Chand and Company, New Delhi.
12. Physics: Resnick, Halliday & Walker, Wiley
13. Mechanics: D. S. Mathur, Revised by P. S. Hemne, S. Chand and Company, New Delhi.
14. Modern Physics-Serway (CENGAGE Learnings)
15. Physics of Atoms and Molecules Bransden and Joachim (Pearson India)
16. Atomic and Nuclear Physics-A. B. Gupta (New Central)

******XXX******

F.Y.B.Sc. (Physics) (Sem-I)

PHY-102-P : General Physics Lab-I

Lectures: 60 hrs **(Credits-02)**

A) Course Contents: - This course aims to introduce the practical related with Mechanics and Physics Principles and its applications.

B) Course Outcomes: The practical knowledge of mechanics doing experiments. They would also learn optical phenomena such as interference, diffraction and dispersion and do experiments related to optical devices: Prism, grating, spectrometers

Section I: Mechanics and its application (Any-6)

Sr. No.	Title of the Experiments
1	To study and use of various measuring instrument's 1. Vernier caliper 2. Micrometer Screw Gauge 3. Travelling Microscope 4.Spectrometer
2	To determine an acceleration due to gravity "g" by using Bar Pendulum
3	To determine an acceleration due to gravity "g" by using Keter's Pendulum
4	To determine the Coefficient of Viscosity by using Poiseuille's method
5	To study and verify Bernoulli's Theorem.
6	To determine the moment of inertia of Disc by Torsional Oscillations.
7	To determine the moment of inertia of a Flywheel.
8	To determine the surface tension using Capillary Rise method
9	To determine the Surface Tension of Water by using Jaeger's method
10	To determine the Surface Tension of Mercury by using Quincke's Method.
11	To determine the Surface Tension of Mercury by using Method of Ripples.

Section II: Physics Principles and Applications (Any-6)

Sr. No.	Title of the experiments
1	To study of Spectrometer Calibration (Determination of Angle of the Prism and Refractive Indices of different colors)
2	To determine the Dispersive Power of the Material of a Prism.
3	To determine the Cauchy's Constants A and B of the Material of a Prism
4	To determine the Planck's Constant.
5	To study the I-V characteristics, and calculate FF, Efficiency of p-n junction Solar Cell
6	To determine the first excitation potential of gas by Frank Hertz Experiment
7	To study of Divergence of LASER beam.
8	To determine the Diameter of Thin Wire by using LASER light.
9	To determine the wavelength of LASER light by using Plane Diffraction Grating.
10	To study of Total Internal Reflection using LASER light.
11	To determine the particle size of any sample material powder by using LASER light.
12	To determine wavelength of LASER using Metric Ruler (Scale)
13	To demonstrate how the gamma-ray energy varies following Compton scattering.

Section III: Additional Activities to be conducted during the semester (Any-3)

1. Mini Projects with report (Minimum 10 pages with completion certificate daily signed by project guide and HOD of Department).
2. Study tour / Industrial visit / Field visit with report.
3. Plotting of any two graphs using spreadsheets (of data obtained from various experiments performed by the student in the semester).
4. Any two computer aided demonstrations (Using computer simulations or animations on YouTube).
5. Demonstrations – Any one demonstrations of other experiments.

Study tour: Student have to participate in study tour organized by department to study about physics in Industry / Company / Organization / Research Institute / Research organization / Small scale industry / University Department and compulsory submitted study tour report.

Note: Students have to perform **12-**experiments (6-experiments from Section-I and 6 experiments form Section-II)

And

Participated in additional any **three** activities equivalent to **3-experiments** with 12-experiments. Total laboratory work with additional activities should be **15-**experiments.

References :

1. B. L. Flint and H.T. Worsnop, "*Advanced Practical Physics for students*", Asia Publishing House, 1971.
2. Michael Nelson and Jon M. Ogborn, "*Advanced level Physics Practical*", 4th Edition, Heinemann Educational Publishers, reprinted 1985.
3. I. Prakash and Ramakrishna, "*A Text Book of Practical Physics*", 11th Edition, Kitab Mahal, 2011.

Xxxxxx ooo xxxxX

Semester-II

Major Core (Semester-II) (6 Credits) (2T+1P)

Note: Every subject has 2 credits

F.Y.B.Sc. (Physics) (Sem-II)

PHY-151-T : Fundamentals of Physics-II

Lectures: 30 hrs **(Credits-02)**

A) Course Objectives: - This course aims to introduce Physics of Thermodynamics to the students. Objectives are.

1) To Study the basic concepts of Thermal Physics.
2) To Study the basic concepts of electricity and magnetism
3) To impart the knowledge and applications about thermal physics, electricity and magnetism in our day to day life.

B) Course Outcomes (CO): Upon Completion of this course, the students will be able to:

1) Understand the basic concepts of Thermodynamics and laws of thermodynamics.
2) Identify the different states of system and their dependence on various thermodynamic variables.
3) Understand different thermodynamic processes and their applications.
4) Understand different heat engines and their working principles.
5) Learn the heat radiation mechanism and relate this course to the daily chores through some applications.
6) Understand concept of electricity and magnetism.

C) Instructional Design: -

1) Lecture Method 2) Tutorial Method 3) Seminars 4) Use of Multimedia 5) Creation of online resources

D) Evaluation Strategies

1) Descriptive written exam 2) Assignments 3) Seminars, Oral, Viva.

E) Prerequisites:

Physics Fundamentals: Knowledge about the basic physical quantities and their SI and CGS unit system along with dimensions, and basics concept about electric circuits

F) Course Contents: - **Lectures: 30 hrs**

Module - 01	**Thermal Physics**	**15 H**
	1.1 Concepts of Heat and Temperature, 1.2 Zeroth law of thermodynamics, 1.3 Thermodynamic variables, and equation of state. (Revision) 1.4 Van der Waal's equation of state, 1.5 First Law of Thermodynamics and its differential form (Revision)	

	1.6 Application of the first law of Thermodynamics 1.7 Second law of thermodynamics (Kelvin's & Clausius' statements), 1.8 Carnot's cycle, and its efficiency 1.9 Concept of Entropy, principle of increase of entropy, Entropy of steam 1.10 Applications of Second law of thermodynamics: 1.11 Third law of Thermodynamics 1.12 Applications of Third law of thermodynamics: Numerical problems	
Module - 02	**Electrostatics**	**10 H**
	2.1 Concept of Electric Charge, Electrostatic Forces (Coulomb's law) 2.2 Electric lines, field & its Physical significance 2.3 Concept of electric flux 2.4 Gauss's law in electrostatics and its applications 2.5 Concept of Electric Potential 2.6 Concept of Electrostatic Energy 2.7 The four quantities for point charges 2.8 Relationship between Electric Field, Electric Force, Electric Potential, and Electric Potential Energy 2.9 Concept of Electric dipole & Dipole moment 2.10 Torque on a dipole placed in an electric field 2.11 Concept of Dielectric & Polarization 2.12 Relation between E, D & P 2.13 Gauss law in dielectric 2.14 Concept of Capacitor, Capacitance and it applications Numerical Problem	
Module - 03	**Magnetostatics**	**05H**
	○ Magnetic Field Lines, Magnetic Force & its properties ○ Biot-Savart's law and its applications ○ Ampere's circuital law and its applications ○ Introduction to Magnetization ○ Types of Magnetic Materials Numerical Problem	

Activities: Conduct **any one** classroom activity during class lecture for each module.

Module 1: Thermal Physics

Activity 1: Perform an activity to understand the concept of Carnot Engine:
Activity 2: Perform an activity to explain the concept of Otto Engine:
Activity 3: Perform an activity to explain the concept of Diesel Engine:
Activity 4: Perform an activity to understand the applications of Thermodynamics first law:
Activity 5: Perform an activity to understand the applications of Thermodynamics second law:
Activity 6: Perform an activity to understand the applications of Thermodynamics third law:

Module 2: Electrostatics

Activity 1: Perform an activity to explain the concept of static charges:

Activity 2:https://phet.colorado.edu/en/simulations/capacitor-lab-basics

Use the link to

1. Explain the relationships between voltage, charge, stored energy, and capacitance
2. Predict how capacitance changes when the plate area or plate separation changes
3. Describe how charge drains away from a capacitor into a light bulb

Module 3: Magnetostatics

Activity 1:

1. Levitating magnets with eddy currents
2. Maglev train
3. Perform an activity to show magnetic field lines using bar magnet and iron filings(particles)

Reference Books:

1) Concept of Physics: H. C. Verma, Bharati Bhavan Publisher.
2) Heat and Thermodynamics: Brijlal, N. Subrahmanyam, S. Chand and Company Ltd.
3) Heat and Thermodynamics: Mark W. Zemansky, Richard H. Dittman, 7th Edition, Mc-Graw Hill, International Edition.
4) Thermodynamics and Statistical Physics: J. K. Sharma, K. K. Sarkar, Himalaya Publishing House.
5) Thermal Physics (Heat and Thermodynamics): A. B. Gupta, H. P. Roy books and Allied (P) Ltd. Calcutta.
6) Instrumentation: Devices & Systems by Rangan, Mani, and Sarma.
7) Theory and Experiments on Thermal Physics by P. K. Chakrabarti, New Central Book Agency (P) Ltd. Landon.
8) Electricity and Magnetism: Brij Lal, N. Subramanyan, S. Chand & Co.
9) Electricity and Magnetism : R. Murugesan, S. Chand & Co.
10) Concept of Physics : H. C. Verma
11) Fundamentals of Physics: D. Halliday and R. Resnick and J. Walker, Wiley Publications
12) Electromagnetics: B.B. Laud, New Age International (P) Ltd.
13) Electricity and Electronics: D.C. Tayal, Himalaya Publishing House, Mumbai
14) Introduction to Electrodynamics: D.G. Griffith, Pearson Publications
15) Electricity and Magnetism: N.S. Khare and S.S. Shrivastav, Atmaram and Sons
16) Classical Electromagnetism: H.C. Verma, Bharati Bhavan Publisher

******XXX******

F.Y.B.Sc. (Physics) (Sem-II)

PHY-152-P : General Physics Lab-II

Lectures: 60 hrs **(Credits-02)**

A) Course Objectives: - This course aims to introduce the practical related with thermal Physics and Electricity and Magnetism.

