Minutes of Board of Studies Meeting: Physics Department

School of Technology (SoT),

Pandit Deendayal Energy University

Gandhinagar, Gujarat-382426

Date: 08-06-2022
Time: 10 am onwards
Venue: E-block Ground floor Committee Room

A. Members of Board of Studies

Name of BoS Member	Name of Organization and Designation	Present / Absent	Remarks
Dr. Satyam M. Shinde	PDEU, Head & Associate Professor	Present	Chairman
Dr. Rajesh Patel	PDEU, Dean FOET & Associate Professor	Present	Dean FOET
Prof. Prafulla K. Jha	Maharaja Sayajirao University of Baroda, Professor	Present	External member
Prof. K C Poria	Veer Narmad South Gujarat University, Professor	Present	External Member
Dr. Rajesh Upadhyay	Space Applications Center, ISRO, Head, TSPD/ MEG, Sci/Engr SG	Absent	External member
Dr. Arvind Singh	Physical Research Laboratory, Ahmedabad, Associate Professor	Present	External member
Dr. Brijesh Tripathi	PDEU, Associate Professor	Absent	Member
Dr. Rohit Srivastava	PDEU, Associate Professor	Present	Member
Dr. Prahlad K. Baruah	PDEU, Assistant Professor	Present	Member
Abhishek Gor	PDEU, Assistant Professor	Present	Invitee
Dr. Anup Sanchela	PDEU, Assistant Professor	Present	Invitee

B. Agenda of Meeting:

1. To discuss the proposed changes in the B.Tech. Engineering Physics 1st Year Syllabus.
2. To discuss the syllabus for B.Sc. electives: Radiological Physics in Semester 5 and Medical Physics in Semester 6.
3. To discuss the change in the B.Sc. course C Programming Lab (19BSP701P) to Programming in Python Lab in Semester 7.
4. To discuss the change in B.Sc. elective Introduction to Programming (19BSP707T) to Programming in Python in Semester 7.
5. To discuss regarding the floating of open electives for B.Sc. students in Semester 5 from the basket of FOET open electives.
6. To discuss the option of allowing relevant NPTEL courses as electives in B.Sc. Semester 7.
7. Any other suggestions by the BOS members.

C. Minutes of BoS Meeting:

Agenda-I: To discuss the proposed changes in the B.Tech. Engineering Physics 1st year syllabus.

Discussion and Resolution:

- The proposed modification in the syllabus of B.Tech. Engineering Physics 1st Year was put up for discussion and was thereupon approved. (***The detailed syllabus has been provided at the end of this document***)

Agenda-II: To discuss the syllabus for B.Sc. electives: Radiological Physics in Semester 5 and Medical Physics in Semester 6.

Discussion and Resolution:

- The proposed syllabus for B.Sc. electives: Radiological Physics in Semester 5 and Medical Physics in Semester 6 were put up for discussion and approval.

  Radiological Physics
- The proposed syllabus was found to be lengthy and the BOS members were of the opinion that the content needs to be curtailed.
- It was also suggested to refer to the syllabi of similar courses offered by other institutions like BARC, etc.
- Based on the suggestions received, the syllabus was revised. (***The detailed syllabus of Radiological Physics has been provided at the end of this document***)

Medical Physics

- For the course Medical Physics, the BOS members suggested to refer to the syllabi of similar courses offered by other institutions like BARC, etc.
- The members felt that the syllabus was not very attractive and it was also suggested that more of Physics should be incorporated in the syllabus.
- Based on the suggestions received, the syllabus was revised. (***The detailed syllabus of Medical Physics has been provided at the end of this document***)

Agenda-III: To discuss the change in the B.Sc. core course C Programming Lab (19BSP701P) to Programming in Python Lab in Semester 7

Discussion and Resolution:

- The proposed changes in the B.Sc. course: C Programming Lab (19BSP701P) to Programming in Python Lab in Semester 7 has been approved by the BOS members. (***The detailed syllabus of Programming in Python Lab has been provided at the end of this document***)

Agenda-IV: To discuss the change in B.Sc. elective Introduction to Programming (19BSP707T) to Programming in Python in Semester 7.