B) Course Outcomes: The practical knowledge of Thermodynamics, Electricity and magnetism doing experiments: Engine, electric vibrations. They would also learn electric phenomena such as diode, CRO and do experiments related to electric devices.

Section I: Thermal Physics **(any 6)**

Sr.No	Title of the Experiments
1	To determine the Coefficient of Thermal Conductivity by Lee's method.
2	To determine the Specific Heat of Graphite.
3	To study the Carnot's cycle by drawing graphs of Isothermal and Adiabatic curves.
4	To investigate the first law and Second law of thermodynamic using heat Engine
5	To study the 2 / 4-Stroke Petrol Engine.
6	To study the 4-Stroke Diesel Engine.
7	To determine the Temperature Coefficient of Thermistor.
8	To study the Thermocouple as a Thermometer
9	To determine the Calorific Values of Different Fuels.
10	To determine the Temperature Coefficient of Resistivity of PTC / NTC type Material.
11	To determine the Coefficient of Liner Expansion of Metals.
12	To determine the specific heat capacity of water by electrical method.
13	To determine the specific heat capacity of a given solid by the method of mixtures.

Section II: Electricity and Magnetism (**any 6**)

Sr. No	Title of the experiments
1	Study of Kirchhoff's Voltage and Current Law.
2	Study of AC and DC Voltage Sensitivity by using CRO.
3	Study of I-V Characteristics of p-n Diode and Zener Diode.
4	Study of Charging and Discharging of a Capacitor.
5	Study of L-R Circuit
6	Study of Impedance of series LCR series circuit.
7	Study of Series and Parallel circuit using Capacitor (Voltage-Current Division Rule)
8	Determination of Frequency of AC by using Sonometer.
9	Study of Digital Multimeter for measuring (i) Resistances, (ii) AC and DC Voltages, (iii) DC Current, and (iv) checking electrical fuses.
10	Comparison of Capacitor using De Sauty's Method
11	Measurement of Dielectric Constant using Schering Bridge Experiment
12	Charges and Fields 1.0.59 (colorado.edu) :

	To study lines of forces and electric field due to a dipole. Place 1 nC charge at 2m apart and determine the electric field at given positions(0,0,), (1,0), (0,1), (0,-1), (-1,0), (2,0), (3,0), (2,1),(2,-1), (1,1),(-1,-1) and also draw equipotential surface for 1 V, 2 V, 3 V, 5 V, 10 V, 20 V and -1V, -2V, -3V, -5V, -10V, -20V
13	To verify Ampere's Law experimentally by graphing the magnetic field strength.

Section III: Additional Activities to be conducted during the semester (Any Three)

1. Mini Projects with report.
2. Study tour / industrial visit / Field visit with report.
3. Plotting of any two graphs using spreadsheets (of data obtained from various experimentsperformed by the student).
4. Any two computer aided demonstrations (Using computer simulations or animations).
5. Demonstrations – Any one demonstrations.

Study tour: Student have to participate in study tour organized by department to study about physics in Industry / Company / Organization / Research Institute / Research organization / Small scale industry / University Department and compulsory submitted study tour report.

Note: Students have to perform **12-**experiments (6-experiments from Section-I and 6 experiments form Section-II)

And

Participated in additional any **three** activities equivalent to **3-experiments** with 12-experiments. Total laboratory work with additional activities should be **15**-experiments.

References :

1. B. L. Flint and H.T. Worsnop, "*Advanced Practical Physics for students*", Asia Publishing House, 1971.
2. Michael Nelson and Jon M. Ogborn, "*Advanced level Physics Practical*", 4th Edition, Heinemann Educational Publishers, reprinted 1985.
3. I. Prakash and Ramakrishna, "*A Text Book of Practical Physics*", 11th Edition, Kitab Mahal, 2011.
4. D. P. Khandelwal, "*A Laboratory Manual of Physics for undergraduate classes*", Vani Publication, 1985,

Xxxxxx ooo xxxxX

20) Syllabus of Generic Elective (GE)/Open Elective (OE) Courses :

F.Y.B.Sc. (Physics) (Sem-I)

OE-101-PHY-T : Physics of Daily Life

Lectures: 30 hrs **(Credits-02)**

A) Course Objective- - The course aims to

1) The Recall, understand, use and apply the scientific knowledge set out in the syllabus.
2) Learn, recognize and apply basic physical principles related to climate, human body and Technology.
3) Learn about earth's atmosphere and related phenomena.
4) Solve simple physics related problems. Apply the simple law of nature to different fields of science, engineering and technology.
5) Evaluate relevant scientific information and make informed judgements about it.

B) Course Outcomes- Upon completion of the course, the students will able to

1) Every student will be able to study physics on a deeper level and to uses basic physics concepts to navigate everyday life.
2) Every student will be able to build essential scientific knowledge and skills for life-long learning.

C) Instructional Design-

1) Lecture Method 2) Use of Multimedia, 3) Creation of Online resources 4) Seminars

D) Evaluation Strategies-

1) Objective 2) Assignments 3) Seminars 4) Practical

E) Course Content :

Module: - 01	**Physics in Earth's Atmosphere**	**10 hrs**
	Sun, Earth's atmosphere as an ideal gas; Pressure, temperature and density, Pascal's Law and Archimedes' Principle, Corioli's acceleration and weather systems, Rayleigh scattering, the red sunset, Reflection, refraction and dispersion of light, Total internal reflection, Rainbow.	
Module: - 02	**Physics in Human Body and Sports**	**10 hrs**
	The eyes as an optical instrument, Vision defects, Rayleigh criterion and resolving power, Sound waves and hearing, Sound intensity, Decibel scale, Energy budget and temperature control, Physics in Sports: The sweet spot, Dynamics of rotating objects, Running, Jumping and pole vaulting, Motion of a spinning ball, Continuity and Bernoulli equations, Turbulence and drag.	
Module: - 03	**Physics in Technology**	**10 hrs**
	Microwave ovens, Lorentz force, Global Positioning System, CCDs, Lasers, Displays, Optical recording, CD, DVD Player, Tape records, Electric motors, Hybrid car, Telescope, Microscope, Projector etc.	

Reference Books:

1. H. C. Verma, Concepts of Physics (Bharati Bhawan publishers and distributers, New Delhi, India) 2011.
2. Sears and Zeemansky, University Physics (Addison Wesley, Boston, USA) 2007.
3. B. Lal and Subramaniam, Electricity and Magnetism (Ratan Prakashan Mandir, Agra, India) 2013.
4. Physics in Daily Life, Jo Hermans, EDP Sciences
5. E. Hecht, Optics (Addison Wesley, Boston, USA) 2001.
6. M. Nelkon and P. Parker, Advanced Level Physics (Heinemann International, London, U.K.) 2012.
7. How Things Work, The Physics of Everyday Life, Louis A. Bloomfield, Wiley, 2013.

*****xox*****

F.Y.B.Sc. (Physics) (Sem-I)

OE-102-PHY-T : Biological Physics

Lectures: 30 hrs **(Credits-02)**

A) Course Objective- The course aims to –

1. Understanding of Biological Systems
2. Bridging the Gap Between Physics and Biology
3. Understand the role of light in the physiology of living organisms.
4. Understand the physical principles that govern cellular processes, such as transport across cell membranes, cell division, and signal transduction.

B) Course Outcomes- Upon completion of the course, the students will able to

1. Understand the biological systems.
2. Understand the principles of interaction of light with organic molecules and their significance in environment.
3. Understand the physics principles and concepts with living systems and their significance.

C) Instructional Design-

1. Lecture Method 2. Use of Multimedia, 3. Creation of Online resources 4. Seminars

D) Evaluation Strategies-

2. Descriptive 2. Assignments 3. Seminars

E) Course Content-

Module- 1	**Cell Organization**	**7 hrs**
	Cell as the basic structural unit, Origin & organization of Prokaryotic and Eukaryotic cell, Cell size & shape, Fine structure of Prokaryotic & Eukaryotic cell organization Internal architecture of cells, cell organelles, compartment & assemblies membrane system, Ribosome, Polysomes, Lysosomes & Peroxisomes, Connection between cell & its environment, Extracellular Matrix. Structure & function of Nucleic acids, Amino acids & Proteins, Carbohydrates, Lipids, Vitamins & hormones	
Module-2	**Photosynthesis**	**7 hrs**
	Photosynthesis phenomenon, Chlorophyll molecules, Chloroplasts, Photochemical Systems, Interaction of photons with chemical compounds, photosensitive chemicals, photo induced electronic transitions in organic molecules, quantum yield, photo induced chemical reactions, Electron Transport Processes, Molecular Mechanism of Photoreception, Bioluminescence, Bacteriorodopsin.	
Module– 3	**Physical Concepts in Biophysics**	**6 hrs**
	Thermodynamics of Biological system: First and second laws of thermodynamics, activation energy, Biological systems as open, non-equilibrium systems, Concept of free energy, unavailable energy and entropy, heat content of food, bomb calorimetry, Enthalpy, Negative	

	entropy as applicable to biological systems. Thermodynamics of passive and active transport, glycolytic oscillations, biological clocks. Bioenergetics: Concept of energy coupling in biological processors, Energy requirements in cell metabolism, structure and role of mitochondria, high energy phosphate bond, energy currency of cell, Biological oxidation, Electron-transport chain, Oxidative Phosphorylation including chemiosmotic hypothesis.	
Module–4	**Physical Concepts understanding through Demonstrations / Experiments**	**10 hrs**
	1. To study the principle of spectrophotometer. To verify the Lambert Beer's law. 2. To determine the beer's limit and measurement of molar and percent extinction coefficient. 3. Spot test for carbohydrates. 4. To Isolate of Casein from milk. 5. Use of pH meter and measuring the pH of the buffer solutions	

F) Reference Books:

1. Ackerman E.A. Ellis, L.E.E. & Williams L.E. (1979), Biophysical Science, Prentice-Hall Inc.
2. Barrow. C. (1974), Physical Chemistry for Life Sciences, McGraw-Hill.
3. Berns M.W. (1982), Cells, Holt Sounders International Editors.
4. Bloomfield V.A. and Harrington R.E. (1975), Biophysical chemistry, W.A. Freeman and CO.
5. Cantor C.R. and Schimmel P.R. (1980), Biophysical chemistry, W.A. Fremman and Co.
6. Casey E.J. (1967), Biophysics, concepts and mechanisms. Affiliated East west press.

*****xox*****

F.Y.B.Sc. (Physics) (Sem-II)

OE-151-PHY-P : LED Light Repairing and Maintenance

Lectures: 60 hrs **(Credits-02)**

A) Course Objective- The course aims to

1. Use the knowledge of basics of electronics and LED to carryout work
2. Perform LED repair and assembly as per the recommended quality standards
3. Implement the soft skills that are required to carry out work efficiently

B) Course Outcomes- Upon completion of the course, the students will able to

1. Understand basics of LED and semiconductor.
2. Apply the knowledge for the repair of LEDs.
3. Identify the importance of reduction electronic waste management and Intellectual Property Rights (IPR).

C) Instructional Design-

1. Practical Method 2. Use of Multimedia, 3. Creation of Online resources 4. Seminars

D) Evaluation Strategies-

1. Objective 2. Assignments 3. Seminars 4. Practical

E) Course Content : (Any 12 experiments + 3 Experimental Activities)

1. To identify the different LEDs in the circuit and measure its activities (ON/OFF).
2. To measure the Power and Energy of different LEDs.
3. To study how soldering and de-soldering of LED in done. (Hands on Training)
4. To check the voltage and current output at different sections of units of LED.
5. To check LEDs in series and parallel circuit. (Hands on Training)
6. To check the burnt out and damage LEDs in bulbs.
7. To perform repair and replacement of LEDs and other components.
8. To study an assembly of LED bulbs / Strips dismantle with different wattage.
9. To identify the operation of LED in the fiber optics.
10. To check and replace the burnt and damage LED strips
11. To demonstrate the process of soldering if loose, de-soldered wires and connections are found.
12. To demonstrate basic knowledge of assembly of products such as spotlight, LED bulb and LED tube light.
13. To study the characteristics of three indicator LEDs that emit in the infrared, red and blue parts of the spectrum.
14. To investigate the relationship between the Threshold Voltage of an LED and the wavelength of light emitted from the LED.
15. To study and measure the P-I characteristics of Light Emitting Diode (LED) used in optical fiber communication as a light source.
16. To determine and plot the characteristics of the light emitting diode in the forward-bias region, and to compare between different colored diodes.
17. To measure I-V characteristics of Infrared (IR), Red and Blue light emitting diodes (LEDs).

18. To measurement of Led Light output using a Photodiode.
19. To study the wavelength characteristics of LED for different 3 colors and measure it.
20. To study the properties of LED and how they can combined in the 7-segment display.

Additional Activities to be conducted related to subject (Any-3)

1. Mini Projects with report.
2. Industrial /Research organization /Working organization /Field visit with report.
3. Any one computer aided demonstrations (Using computer simulations or animations).
4. Demonstrations – Any one demonstrations.

Note: Students have to perform **12-**experiments **and** participated in additional any **three** activities equivalent to **3-experiments** with 12-experiments. Total laboratory work with additional activities should be **15**-experiments.

Reference Books:

1. NSDC Skill Based Participant Handbook LED Light Repair Technician (E), Publisher-Rachna Sagar Pvt Ltd.
2. Vigyan Ashram, Design Manual (LED)

*****xox*****

F.Y.B.Sc. (Physics) (Sem-II)

OE-152-PHY-P : Maintenance and Repairing of Physics Lab Equipment

Lectures: 60 hrs **(Credits-02)**

A) Course Objective- The course aims to

1. Use the knowledge of basics laboratory equipment's to carryout work
2. Knowledge to create awareness of Lab Equipment
3. Perform equipment repair and assembly as per the recommended quality standards
4. Implement the soft skills that are required to carry out work efficiently
5. To expose the students to the repairing of equipment.

B) Course Outcomes- Upon completion of the course, the students will able to

1. Awareness of Lab Equipment and Electronic Components
2. Understand basics principle of physical instruments.
3. Apply the knowledge for the repair.
4. Identify the importance of reduction electronic waste management\

C) Instructional Design-

1. Practical Method 2. Use of Multimedia, 3. Creation of Online resources 4. Seminars

D) Evaluation Strategies-

1. Assignments 2. Oral 3. Practical

F) Course Content : (Any 12 experiments + 3 Experimental Activities)

1) To identify the different equipment's in used in physics lab.
2) To study least count and measure the diameter of different size of thin wire using screw gauge.
3) To study least count and measure the diameter of different size of rod using vernier caliper.
4) To study least count and how to measure the Current and Voltage using ammeter and voltmeter.
5) To study the DC and AC Voltage, Current and Power using multimeter.
6) To study the function/operation of resistance and measure the values of different resistance using color code and multimeter.
7) To study the function/operation of capacitor and measure the values of different capacitor using multimeter.
8) To measure current and voltage when resistance connected in series and parallel form.
9) To measure current and voltage when capacitor connected in series and parallel form.
10) To check and identify the fault in the circuit and how to repair it.
11) To study of CRO for the measurement of voltage and frequency.
12) To study the calibration of Spectrometer.
13) To study the function and operation of simple p-n junction and Zener diode.
14) To study the function and operation of IC. (IC 555, IC 741, IC 7400, etc.)
15) To study the simple pendulum to measure "g".
16) To study the telescope and measure oscillation of pendulum.
17) To study PCB and Breadboard for connections of simple electric components.

18) To study and measurement of wavelength of LASER light.
19) To study and demonstration of various geometrical glasses.
20) To study the use of stop watch.
21) To study how to draw the graphs using excel.
22) To study the principle and operation of Transformer.
23) To study an operation and how electric fan is repairing.
24) To study an operation and how power supply is repairing.
25) To study how spectrums are obtain using normal prism.
26) To study and repairing of mobile charger.
27) To study function generator.

Additional Activities to be conducted related to subject (Any-3)

1. Mini Projects with report.
2. Industrial /Research organization /Working organization /Field visit with report.
3. Any one computer aided demonstrations (Using computer simulations or animations).
4. Demonstrations – Any one demonstrations.

Note: Students have to perform **12-**experiments **and** participated in additional any **three** activities equivalent to **3-experiments** with 12-experiments. Total laboratory work with additional activities should be **15**-experiments.

Reference Books:

NSDC Skill Based Participant Handbook LED Light Repair Technician (E), Publisher- Rachna Sagar Pvt Ltd.

*****xox*****

21) Syllabus of Skill Enhancement Courses (SECs) :

F.Y.B.Sc. (Physics) (Sem-I)

SEC-101-PHY-P : Experimental Skills in Physics

Lectures: 60 hrs **(Credits-02[P])**

A) Course Objective- The course aims to introduce

1. To understand working principle and its applications the various instruments in physics
2. To impart knowledge about the measurement of physical quantity and its analysis

B) Course Outcomes- Upon completion of the course, the students will able to

1. Understand the working principles of various measuring instruments.
2. Acquire the scientific information of various physical and electrical instruments used in physics practical.
3. Identify the errors in instrument and study their analysis.