Discussion and Resolution:

- The proposed changes in the B.Sc. course: C Programming Lab (19BSP701P) to Programming in Python Lab in Semester 7 has been approved by the BOS members. ***(The detailed syllabus of Programming in Python Lab has been provided at the end of this document)***

Agenda-V: To discuss regarding the floating of open electives for B.Sc. students in Semester 5 from the basket of FOET open electives

Discussion and Resolution:

- The BOS members approved the proposal of floating open electives for B.Sc. students in Semester 5 from the basket of FOET open electives.
- There was a concern raised regarding probable clash in timetable for the students for the open electives. However, it was brought to the notice of the board that special slots are provided for open electives as per the convenience of students from various branches. This resolved the concern.

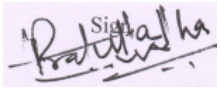
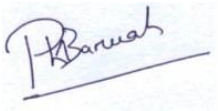
Agenda-VI: To discuss the option of allowing relevant NPTEL courses as electives in B.Sc. Semester 7

Discussion and Resolution:

- The BOS members approved the proposal of allowing relevant NPTEL courses as electives in B.Sc. Semester 7.
- It was suggested that the department should create a basket of relevant NPTEL courses from which the students can select. Accordingly, it was decided that the department would be creating a basket of relevant NPTEL courses and the students would be asked to select from this basket. This basket of courses would be created by the Head of the Department in consultation with the NPTEL coordinator and the same would be updated from time to time.

General Discussion and Recommendation by BoS Members:

- There was a suggestion to jointly design and offer some courses by different departments. This would help the students develop an interdisciplinary approach and would also help in inter-departmental collaborations.

Dr. Satyam M. Shinde	**Dr. Rajesh Patel**	**Prof. Prafulla K. Jha**	**Prof. K C Poria**
Sign	Sign		Approved via email
Dr. Rajesh Upadhyay	**Dr. Arvind Singh**	**Dr. Brijesh Tripathi**	**Dr. Rohit Srivastava**
 Digitally signed by DR. RAJESH B UPADHYAYA Date: 2022.06.20 17:34:31 +05'30'		Sign	Sign
Dr. Prahlad K. Baruah	**Abhishek Gor**	**Dr. Anup Sanchela**	
	Sign	Sign	Sign

Note: Take signature of all the members present in BoS

XXPH101T					Engineering Physics					
Teaching Scheme					Examination Scheme					
L	T	P	C	Hrs/Week	Theory			Practical		Total Marks
					MS	ES	IA	LW	Viva	
3	0	0	0	3	25	50	25	--	--	100

COURSE OBJECTIVES

- To understand basic concepts of quantum mechanics and solve the Schrödinger equation for various cases.
- To understand basics concepts of electric and magnetic properties of solids.
- To develop the fundamental understanding of optoelectronic devices.
- To understand the heat transfer mechanism in solids and fluids.

UNIT 1 Introduction to Quantum Mechanics	**12 Hrs.**
Inadequacies in Classical Physics, Wave Nature of Matter, Heisenberg's Uncertainty Principle and its applications, zero point energy, Basic Postulates and Formalism of QM: Energy, Momentum and Hamiltonian Operators, Time-independent Schrodinger Wave Equation for Stationary States, Properties of Wave Function, Quantum Tunnelling, Quantum confinement in Nanomaterials, Introduction to single electron transistors.	
UNIT 2 Electronic theory of Solids	**10 Hrs.**
Origin of energy bands, band structure of conductors, type of semiconductors, Free Electron Theory of metals, Wiede-mann Franz Law, Hall effect. Applications: LED and Solar cells, Magnetism and its origin, magnetization and susceptibility, dia-para-ferro-magnetism. Ferromagnetism, Giant Magnetoresistance (GMR) and its applications, Lattice vibrations-introduction, Phenomenology of Superconductors, Meissner effect, BCS theory - high temperature superconductors, Josephson effect, Applications of superconductors.	
UNIT 3 OPTICS, LASER AND OPTO-ELECTRONICS	**08 Hrs.**
Optics: Introduction, division of amplitude, thin film interference, Applications of interference, Laser: The Einstein coefficients, Spontaneous and stimulated emission, Optical amplification and population inversion, meta stable state, optical resonator, the principle of pumping scheme, laser beam characteristics, Types of LASER, Injection Laser Diode (ILD), Quantum Cascade Laser, Comparison between ILD and QCL, Applications of lasers.	
UNIT 4 THERMAL PHYSICS	**10 Hrs.**
Laws of thermodynamics-basic concepts, closed and open systems, Carnot cycle, Heat transfer-thermal expansion of solids and liquids –Conduction in solids – thermal conductivity- Forbe's method, Lees' disc method thermal insulation and its applications, Thermal Convection and its applications- Thermal Radiation – emission and absorption radiation, emissive power, black body radiation –Stefan's laws, Wien's law, Newton's law of cooling, Joule-Thomson effect, Liquefaction of gases.	
Max. 40 Hrs.	