C) Instructional Design-

1. Lecture Method 2. Use of Multimedia, 3. Creation of Online resources 4. Seminars

D) Evaluation Strategies-

1. Descriptive 2. Assignments 3. Seminars

E) Course Content- (Any 12 experiments + 3 Experimental Activities)

1) To plot the graph of distance verses time, velocity verses time by given data and write the conclusion.
2) To determine the least count of instruments like Vernier Calliper, Micrometer Screw Gauge, Travelling Microscope, Spectrometer, etc.
3) To determine the inner and outer radius of given pipe by using Vernier Calliper and determine the diameter of pin by using micrometer screw gauge.
4) To determine the radius of curvature of the lenses by using spherometer.
5) To measurement of relative humidity using hygrometer.
6) To find unknown incident power using solar insolation calibration curve.
7) To determine the coefficient of viscosity of water by Viscometer.
8) To determine the angle of prism by using spectrometer.
9) To measure ac, and dc voltage of signals by using CRO.
10) To observe the loading effect of a multimeter while measuring voltage across a low resistance and high resistance.
11) To measurement of ‘Q’ factor using LCR circuit.
12) To measure ‘Q’ of a coil and its dependence on frequency, using a Q-meter.
13) To measurement of rise, fall and delay times using a CRO.
14) To measure frequency of different signals by using CRO.
15) To check and repairing the fault of DC circuit.
16) To study how to plot the graph of any single observation on graph paper and how to observe the readings from graphs (e.g. I-V, V-T, I-T, etc.)

17) To study how to plot the graph of two or more observations on a single graph. (e.g. Charging and discharging of capacitor, Line and Load regulation, etc.)
18) To study and repairing of Power supply.
19) To study and repairing of LED bulb or Strip light, etc.
20) To study the measurement of sound frequency of audio speaker.
21) Calibration of Spectrometer to determine RI of prism.
22) To study and measurement of value of resistance, and capacitor using multimeter.
23) To measure the viscosity of a liquid using viscometer.

Additional Activities to be conducted related to subject (Any-3)

1. Mini Projects with report.
2. Industrial /Research organization /Working organization /Field visit with report.
3. Any one computer aided demonstrations (Using computer simulations or animations).
4. Demonstrations – Any one demonstrations.

Note: Students have to perform **12-**experiments **and** participated in additional any **three** activities equivalent to **3-experiments** with 12-experiments. Total laboratory work with additional activities should be **15-**experiments.

Reference Books:

1. Digital Circuits and systems - K. R. Venugopal, Tata McGraw Hill Publishing Company Ltd.
2. Electronic circuits: Handbook of design and applications - U. Tietze, Ch. Schenk
3. A text book in Electrical Technology – B. L. Theraja- S. Chand and Co. (Volume III) Publishers, New Delhi
4. BSc Practical Physics,-Harnam Singh, S Chand Publishers, New Delhi
5. Advanced Practical Physics, B.L. Worsnop and H. T. Flint, Khosla Publishing House, New Delhi
6. B.Sc. Practical Physics, Arora C.L., S Chand & Company, New Delhi

******XoX******

F.Y.B.Sc. (Physics) (Sem-I)

SEC-102-PHY-P : Physics of Water Filtration Systems

Lectures: 60 hrs **(Credits-02[P])**

A) Course Objectives: This course aim to introduce "Physics of construction, service and maintenance of water filtration systems.

1) To study the fundamental principles and concepts of Physics as they pertain to water filtration systems.
2) Improving import knowledge of talents in the construction service and maintenance of RO and conventional water filtration systems.
3) Discuss the importance of water filtration and how it affects public health and environmental sustainability.
4) Examine the factors influencing water quality and identify the many forms of water pollutants.
5) Understand the principles of operation of reverse osmosis and normal filtration systems.
6) Distinguish between various filtering processes and their applicability in various water treatment scenarios. Design and optimize water filtration systems based on specified requirements.
7) Use testing and analysis to assess the performance of water filtration systems.
8) Create maintenance and troubleshooting techniques for RO and normal filtration systems. Apply water filtration knowledge to unique water treatment difficulties and to respond to changing water quality conditions.

B) Course outcome (CO): Upon completion of the course the student will be able to

1) Understand the physical processes at work in water filtration systems.
2) Determine how to create an effective water filtering system.
3) To build, maintain, and service various water filtration systems and to understand their relevance.
4) When working with water filtration systems, apply your knowledge of safety protocols.
5) Students will be able to make money by learning this information.

C) Instructional Design:

(1) **Lecture method**: Theoretical concept and principles related to the Physics of water filtration system will be covered through the interactive lectures.

(2) **Tutorial method:**

(3) **Lab sessions:** Practical hand on sessions will allow students to construct, service and maintenance of different water filtration systems.

(4) **Group projects:** To design and build different water filtration systems.

(5) **Seminars**: To take seminars on different tropics.

(6) **Create online resources:** Through YouTube or other platform we will create online resources.

D) Evaluation Strategies:

Descriptive written examinations, Assignments, Seminars, Orals and Viva

E) Course Contents: (Any 12 experiments + 3 Experimental Activities)

1) To study Water filtration system with its different components.
2) To study how to installing water filtration systems.

3) Demonstration of operate water filtration systems.
4) How to choose best water filtration system for your needs.
5) Demonstration of testing and analyzing water quality (TDS of water).
6) To study maintaining and cleaning water filtration systems.
7) To study the usage of power supplies in water filters.
8) To study the various Cartage types in Filters.
9) To building, assembling, and operating an Activated Carbon Water Filtration System.
10) To building, assembling, and operating an Ultrafiltration (UF) Water Filtration System.
11) To building, assembling, and operating a Reverse Osmosis (RO) Water Filtration System.
12) To study RO membrane properties and its operation.
13) To study the RO maintenance and troubleshooting.
14) To investigate how Ultra Violet light (UV) kills germs in water.
15) To study the operation of the Gravity Water Filtration System assembly.
16) To study the UF membrane, its qualities, and how it works.
17) To study the UF system components: pre-filters, post-filters, storage tank, faucet and how they works.
18) To study the Gravity filter maintenance and troubleshooting.
19) To study the Activated Carbon Filter maintenance and troubleshooting.
20) To study ceramic filter, activated carbon filter, mineral stones, and a storage tank in Gravity Filter.

Additional Activities to be conducted related to subject (Any-3)

1. Mini Projects with report.
2. Industrial /Research organization /Working organization /Field visit with report.
3. Any one computer aided demonstrations (Using computer simulations or animations).
4. Demonstrations – Any one demonstrations.

Note: Students have to perform **12**-experiments **and** participated in additional any **three** activities equivalent to **3-experiments** with 12-experiments. Total laboratory work with additional activities should be **15**-experiments.

References:

1) Water Treatment Plants: Planning, Design, and Operations by Syed R. Qasim
2) Water Supply and Pollution Control by Warren Viessman, Jr., Mark J. Hammer, Elizabeth M. Perez, and Paul A. Chadik
3) Water Treatment: Principles and Design by MWH
4) Principles of Water Treatment by Kerry J. Howe
5) Handbook of Water and Wastewater Treatment Plant Operations by Frank R. Spellman
6) Water Purification (Science and Technology) by Satinder Ahuja
7) Water Treatment Technologies for the Removal of High-Toxicity Pollutants (NATO Science for Peace and Security Series C: Environmental Security) by Despo Fatta-Kassinos

8) Advanced Materials for Water Purification (Woodhead Publishing Series in Energy) by Maria
9) D. Kennedy and Giuseppe Cirillo
10) Nanotechnology-Enabled Water Treatment by Jeffery L. Coffer and P. Davide Ferreira
11) Sustainable Water Treatment: Engineering Solutions for a Variable Climate by Jason Montgomery
12) Sustainable Water Purification (Green Chemistry and Chemical Engineering) by Rajindar Singh.

Website references:

1) World Health Organization (WHO) - Water Sanitation and Health:
Website: https://www.who.int/water_sanitation_health/en/
2) United Nations Environment Programme (UNEP) - Water and Sanitation:
Website: https://www.unep.org/our-work/water-and-sanitation
3) American Water Works Association (AWWA): Website: https://www.awwa.org/
4) Water Research Foundation (WRF): Website: https://www.waterrf.org/
5) International Water Association (IWA): Website: https://iwa-network.org/
6) Environmental Protection Agency (EPA) - Drinking Water Standards and Regulations:
Website: https://www.epa.gov/dwstandardsregulations
7) United States Geological Survey (USGS) - Water Science School:
Website: https://www.usgs.gov/special-topic/water-science-school
8) National Environmental Services Center (NESC) - Training Resources:
Website: https://www.nesc.wvu.edu/training/
9) Center for Disease Control and Prevention (CDC) - Water-Related Diseases:
Website: https://www.cdc.gov/healthywater/diseases/index.html

*****xox*****

F.Y.B.Sc. (Physics) (Sem-I)

SEC-103-PHY-P : Renewable Energy and Energy Harvesting

Lectures: 60 hrs **(Credits-02)**

A) Course Objectives:- This course aim to introduce "Renewable Energy and Energy Harvesting".

2) To study the Renewable Energy and Energy Harvesting.
3) To improve the knowledge of Renewable Energy and Energy Harvesting.
4) Using the knowledge of Renewable Energy and Energy Harvesting to solve the problems in Physics.

B) Course outcome (CO): Upon completion of the course the student will be able to

1) The students are expected to learn not only the theories of the renewable sources of energy, but also to have hands-on experiences on them wherever possible. Some of the renewable sources of energy which should be studied here are: (i) off-shore wind energy, (ii) tidal energy, (iii) solar energy, (iv) Bio-gas energy and (v) hydroelectricity.
2) All these energy sources should be studied in detail.
3) Learn about piezoelectricity, carbon- captured technologies like cells, batteries.
4) The students should observe practical demonstrations of (i) training modules of solar energy, wind energy etc., (ii) Conversion of vibration into voltage using piezoelectric materials, (iv) conversion of thermal energy into voltage using thermoelectric modules

C) Instructional Design:

1) **Lecture method** 2) **Tutorial method** **3)Lab sessions** **4) Group projects** **5)Seminars**: To take seminars on different tropics. **6)Create online resources**: Through YouTube or other platform we will create online resources.

D) Evaluation Strategies:

Descriptive written examinations, Assignments, Seminars, Orals and Viva

E) Course Contents: (Any 12 experiments + 3 Experimental Activities)

1) Demonstration of Training modules on solar energy as a solar panel.
2) Demonstration of Training modules on wind energy as a wind mill.
3) Conversion of vibration into electric voltage using piezoelectric materials.
4) Conversion of thermal energy into electric voltage using thermoelectric modules.
5) To study the biogas plants.
6) To study the gasifier.
7) To study the production process of biodiesel.
8) To study briquetting machine.
9) To study the production process of bio-fuels.
10) To study the different solar energy gadgets.
11) To study solar photovoltaic system.
12) To study about solar lighting.
13) To study about solar pumping.

14) To study about solar fencing.
15) To study solar cooker.
16) To study solar drying system.
17) To study solar distillation.
18) To study solar pond.
19) To study solar water heater.
20) To study solar system with model.

Additional Activities to be conducted related to subject (Any-3)

1. Mini Projects with report.
2. Industrial /Research organization /Working organization /Field visit with report.
3. Any one computer aided demonstrations (Using computer simulations or animations).
4. Demonstrations – Any one demonstrations.

Note: Students have to perform **12-**experiments **and** participated in additional any **three** activities equivalent to **3-experiments** with 12-experiments. Total laboratory work with additional activities should be **15-**experiments.

References:

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 Sukhatme 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 Assessment Handbook, 2009
6. J. Balfour, M. Shaw and S. Jarosek, Photovoltaics, Lawrence J Goodrich (USA).

*****xox*****

F.Y.B.Sc. (Physics) (Sem-I)

SEC-104-PHY-P : Programming for Physical Applications (Python)

Lectures: 60 hrs **(Credits-02[P])**

A) Course Objective- The course aims to introduce

1. To understand the fundamental programming concepts and problem solving skills using high level language like Python with no prior knowledge of programming.
2. To understand key concepts in programming such as variables or objects, data types, control structures, functions and basic algorithmic thinking.

B) Course Outcomes- Upon completion of the course, the students will able to

1. Understand the problem solving approach in any computational problem.
2. Student will be able to write algorithms and draw flowcharts for simple computational problem in physical science or mathematics.
3. Able to write and test code for simple problems of his class
4. Able to understand different interactive development environment (IDLE) for python3.10 and onward.

C) Instructional Design-

1. Practical Method 2. Lecture method supported with use of LCD /multimedia
3. Creation of Online resources 4. Seminars

D) Evaluation Strategies-

1. Descriptive 2. Assignments 3. Seminars 4. Writing codes as assignments

E) Course Content- (Any 12 experiments + 3 Experimental Activities)

1) Write a python program of simple calculator when two operands and operation is entered. (Add, Subtract, Multiply, Divide, Module, etc.)
2) Write a python program to calculate simple interest, compound interest and total amount for a given principal, rate of interest and duration in years.
3) Write a python program to check whether given no is even/odd.
4) Write a python program to calculate total salary of employee. (Given Basic pay, DA, TA).
5) Write a python program to check entered string for palindrome.
6) Write a python program to check whether entered number is prime or not.
7) Write a python program to generate Fibonacci numbers series with starting no (up to 10).
8) Write a python program using dictionary to write given number in words. (e.g. 100 - one zero zero).
9) Write a python program to calculate factorial of a given number.
10) Write a python program to calculate values of pair of points (x, t) for a given equation of motion x = 5 + 9.8 * t * t. Where ‘t’ varies from 0 to 10 seconds at every second.
11) Write a python program that takes as its input the values of A and Z, and prints out the binding energy for the corresponding atom. Use your program to find the binding energy of an atom with A = 58 and Z = 28. (Hint: The correct answer is around 500 MeV.)
12) Write a python program to print out not the total binding energy B, but the binding energy per nucleon, which is B/A.
13) Write a python program to demonstrate Velocity to Time conversion functions.

14) Write a python program to demonstrate Force to Work done conversion functions.
15) Write a python program to demonstrate Force to pressure conversion functions.
16) Write a python program to demonstrate Force to Energy conversion functions.
17) Write a python program to demonstrate Energy to velocity conversion functions.
18) Write a python program to demonstrate Charge to Radius conversion functions.
19) Write a python program to demonstrate Electric Energy to Radius conversion functions.
20) Write a python program to demonstrate electric bill generation.

Additional Activities to be conducted related to subject (Any-3)

1. Mini Projects with report.
2. Industrial /Research organization /Working organization /Field visit with report.
3. Any one computer aided demonstrations (Using computer simulations or animations).
4. Demonstrations – Any one demonstrations.

Note: Students have to perform **12-**experiments **and** participated in additional any **three** activities equivalent to **3-experiments** with 12-experiments. Total laboratory work with additional activities should be **15-**experiments.

Reference Books:

1. Introduction to problem solving using python by E. Balgurswami TMH
2. Exploring Python by Budd TMH
3. Let us Python by Aditya Kanetkar BPB Publication

******XoX******

F.Y.B.Sc. (Physics) (Sem-II)

SEC-151-PHY-P : Numerical Techniques in Physics

Lectures: 60 hrs **Credits-02[P]**

A) Course Objectives:- This course aim to introduce "Numerical Techniques in Physics".

- To study the Numerical Techniques in Physics.
- To improve the knowledge of Numerical Techniques in Physics.
- Using the knowledge of Numerical Techniques to solve the problems in Physics.

B) Course outcome (CO): Upon completion of the course the student will be able to

1) Identify modern numerical techniques and describe the extent and limitations of computational methods in physics.
2) Discuss the characteristics of various numerical methods.
3) Solve the problem using numerical methods techniques and computationally solve a selection of problems in physics.
4) Explain and solve the physics problem using numerical methods, write a program for it using leading-edge tools.
5) Compare the tools, methodologies, language to test various physics problems.
6) Design the physics system and solve it, collect the result and discuss, justify and communicate ideas and explanations.

C) Instructional Design:

2) **Lecture method** 2) **Tutorial method** **3)Lab sessions** **4) Group projects**

5)Seminars: To take seminars on different tropics.

6)Create online resources: Through YouTube or other platform we will create online resources.

D) Evaluation Strategies:

1) Descriptive written examinations
2) Assignments
3) Seminars, Orals and Viva

E) Course Contents: (Any 12 experiments + 3 Experimental Activities)

1) To study of Introduction to MATLAB
2) To study of basic matrix operations
3) To solve linear equation
4) To determine the Eigen values and Eigen vectors of a Square matrix
5) To determine the solution of Partial Differencial Equations.
6) To determine the solution of Difference Equations using Euler Method.
7) To determine the solution of differential equation using 4th order Runge-Kutta method.
8) To determine the roots of a polynomial.
9) To determine the polynomial using method of Least Square Curve Fitting.
10) To determine the polynomial fit, analyzing residuals, exponential fit and error bounds from the given data.
11) To determine the time response of an L-C-R circuit.

12) To determine the time constant of C-R circuit.
13) To determine the solution of differential equation using 4th order Runge-Kutta method.
14) To determine the Solution of simultaneous non-linear equations using Newton-Raphson method.
15) To determine the Numerical solution of central difference interpolation by using Lagrange interpolation method.
16) To determine the Numerical solution of integrals using Trapezoidal method.
17) To determine the Numerical evaluation of integrals using Simpson's 1/3rd method.
18) To determine the Numerical Solution of Laplace equation in two variables by suitable method.
19) To determine the Numerical Solution of tri-diagonal system by using Thomas algorithm.
20) To determine the Numerical Solution of tri-diagonal system using Thomas algorithm.

Additional Activities to be conducted related to subject (Any-3)

1. Mini Projects with report.
2. Industrial /Research organization /Working organization /Field visit with report.
3. Any one computer aided demonstrations (Using computer simulations or animations).
4. Demonstrations – Any one demonstrations.

Note: Students have to perform **12-**experiments **and** participated in additional any **three** activities equivalent to **3-experiments** with 12-experiments. Total laboratory work with additional activities should be **15-**experiments.