COURSE OUTCOMES

CO1 - identify and understand the experimental results which require conceptualization of quantum theory.

CO2 - Interpret the solution of Schrödinger equation to obtain physical information about the system.

CO3 - Identify basic concepts in semiconductors, superconductors and magnetism and apply it in engineering applications.

CO4 - To understand concepts of optical interference and LASER, analyse the lasing characteristics to apply in different laser diodes and other applications
CO5 - To understand concepts of thermal physics in terms of laws and modes of heat transfer.
CO6 - To apply knowledge of concepts of engineering physics to solve real world problems.

TEXT/REFERENCE BOOKS

1. N. Zettili, Quantum Mechanics: Concepts and applications, Willey Publications
2. Kittel, Charles. Introduction to Solid State Physics. John Wiley and Sons.
3. W.D. Callister and David Rethwisch, Materials Science & Engineering -An Introduction, 9th edn.,
4. Heat and Thermodynamics BrijLal, N. Subrahmanyam, S. Chand, Limited, 2001.
5. Optics by Ajay Ghatak, Tata macgraw hill publishing.

END SEMESTER EXAMINATION QUESTION PAPER PATTERN

Max. Marks: 100	**Exam Duration: 3 Hrs**
Part A/Question: 3 Questions from each unit, each carrying 3 marks	36 Marks
Part B/Question: 2 Questions from each unit, each carrying 8 marks	64 Marks

Course Code					Radiological Physics					
Teaching Scheme					Examination Scheme					
L	T	P	C	Hrs/Week	Theory		Internal	Team Work	Practical/ Viva	Total Marks
					MS	ES				
3	0	0	3	3	25	50	25	-	-	100

COURSE OBJECTIVES:

- To provide knowledge of the interaction of ionising and non-ionizing radiation with matter at a fundamental physics level
- Identify the properties of x-rays and principles of x-ray production, and its use for fluoroscopy and Computed Tomography
- To provide them knowledge of the Magnetic Resonance and it use for imaging and the interaction of ultrasound with matter in the formation of medical images
- Critically appraise the legislation and guidance that applies to ionising radiation safety and use of radioactive materials in field of medicine.

Unit-I: Basic Concepts **[8]**
Atomic Structure and Transitions, Nuclear Structure, Particle Interactions, X-ray and Gamma-Ray Interactions, Attenuation of x-rays and Gamma Rays, Absorption of Energy from X-rays and Gamma Rays, Imparted Energy.
Unit-II: Diagnostic Radiology **[12]**
Production of X-rays, X-ray Tubes, X-ray Generators, Power Ratings and Heat Loading and Cooling Factors Affecting x-ray Emission, Geometry of Projection Radiography, Screen-Film Radiography, Computed Radiography, introduction to Computed Tomography, Principle of radiation detection, Ion chamber, GM counter, Film dosimetry, scintillation detector, personnel monitoring instruments, Units and definitions in dosimetry.
Unit-III: Non Ionizing Radiation Physics and lasers **[12]**
First law of photochemistry, Law of reciprocity, principle and theory of thermography, Characteristics of Laser in biological tissues, Optical properties of tissues, Laser systems in medicine and biology, Surgical application of laser, Laser in diagnosis, Regulations, Nuclear Medicine, Radiation Detection and Measurement.
Unit-IV: Radiation Therapy and Protection **[8]**
Application of radiation in therapy, Type of radiation therapy, Detectors, basic Beam parameters, Percentage depth dose, Treatment Simulation, Treatment Planning, Therapy Equipment's and Simulators, Sources of Exposure to Ionizing Radiation, Radiation Detection Equipment in Radiation Safety, Radiation Protection in Diagnostic, Regulatory Agencies and Radiation Exposure Limits.
Max: 40 Lectures