References:

1. Computer Oriented Numerical Methods, by V. Rajaraman (PHI Learning Publications)
2. Numerical methods for scientists and engineers, by H. M. Antia (Hindustan Book Agency)
3. Computational Physics, by N. J. Giordano and Hisao Nakanishi (Pearson Education India

*****xox*****

F.Y.B.Sc. (Physics) (Sem-II)

SEC-152-PHY-P : Introduction to Laser and Fiber Optics

Lectures: 60 hrs **(Credits-02[P])**

A) Course Objectives:- This course aim to introduce "Laser and Fiber Optics" to contribute the knowledge of Fibre optics and Laser Instrumentation and its Industrial and Medical Application.

B) Course outcome (CO): Upon completion of the course the student will be able

1) To expose the students to the basic concepts of optical fibres and their properties.

2) To provide adequate knowledge about the Industrial applications of optical fibres.

3) To expose the students to the Laser fundamentals.

4) To provide adequate knowledge about Industrial application of lasers.

5) To provide adequate knowledge about holography and Medical applications of Lasers.

C) Instructional Design:

21) **Lecture method** 2) **Tutorial method** **3)Lab sessions** **4) Group projects**

5) Seminars: To take seminars on different tropics.

6) Create online resources: Through YouTube or other platform we will create online resources.

D) Evaluation Strategies:

1) Descriptive written examinations
2) Assignments
3) Seminars, Orals and Viva

D) Course Contents: (Any 12 experiments + 3 Experimental Activities)

1) To determining Laser Wavelength using a Ruler.
2) To determine of angle of divergence of a laser beam using He-Ne laser.
3) To study V-I characteristics of Laser Diode.
4) To study the P-I characteristics and measure slope efficiency of Laser Diode
5) To study Characteristics of Photodiode and measure its responsivity.
6) To measure the Numerical Aperture of a fiber optic cable.
7) To measure the Acceptance Angle of a fiber optic cable.
8) To study of losses in Optical fiber
9) To study how setting up of Fiber optic Digital link.
10) To study preparation of Splice joint and measurement of the splice loss.
11) To measurement of fiber characteristics, fiber damage and splice loss/connector loss by OTDR.
12) To observe and characterize Fiber Bragg Grating (FBG) as an optical Filter
13) To observe and characterize Fiber Bragg Grating (FBG) as an optical sensor.
14) To study and characterize optical time domain reflectometer.
15) To study the characteristics of optical transmitters and receivers.
16) To study of Optical Spectrum Analyzer.

17) To design and setting up a WDM system.
18) To study the Link Analysis using OTDR.
19) To determine the wavelength of laser light using plane diffraction grating.
20) To Determine the wavelength of laser light using semiconductor laser diffraction.

Additional Activities to be conducted related to subject (Any-3)

1. Mini Projects with report.
2. Industrial /Research organization /Working organization /Field visit with report.
3. Any one computer aided demonstrations (Using computer simulations or animations).
4. Demonstrations – Any one demonstrations.

Note: Students have to perform **12-**experiments **and** participated in additional any **three** activities equivalent to **3-experiments** with 12-experiments. Total laboratory work with additional activities should be **15-**experiments.

References:

1) G. Keiser, 'Optical Fibre Communication', McGraw Hill, 1995.
2) M. Arumugam, 'Optical Fibre Communication and Sensors', Anuradha Agencies, 2002.
3) John F. Ready, "Industrial Applications of Lasers", Academic Press, Digitized in 2008.
4) Monte Ross, 'Laser Applications', McGraw Hill, 1968.
5) John and Harry, "Industrial lasers and their application", McGraw-Hill, 2002.
6) Keiser, G., "Optical Fiber Communication", McGraw-Hill, 3rd Edition, 2000. http://nptel.ac.in/courses/117101002/

*****xox*****

F.Y.B.Sc. (Physics) (Sem-II)

SEC-153-PHY-P : Radiation Safety

Lectures: 60 hrs **(Credits-02[P])**

A) Course Objectives:- This course aim to introduce "Radiation Safety" to contribute the knowledge of radiation and its safety, and also aware about Instrumentation and its Industrial, and Medical Application.

B) Course outcome (CO): Upon completion of the course the student will be able

1) To expose the students to the basic concepts of radiation and their properties.
2) To provide adequate knowledge about the Industrial applications of instruments.
3) To provide adequate knowledge about Medical applications of radiation therapy.

C) Instructional Design:

1) Lecture method 2) Tutorial method 3) Lab sessions 4) Group projects
5) Seminars, 6) Create online resources: YouTube or other platform

E) Evaluation Strategies:

Descriptive written examinations, Assignments, Seminars, Orals and Viva, etc.

F) Course Contents: (Any 12 experiments + 3 Experimental Activities)

1) Quality Assurance and radiation protection survey of a conventional X-ray installation.
2) Quality Assurance and radiation protection survey of interventional X-ray equipment.
3) Quality Assurance and radiation protection survey of a CT scanner installation.
4) Radiation absorption characteristics and HVT, TVT measurements.
5) Familiarization with therapy and protection level equipment and radiation protection survey of a radiotherapy facility.
6) Quality Assurance of radiotherapy equipment(s).
7) Introduction to radiation monitoring instruments.
8) Characteristics of GM counter.
9) Statistics of counting and activity measurement.
10) Calibration of survey instruments and pocket dosimeter.
11) Dose distribution measurement in the product box(s).
12) Radiation protection survey of IRGDs /NGs installations.
13) Standardization of reference radiation field.
14) Calibration of radiation monitoring instruments.
15) Operational Aspects of calibration exposure devices (CED).
16) Calibration of personnel monitoring instruments and badges.

Additional Activities to be conducted related to subject (Any-3)

1. Mini Projects with report.
2. Industrial /Research organization /Working organization /Field visit with report.
3. Any one computer aided demonstrations (Using computer simulations or animations).
4. Demonstrations – Any one demonstrations.

Note: Students have to perform **12-**experiments **and** participated in additional any **three** activities equivalent to **3-experiments** with 12-experiments. Total laboratory work with additional activities should be **15-**experiments.

References:

1) Advisory Committee on X-ray and Radium Protection. 1941. Safe Handling of Radioactive Luminous Compounds. In: National Bureau of Standards Handbook 27. Washington, DC: National Bureau of Standards.
2) Ahmed JU. 1992. Regulatory approach toward controlling exposure to radon in dwellings. Radiation Protection Dosimetry 45(1/4):745-750.
3) Alter HW, Oswald RA. 1987. Nationwide distribution of indoor radon measurements: a preliminary data base. Journal of the Air Pollution Control Association 37:227-231. [PubMed]
4) Anonymous. 1995. New rules could bring ceramics industry under LLW standards. Nuclear Waste News 15(44):435.
5) Textbook of Radiological Safety, by Kuppusamy Thayalan, 2023
6) Workbook for Radiation Protection in Medical Radiography - E-Book, By Mary Alice Statkiewicz Sherer, Kelli Haynes, Paula J. Visconti, E. Russell Ritenour · 2014

*****xox*****

F.Y.B.Sc. (Physics) (Sem-II)

SEC-154-PHY-P : Basic Lab Electric Devices and Circuits

Lectures: 60 hrs **(Credits-02[P])**

A) Course Objectives:- This course aim to introduce "Electric circuits and Networks" to contribute the knowledge of electric elements and its uses, and also aware about Instrumentation and its Industrial Application.

B) Course outcome (CO): Upon completion of the course the student will be able

1) To expose the students to the basic concepts of electric elements and their functions.

2) To provide adequate knowledge about the Industrial applications of electric instruments.

3) To provide adequate knowledge about its applications.

4) Students can study Electrical Engineering.

5) Students can understand about devices and systems that use electricity and electromagnetism and their design and application.

C) Instructional Design:

1) Lecture method 2) Tutorial method 3) Lab sessions 4) Group projects
5) Seminars, 6) Create online resources: YouTube or other platform

D) Evaluation Strategies:

Descriptive written examinations, Assignments, Seminars, Orals and Viva, etc.

E) Course Contents: (Any 12 experiments + 3 Experimental Activities)

1. To study of CRO.
2. To study V-I Characteristics of p-n Junction Diode.
3. To study V-I Characteristics of Zener Diode and Zener Regulator Characteristics.
4. To study V-I Characteristics of LED.
5. To study Half-Wave Rectifier with and without Filter.
6. To study Full-Wave Rectifier with and without Filter.
7. To study Bridge-Wave Rectifier with and without Filter
8. To study output characteristics of Transistor in CB mode.
9. To study output characteristics of Transistor in CE mode.
10. To measure h-Parameters of Transistor in CE mode.
11. To measure h-Parameters of CB Configuration.
12. To study Drain and Transfer Characteristics of JFET.
13. To study Frequency Response of CE Amplifier.
14. To study Frequency Response of CS-FET Amplifier.
15. To study comparison of performance of Self Bias and Fixed Bias Circuits.
16. To study applications of Diodes.
17. To study characteristics of Thermistor.
18. To study oscillator.
19. To study simple power supply.
20. To study introduction to Integrated Circuit (e.g. IC 555).