COURSE OUTCOMES

On completion of the course, student will be able to

CO1 - Critically review the range of medical imaging modalities - both ionising and non-ionising and discuss their utility in a wide range of conditions.

CO2- Understand the X-ray production methods, their applications for various imaging methods.

CO-3: Understand and critically review the Magnetic Resonance imaging and its system regulation.

CO-4: Can apprise the interaction of ultrasound with various body tissue and imaging of various body parts.

CO-5 can explain and discuss the various nuclear medicine and radiation their effect and required dosages.

CO-6 Appraise the legislation and guidance that applies to ionising radiation and safety.

TEXT/REFERENCE BOOKS

1. Essential Physics of Medical Imaging; 3rd Edition; Bushberg, Seibert, Leidholdt Jr & Boone; Lippincot, Williams & Wilkins; Baltimore, MD; 2011.
2. F.M.Khan,The Physics of Radiation Therapy,Third Edition,Lippincott Williams and Wilkins,U.S.A.,2003 .
3. J. E. Coggle, Biological Effects of Radiation. 2nd edition, Taylor & Francis.
4. C. G. Orton, Radiation Dosimetry: Physical and Biological Aspects, Plenum Press.
5. C. R. Hill, J. C. Bamber, G. R. ter Haar, Physical Principles of Medical Ultrasonics, John Wiley & Sons, 2002.
6. Dowden-Hatchinson& Ross Inc.
7. Bo N. Nilsson, Exercises with Solutions in Radiation Physics, De Gruyter, 2015.
8. Christensen's Physics of Diagnostic Radiology, Curry, T.S. and Dowdey, J.E. and Murry, R.C., Fourth Edition, Lippincott Williams and Wilkins, 1990.

Course Code					Medical Physics					
Teaching Scheme					Examination Scheme					
L	T	P	C	Hrs/Week	Theory		Internal	Team Work	Practical/ Viva	Total Marks
					MS	ES				
3	0	0	3	3	25	50	25	-	-	100

Course Objective: To give students knowledge that how physical principles and techniques are applied in tackling different problems in biology. It will also help them to apply applications of physics in medical sciences. It uses physics concepts and procedures in the prevention, diagnosis, and treatment of disease. This course introduces a student to the basics of Medical Physics. Today with the changing life styles it is also necessary for one to have a better understanding of the human body from the perspective of Physics. This course seeks to fulfill all these needs.

UNIT I Introduction

Introductory: General Medical physics, Prerequisites of Medical physics, History of Medical physics, Applications of Medical Physics.
Role of medical physicists: General patient care, Principles of professional practice, Ethical and cultural issues, Legal aspects, Confidentiality, informed consent, Health and safety.
Basic Anatomical Terminology: Standard Anatomical Position, Planes. Familiarity with terms like- Superior, Inferior, Anterior, Posterior, Medial, Lateral, Proximal and Distal.
Radiopharmaceuticals: Definition, types, applications of radiopharmaceuticals.

UNIT II Physics of the body

Mechanics of the body: Skeleton, forces, and body stability. Muscles and dynamics of body movement. Physics of Locomotors Systems: joints and movements, Stability and Equilibrium.
Energy household of the body: Energy balance in the body, Energy consumption of the body, Heat losses of the body, Thermal Regulation. Pressure system of body. Mechanics of breathing, Cardiovascular mechanism of body.
Acoustics of the body: Nature and characteristics of sound, Production of speech, Structure of ear, Diagnostics with sound and ultrasound.
Optical system of the body: Human eye and refraction.
Electrical system of the body: Nervous system of body, Electrical signals and information transfer, Magnetic fields for modulating the nervous system.