Additional Activities to be conducted related to subject (Any-3)

1. Mini Projects with report.
2. Industrial /Research organization /Working organization /Field visit with report.
3. Any one computer aided demonstrations (Using computer simulations or animations).
4. Demonstrations – Any one demonstrations.

Note: Students have to perform **12-**experiments **and** participated in additional any **three** activities equivalent to **3-experiments** with 12-experiments. Total laboratory work with additional activities should be **15-**experiments.

References:

1) Basic Electronics and Linear Circuit by NN Bhargava, Kulshreshta and SC Gupta, Tata McGraw Hill Education Pvt Ltd., New Delhi.
2) Principles of Electrical and Electronics Engineering by VK Mehta; S Chand and Co., New Delhi
3) Electrical and Electronics Engineering by SK Bhattacharya, Pearson Education, New Delhi
4) Principles of Electronics by SK Bhattacharya and Renu Vig, SK Kataria and Sons, Delhi
5) Electronics Devices and Circuits by Millman and Halkias; McGraw Hill.

*****xox*****

22) Syllabus of Value Education Courses (VEC):

F.Y.B.Sc. (Physics) (Sem-I)

VEC-101-T : Environment Education-I

Lectures: 30 hrs **(Credits-02)**

C) Course Objectives:- This course aim to introduce "Environment Education-I".

1) To study environmental issues and sustainable development in the context of physics.

D) Course outcome (CO): Upon completion of the course the student will be able to

1) To analyze local, regional, and global environmental issues and their effects.
2) To apply relevant environmental policies and ethical considerations to real-world scenarios.
3) To explain principles of resource management and recycling issues.
4) To describe how human activities impact the environment.
5) To design and implement action plans for community-based environmental projects.
6) To evaluate different strategies for conserving biodiversity and ecosystems

E) Instructional Design:

21) **Lecture method** 2) **Tutorial method** **3)Lab sessions** **4) Group projects**

5) Seminars: To take seminars on different tropics.

6) Create online resources: Through YouTube or other platform we will create online resources.

D) Evaluation Strategies:

1) Descriptive written examinations 2) Assignments 3) Seminars, Orals and Viva

E) Course Contents:

Module: - 01	**Humans and the Environment**	**06 hrs**
	The man-environment interaction: Humans as hunter-gatherers; Mastery of fire; Origin of agriculture; Emergence of city-states; Great ancient civilizations and the environment; Middle Ages and Renaissance; Industrial revolution and its impact on the environment; Population growth and natural resource exploitation; Global environmental change. **The emergence of environmentalism:** Anthropocentric and eco-centric perspectives (Major thinkers); The Club of Rome- Limits to Growth; UN Conference on Human Environment 1972; World Commission on Environment and Development and the concept of sustainable development; Rio Summit and subsequent international efforts.	
Module: - 02	**Natural Resources and Sustainable Development**	**08 hrs**
	Overview of natural resources: Definition of resource; Classification of natural resources - biotic and abiotic, renewable and non-renewable. **Biotic resources:** Major type of biotic resources- forests, grasslands, wetlands, wildlife and aquatic (fresh water and marine); Microbes as a resource; Status and challenges.	

	Water resources: Types of water resources- fresh water and marine resources; Availability and use of water resources; Environmental impact of over-exploitation, issues and challenges; Water scarcity and stress; Conflicts over water. **Soil and mineral resources:** Important minerals; Mineral exploitation; Environmental problems due to extraction of minerals and use; Soil as a resource and its degradation. **Energy resources:** Sources of energy and their classification, renewable and non-renewable sources of energy; Conventional energy sources- coal, oil, natural gas, nuclear energy; Non-conventional energy sources- solar, wind, tidal, hydro, wave, ocean thermal, geothermal, biomass, hydrogen and fuel cells; Implications of energy use on the environment. **Introduction to sustainable development:** Sustainable Development Goals (SDGs)- targets and indicators, challenges and strategies for SDGs.	
Module: - 03	**Environmental Issues: Local, Regional and Global**	**08 hrs**
	Environmental issues and scales: Concepts of micro-, meso-, synoptic and planetary scales; Temporal and spatial extents of local, regional, and global phenomena. **Pollution:** Impact of sectoral processes on Environment, Types of Pollution- air, noise, water, soil, municipal solid waste, hazardous waste; Trans boundary air pollution; Acid rain; Smog. **Land use and Land cover change:** land degradation, deforestation, desertification, urbanization. Biodiversity loss: past and current trends, impact. **Global change:** Ozone layer depletion; Climate change.	
Module: - 04	**Conservation of Biodiversity and Ecosystems**	**08 hrs**
	Biodiversity and its distribution: Biodiversity as a natural resource; Levels and types of biodiversity; Biodiversity in India and the world; Biodiversity hotspots; Species and ecosystem threat categories. **Ecosystems and ecosystem services:** Major ecosystem types in India and their basic characteristics- forests, wetlands, grasslands, agriculture, coastal and marine; Ecosystem services- classification and their significance. **Threats to biodiversity and ecosystems:** Land use and land cover change; Commercial exploitation of species; Invasive species; Fire, disasters and climate change. **Major conservation policies:** in-situ and ex-situ conservation approaches; Major protected areas; National and International Instruments for biodiversity conservation; the role of traditional knowledge, community-based conservation; Gender and conservation.	

References:

1. Fisher, Michael H. (2018) An Environmental History of India- From Earliest Times to the Twenty-First Century, Cambridge University Press.
2. Headrick, Daniel R. (2020) Humans versus Nature- A Global Environmental History, Oxford University Press.
3. Hughes, J. Donald (2009) An Environmental History of the World- Humankind's Changing Role in the Community of Life, 2nd Edition. Routledge.
4. Perman, R., Ma, Y., McGilvray, J., and Common, M. (2003) Natural Resource and Environmental Economics. Pearson Education.
5. Simmons, I. G. (2008). Global Environmental History: 10,000 BC to AD 2000. Edinburgh University Press
6. Chiras, D. D and Reganold, J. P. (2010). Natural Resource Conservation: Management for a Sustainable Future.10th edition, Upper Saddle River, N. J. Benjamin/Cummins/Pearson.
7. John W. Twidell and Anthony D. (2015). Renewable Energy Sources, 3rd Edition, Weir Publisher (ELBS)
8. William P.Cunningham and Mary A. (2015) Cunningham Environmental Science: A Global Concern, Publisher (Mc-Graw Hill, USA)
9. Gilbert M. Masters and W. P. (2008). An Introduction to Environmental Engineering and Science, Ela Publisher (Pearson)
10. Singh, J.S., Singh, S.P. & Gupta, S.R. 2006. Ecology, Environment and Resource Conservation. Anamaya Publications
11. Harper, Charles L. (2017) Environment and Society, Human Perspectives on Environmental Issues 6th Edition. Routledge.
12. Harris, Frances (2012) Global Environmental Issues, 2nd Edition. Wiley- Blackwell.
13. William P. Cunningham and Mary A. (2015). Cunningham Environmental Science: A global concern, Publisher (Mc-Graw Hill, USA)
14. Manahan, S.E. (2022). Environmental Chemistry (11th ed.). CRC Press. https://doi.org/10.1201/9781003096238
15. Rajagopalan, R. (2011). Environmental Studies: From Crisis to Cure. India: Oxford University Press.
16. Bawa, K.S., Oomen, M.A. and Primack, R. (2011) Conservation Biology: A Primer for South Asia. Universities Press.
17. Sinha, N. (2020) Wild and Wilful. Harper Collins, India.
18. Varghese, Anita, Oommen, Meera Anna, Paul, Mridula Mary, Nath, Snehlata (Editors) (2022) Conservation through Sustainable Use: Lessons from India. Routledge.
19. Bhagwat, Shonil (Editor) (2018) Conservation and Development in India: Reimagining Wilderness, Earthscan Conservation and Development, Routledge.
20. Krishnamurthy, K.V. (2003) Textbook of Biodiversity, Science Publishers, Plymouth, UK

*****xox*****

F.Y.B.Sc. (Physics) (Sem-II)

VEC-151-T : Environment Education-II

Lectures: 30 hrs **(Credits-02)**

A) Course Objectives:- This course aim to introduce "Environment Education-II".

1) To study environmental issues and sustainable development in the context of physics.

B) Course outcome (CO): Upon completion of the course the student will be able to

1) Identify various types of environmental pollution and their impacts on health.
2) Explain the basic concepts of climate change, including its causes and effects.
3) Analyze different strategies for adapting to and mitigating the effects of climate change.
4) Evaluate various environmental management practices and their effectiveness.
5) Apply the principles of key environmental treaties and legislation to case studies.
6) Create action plans that address specific environmental issues based on current policies and management practices.

C) Instructional Design:

1) Lecture method 2) Tutorial method 3) Lab sessions 4) Group projects
5) Seminars: To take seminars on different tropics.
6) Create online resources: Through YouTube or other platform we will create online resources.

D) Evaluation Strategies:

1) Descriptive written examinations 2) Assignments 3) Seminars, Orals and Viva

E) Course Contents:

Module: - 01	**Environmental Pollution and Health**	**08 hrs**
	Understanding pollution: Production processes and generation of wastes; Assimilative capacity of the environment; Definition of pollution; Point sources and non-point sources of pollution. **Air pollution**: Sources of air pollution; Primary and secondary pollutants; Criteria pollutants-carbon monoxide, lead, nitrogen oxides, ground-level ozone, particulate matter and sulphur dioxide; Other important air pollutants- Volatile Organic compounds (VOCs), Peroxyacetyl Nitrate (PAN), Polycyclic aromatic hydrocarbons (PAHs) and Persistent organic pollutants (POPs); Indoor air pollution; Adverse health impacts of air pollutants; National Ambient Air Quality Standards. **Water pollution:** Sources of water pollution; River, lake and marine pollution, groundwater pollution; water quality Water quality parameters and standards; adverse health impacts of water pollution on human and aquatic life. **Soil pollution and solid waste:** Soil pollutants and their sources; Solid and hazardous waste; Impact on human health. **Noise pollution:** Definition of noise; Unit of measurement of noise pollution; Sources of noise pollution; Noise standards; adverse impacts of noise on human health.	

	Thermal and Radioactive pollution: Sources and impact on human health and ecosystems.	
Module: - 02	**Climate Change: Impacts, Adaptation and Mitigation**	**06 hrs**
	Understanding climate change: Natural variations in climate; Structure of atmosphere; Anthropogenic climate change from greenhouse gas emissions– past, present and future; Projections of global climate change with special reference to temperature, rainfall, climate variability and extreme events; Importance of 1.5 °C and 2.0 °C limits to global warming; Climate change projections for the Indian sub-continent. **Impacts, vulnerability and adaptation to climate change:** Observed impacts of climate change on ocean and land systems; Sea level rise, changes in marine and coastal ecosystems; Impacts on forests and natural ecosystems; Impacts on animal species, agriculture, health, urban infrastructure; the concept of vulnerability and its assessment; Adaptation vs. resilience; Climate-resilient development; Indigenous knowledge for adaptation to climate change. **Mitigation of climate change:** Synergies between adaptation and mitigation measures; Green House Gas (GHG) reduction vs. sink enhancement; Concept of carbon intensity, energy intensity and carbon neutrality; National and international policy instruments for mitigation, decarbonizing pathways and net zero targets for the future; Energy efficiency measures; Renewable energy sources; Carbon capture and storage, National climate action plan and Intended Nationally Determined Contributions (INDCs); Climate justice.	
Module: - 03	**Environmental Management**	**06 hrs**
	Introduction to environmental laws and regulation: Constitutional provisions- Article 48A, Article 51A (g) and other derived environmental rights; Introduction to environmental legislations on the forest, wildlife and pollution control. **Environmental management system:** ISO 14001 Life cycle analysis; Cost-benefit analysis Environmental audit and impact assessment; Environmental risk assessment, Pollution control and management; Waste Management- Concept of 3R (Reduce, Recycle and Reuse) and sustainability; Ecolabeling /Ecomark scheme	
Module: - 04	**Environmental Treaties and Legislation**	**10 hrs**
	An overview of instruments of international cooperation; bilateral and multilateral agreements; conventions and protocols; adoption, signature, ratification and entry into force; binding and non-binding measures; Conference of the Parties (COP)	

	Major International Environmental Agreements: Convention on Biological Diversity (CBD); Cartagena Protocol on Biosafety; Nagoya Protocol on Access and Benefit-sharing; Convention on International Trade in Endangered Species of Wild Flora and Fauna (CITES); Ramsar Convention on Wetlands of International Importance; United Nations Convention to Combat Desertification (UNCCD); Vienna Convention for the Protection of the Ozone Layer; Montreal Protocol on Substances that Deplete the Ozone Layer and the Kigali Amendment; Basel Convention on the Control of Transboundary Movements of Hazardous Wastes and their Disposal; Rotterdam Convention on the Prior Informed Consent Procedure for Certain Hazardous Chemicals and Pesticides in International Trade; Stockholm Convention on Persistent Organic Pollutants; Minamata Convention on Mercury; United Nations Framework Convention on Climate Change (UNFCCC); Kyoto Protocol; Paris Agreement; India's status as a party to major conventions **Major Indian Environmental Legislations:** The Wild Life (Protection) Act, 1972; The Water (Prevention and Control of Pollution) Act, 1974; The Forest (Conservation) Act, 1980; The Air (Prevention and Control of Pollution) Act, 1981; The Environment (Protection) Act, 1986; The Biological Diversity Act, 2002; The Scheduled Tribes and Other Traditional Forest Dwellers (Recognition of Forest Rights) Act, 2006; Noise Pollution (Regulation and Control) Rules, 2000; Industry-specific environmental standards; Waste management rules; Ramsar sites; Biosphere reserves; Protected Areas; Ecologically Sensitive Areas; Coastal Regulation Zone; Status phase-out of production and consumption of Ozone Depleting Substances by India; National Green Tribunal; Some landmark Supreme Court judgements **Major International organisations and initiatives:** United Nations Environment Programme (UNEP), International Union for Conservation of Nature (IUCN),World Commission on Environment and Development (WCED), United Nations Educational, Scientific and Cultural Organization (UNESCO), Intergovernmental Panel on Climate Change (IPCC), and Man and the Biosphere (MAB) programme.	

Note: Case Studies and Field Work is compulsory

The students are expected to be engaged in some of the following or similar identified activities:

1) Discussion on one national and one international case study related to the environment and sustainable development.

2) Field visits to identify local/regional environmental issues, make observations including data collection and prepare a brief report.
3) Documentation of campus biodiversity.
4) Campus environmental management activities such as solid waste disposal, water management, and sewage treatment.

References:

1. Jackson, A. R., & Jackson, J. M. (2000). Environmental Science: The Natural Environment and Human Impact. Pearson Education.
2. Masters, G. M., & Ela, W. P. (2008). Introduction to environmental engineering and science (No.60457). Englewood Cliffs, NJ: Prentice Hall.
3. Miller, G. T., & Spoolman, S. (2015) Environmental Science. Cengage Learning.
4. Central Pollution Control Board Web page for various pollution standards. https://cpcb.nic.in/standards/
5. Ahluwalia, V. K. (2015). Environmental Pollution, and Health. The Energy and Resources Institute (TERI).
6. Pittock, Barrie (2009) Climate Change: The Science, Impacts and Solutions. 2nd Edition. Routledge.
7. Adenle A., Azadi H., Arbiol J. (2015). Global assessment of technological innovation for climate change adaptation and mitigation in developing world, Journal of Environmental Management, 161 (15): 261-275.
8. Barnett, J. & S. O'Neill (2010). Maladaptation. Global Environmental Change— Human and Policy Dimensions 20: 211–213.
9. Berrang-Ford, L., J.D. Ford & J. Paterson (2011). Are we adapting to climate change ? Global Environmental Change—Human and Policy Dimensions 21: 25-33.
10. Jørgensen, Sven Marques, Erik João Carlos and Nielsen, Søren Nors (2016) Integrated Environmental Management, A transdisciplinary Approach. CRC Press.
11. Theodore, M. K. and Theodore, Louis (2021) Introduction to Environmental Management, 2nd Edition. CRC Press.
12. Barrow, C. J. (1999). Environmental management: Principles and practice. Routledge.
13. Tiefenbacher, J (ed.) (2022), Environmental Management - Pollution, Habitat, Ecology, and Sustainability, Intech Open, London. 10.5772/
14. Richard A. Marcantonio, Marc Lame (2022). Environmental Management: Concepts and Practical Skills. Cambridge University Press.
15. UNEP (2007) Multilateral Environmental Agreement Negotiator's Handbook, University of Joensuu, ISBN 978-952-458-992-5
16. Ministry of Environment, Forest and Climate Change (2019) A Handbook on International Environment Conventions & Programmes. https://moef.gov.in/wpcontent/uploads/2020/02/convention-V-16-CURVE-web.pdf
17. Kanchi Kohli and Manju Menon (2021) Development of Environment Laws in India, Cambridge University Press.
18. India Code – Digital repository of all Central and State Acts: https://www.indiacode.nic.in/
19. Bohra, Saroj, Judicial Intervention and Evolution of Environmental Principles and Doctrines (January 7, 2019).

*****xox*****

23) Syllabus of Co-Curricular Courses (CC):

F.Y.B.Sc. (Physics) (Sem-II)

CC-151-T : Co-Curricular Courses

(Credits-02)

Students are required to go through the list of following Co-curricular Courses and select any one of their interests. They will be allocated one course from the list.

(Activity Report and Certificate are needs to be produced)

Basket of Co-curricular Courses

1. Health and Wellness
2. Yoga education
3. Sports and Fitness
4. Cultural Activities
5. NSS
6. NCC
7. Fine Arts
8. Applied Arts
9. Visual Arts
10. Performing Arts
11. Dancing
12. Art of Short Film Making / Cinematography
13. Basics of Music Composition
14. Physical Fitness
15. Self Defense for Women
16. Jeevan Vidya (Work Life Balance)
17. Integrated Personality Development
18. Design Thinking
19. Innovation and Creativity
20. Principle Centered Leadership
21. Mentoring of School Children
22. Basics of Fire Safety
23. Representation or Participation at State, National and International Co-curricular Events.

*****xox*****