UNIT III Biomedical Instrumentation

Diagnostic Equipment: Audiometer, Endoscopes, Blood Flow meters, Oximeter, Pulmonary Function Analyzers, Blood Gas Analyzers, Ventilator and its modes.
Therapeutics Equipments: Cardiac Pacemaker, Haemodialysis Machine, Ultrasound Therapy, Pain relief through electrical Stimulation, Anaesthesia Machine, Ventilators, Radiotheraphy Equipment, Automatic drug delivery system, echocardiography.
Bioelectric Signal Recording: Origin and Characteristics of Bioelectric Signals and Recording, Bioelectric potentials – Neuron potential of Nervous system - resting and action potentials, Electrocardiograph (ECG), Electroencephalograph (EEG), Electromyograph (EMG), Electroneurograph (ENG), Electrocorticography (ECoG), Electrooculograph (EOG), Fetal Electrocardiography (FECG).
Computed tomography scanner, Magnetic Resonance Imaging, Ultrasound imaging, **3D/4D Sonography**

UNIT IV Physics of Cancerous Cell

Basics of Cancer: Definition, Benign Tumours and Malignant Tumours, Types of Cancer, Cancer Genes, Oncogenes and Tumour Suppressor Genes, Programmed Cell Death.

Cancer Risk Factors: Oncogene and antioncogene - Physical, Biological, Chemical - Exogenous and Endogenous Carcinogens, Metabolism of Chemical Carcinogens, DNA Adduct Formation, Biological - DNA Viruses and RNA Viruses, Genetic Syndromes, other factors

Cancer Screening: Different kind of Screening tests, Screening for specific types of Cancer.

Cancer treatment using medical physics: Radiation therapy, Radiolabelled Immunotherapy, Gene therapy, Laser therapy, Photodynamic therapy, Hyperthermia.

Course Outcomes

On completion of the course, student will be able to

CO1 - Understand the dependence of physics and biology.

CO2 - Analyze different biomedical techniques used in diagnosis of different diseases.

CO3 - Identify physics involved in biological system.

CO4 - Identify and differentiate working principle, instrumentation and applications of various biomedical instruments.

CO5 - Understanding various role of physics in cancer biology.

CO6 - Describe the role of medical physicist.

Reference Books:

1. R.S.Khandpur, Handbook of Biomedical Instrumentation, Tata McGraw Hill, New Delhi, 1990.
2. Medical Physics, J.R. Cameron and J.G.Skofronick, Wiley 1978.
3. Jacobson and Webster, Medicine and Clinical Engineering, Prentice Hall of India, New Delhi, 1979.
4. The Essential Physics of Medical Imaging, Jerrold T Bushberg, Second Edition 2002.
5. Introduction to Biomedical Equipment Technology, Joseph J. Carr and John M. Brown, Fourth Edition, Pearson Education, 2001.
6. R. S Khandpur, Handbook of Analytical Instruments, McGraw Hill, Education.
7. Robert A. Weinberg, The Biology of Cancer, Garland Science, 2012
8. Robin Hesketh, Introduction to Cancer Biology, Cambridge University Press, 2013.
9. The Neurophysics of Human Behavior, Mark Evan Furman and Fred P. Gallo.

Course Code					Programming in Python (Practical)					
Teaching Scheme					Examination Scheme					
L	T	P	C	Hrs./Week	Theory		Internal	Team Work	Practical/ Viva	Total Marks
					MS	ES				
0	0	2	1	2				-	-	100

Course Objective:

1. To help students to feel justifiably confident of their ability to write small programs.
2. To help students to learn Python for computational physics by making use of various mathematical methods.
3. To help students to have mathematical and logical aptitude towards the problem.

Practical in the lab session will be related to or based on:

1. **Implementation of various mathematical, logical, string and boolean operations in Python.**
2. **Implementing conditional statements and control statements in Python.**
3. **Problems based on iteration techniques in Python.**
4. **Implementation of various modules such as NumPy, Math, cMath, Statistics and Matplotlib in Python.**
5. **Writing a program based on various root finding methods for algebraic and transcendental equations in Python.**
6. **Performing differentiation and integration in Python.**
7. **Application of curve fitting on suitable problem in Python.**
8. **Writing a program for obtaining an analytical and numerical solution of ordinary and partial differential equations in Python.**
9. **Writing a program based on statistical analysis, discrete and continuous probability distributions.**
10. **Evaluation and graphical representation of various integral transforms in Python.**
11. **Writing a program based on correlation and regression in Python.**
12. **Implementation of cMath module functions for various concepts of complex analysis in Python.**

Course Outcomes: On completion of the course, student will be able to:

CO1 - Understand the dependence of programming in physics.
CO2 - Analyze different programming techniques used for solution of physical world problems.
CO3 - Identify errors involved in the problem.
CO4 – Understanding and implementing various modules in Python.
CO5 – Understanding the algorithm of program for the solution of model problem.
CO6 – Graphical representation of model solution in Python.

Reference Books:

1. Lutz, Mark. Learning Python: Powerful Object-Oriented Programming. United States: O'Reilly Media, 2013.
2. Core Python Programming, 3ed: Dr. R. Nageswara Rao, Wiley India, 2021, ISBN: 9789390457151
3. Thareja, Reema. Python Programming: Using Problem Solving Approach. Oxford University Press, 2018.
4. Guttag, John. Introduction to Computation and Programming Using Python: With Application to Understanding Data. MIT Press, 2016. ISBN: 9780262529624.

Programming in Python (Theory)										
Teaching Scheme					Examination Scheme					
L	T	P	C	Hrs./Week	Theory		Internal	Team Work	Practical/ Viva	Total Marks
					MS	ES				
3	0	0	3	3				-	-	100

Course Objective:

- To help students to feel justifiably confident of their ability to write small programs.
- To help students to learn Python for computational physics by making use of various mathematical methods.
- To help students to have mathematical and logical aptitude towards the problem.

Unit I Introduction to Python

Programming in Python | History of Python | Installation and Setup | Understanding Python Environment, Writing and Running Python Script | Keywords, Identifiers, Indentation, Variables, Comments, Escape Characters, and User Inputs | Printing with Parameters | Python File Methods.

Unit II Data Types and Functions in Python

Data Types | Operators | Conditional Statements | Looping | Logical Expressions | Python Built-In Functions | User Defined Functions | Defining and Calling Functions | Function Input and Output| Local and Global Scope | Lambda Function | Recursive Function | Function Overloading.

Unit 3 Data Structure and Visualization in Python

List in Python | List Operations and Methods | List Iteration and Comprehensions | List Indexing and Slicing | List and Arrays in Python | Dictionary in Python | Defining Dictionary in Python | Dictionary Operations and Methods | Tuples in Python | List and Tuples in Python | Tuple Operations and Methods | Set in Python | Set Operation and Methods | NumPy and SciPy, Matplotlib | Math, cMath and Stat Module.

Unit 4 Errors and Exception in Python

Error in Python | Types of Errors | Python Debugger | Exception in Python | Try Except Else |

Try - Finally Clause | Argument of an Exception | Python Standard Exceptions | Raising an Exceptions | User-Defined Exceptions.

Course Outcomes:

On completion of the course, student will be able to:
CO1 - Understand the dependence of programming in physics.
CO2 - Analyze different programming techniques used for solution of physical world problems.
CO3 - Identify errors involved in the problem.
CO4 – Understanding and implementing various modules in Python.
CO5 – Understanding the algorithm of program for the solution of model problem.
CO6 – Graphical representation of model solution in Python.

Reference Books:

1. Lutz, Mark. Learning Python: Powerful Object-Oriented Programming. United States: O'Reilly Media, 2013.
2. Core Python Programming, 3ed: Dr. R. Nageswara Rao, Wiley India, 2021, ISBN: 9789390457151
3. Thareja, Reema. Python Programming: Using Problem Solving Approach. Oxford University

Press, 2018.
4. Guttag, John. Introduction to Computation and Programming Using Python: With Application to Understanding Data. MIT Press, 2016. ISBN: 9780262529624.