1.2.1

List of New Courses Introduced with Course Contents

Colour Codes		
Employability Contents	**Green**	
Entrepreneurship Contents	**Light Blue**	
Skill Development Contents	**Pink**	
Name of the Subjects/Related to all three Components (Employability/ Entrepreneurship/ Skill Development)	**Yellow**	

List of New Courses

Department : *Pure and Applied Physics*

Program Name : *B.Sc. (Physics)*

Academic Year : 2021-22

List of New Courses

Sr. No.	Course Code	Name of the Course
01.	AECPP01	Indian Contribution to Physics
02.	SECPP01	Analytical Techniques in Physics
03.	SECPP01	Analytical Techniques in Physics Lab
04.	AECPP02	Physics for Sustainable Future
05.	SECPP02	Renewable Energy and Energy Harvesting

विभागाध्यक्ष/H.O.D.
शुद्ध एवं अनुप्रयुक्त भौतिकी विभाग
Dept. of Pure & Applied Physics
गुरु घासीदास विश्वविद्यालय
Guru Ghasidas Vishwavidyalaya
बिलासपुर (छ.ग.)/Bilaspur (C.G.)

Minutes of Meetings (MoM) of Board of Studies (BoS)

Academic Year : 2021-22

School : *School of Physical Sciences*

Department : *Pure and Applied Physics*

Date and Time : *March 10, 2022 – 02:00 PM*

Venue : *Smart Class Room*

The scheduled meeting of member of Board of Studies (BoS) of Department of Pure and Applied Physics, School of Studies of Physical Sciences, Guru Ghasidas Vishwavidyalaya, Bilaspur, was held to design and discuss the B. Sc. (Physics), scheme and syllabi.

The following members were present in the meeting:

1. Dr. M. N. Tripathi
2. Prof. P. K. Bajpai
3. Prof. D. C. Gupta, External Member (Professor & Head, School of Studies in Physics, Jiwaji University, Gwalior)
4. Dr. A. K. Singh
5. Mr. P. Rambabu
6. Dr. R. P. Patel
7. Dr. M. P. Sharma

The committee discussed and approved the scheme and syllabi. The following courses were revised in the B. Sc. (Physics):

- Mathematical Physics-I
- Waves and Optics

The following new courses were introduced in the B. Sc. (Physics):

- Indian Contribution to Physics (AECPP01)
- Analytical Techniques in Physics (SECPP01)
- Analytical Techniques in Physics Lab (SECPP01)
- Physics for Sustainable Future (AECPP02)
- Renewable Energy and Energy Harvesting (SECPP02)

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Signature & Seal of HoD

Scheme and Syllabus

Course Structure
B.Sc. Physics Syllabus 2021-22

Sem.	Course	Course Code	Course Name	Credits	Credits (L+T+P)	Internal Marks/	ESE Max. Marks	Total Marks
I	Core 1	PPUATT1	Mathematical Physics-I	5	4+1+0	30	70	100
	Core 2	PPUATT2	Mechanics	3	3+0+0	30	70	100
		PPUALT2	Mechanics Lab	2	0+0+2	30	70	100
	GE-1		Opted from the pool Course and offered by Sister Departments	5		30	70	100
	AEC-1		Opted from the Pool Course offered by University	2		30	70	100
	SEC-1		Opted from the Pool Course offered by University	2		30	70	100
			Total	**19**				**600**
II	Core 3	PPUBTT1	Electricity and Magnetism	3	3+0+0	30	70	100
		PPUBLT1	Electricity and Magnetism Lab	2	0+0+2	30	70	100
	Core 4	PPUBTT2	Waves and Optics	3	3+0+0	30	70	100
		PPUBLT2	Waves and Optics Lab	2	0+0+2	30	70	100
	GE-2		Opted from the pool Course and offered by Sister Departments	5		30	70	100
	AEC-2		Opted from the Pool Course offered by University	2		30	70	100
	SEC 2		Opted from the Pool Course offered by University	2		30	70	100
			Total	**19**				**600**
III	Core 5	PPUCTT1	Mathematical Physics-II	5	4+1+0	30	70	100
	Core 6	PPUCTT2	Thermal Physics	3	3+0+0	30	70	100
		PPUCLT2	Thermal Physics Lab	2	0+0+2	30	70	100
	Core 7	PPUCTT3	Analog Systems and Applications	3	3+0+0	30	70	100
		PPUCLT3	Analog Systems & Applications Lab	2	0+0+2	30	70	100
	GE-3		Opted from the pool Course and offered by Sister Departments	5		30	70	100
	AEC-3		Opted from the Pool Course offered by University	2		30	70	100
	Additional Credit Courses					30	70	100
			Total	**22**				**800**
IV	Core 8	PPUDTT1	Mathematical Physics-III	5	4+1+0	30	70	100
	Core 9	PPUDTT2	Elements of Modern Physics	3	3+0+0	30	70	100
		PPUDLT2	Elements of Modern Physics Lab	2	0+0+2	30	70	100
	Core 10	PPUDTT3	Digital Systems and Applications	3	3+0+0	30	70	100
		PPUDLT3	Digital Systems and Applications Lab	2	0+0+2	30	70	100
	GE 4		Opted from the pool Course and offered by Sister Departments	5		30	70	100
	AEC -4		Opted from the Pool Course offered by University	2		30	70	100

	Internship*			6**		30	70	100
	Additional Credit Course					30	70	100
			Total	**22+6****				**900**
V	Core 11	PPUETT1	Quantum Mechanics & Applications	5	4+1+0	30	70	100
	Core 12	PPUETT2	Statistical Mechanics	5	4+1+0	30	70	100
	DSE - 1	PPUETD1	Fundamentals of Nano Materials	3	3+0+0	30	70	100
		PPUELD1	Basic Nano Materials Lab	2	0+0+2	30	70	100
	DSE - 2	PPUETD2	Experimental Techniques	3	3+0+0	30	70	100
		PPUELD3	Experimental Techniques Lab	2	0+0+2	30	70	100
	AEC-5		Opted from the Pool Course offered by University	2		30	70	100
	Additional Credit Courses					30	70	100
			Total	**22**				**800**
VI	Core 13	PPUFTT1	Electromagnetic Theory	5	4+1+0	30	70	100
	Core 14	PPUFTT2	Solid State Physics	3	3+0+0	30	70	100
		PPUFLT2	Solid State Physics Lab	2	0+0+2	30	70	100
	DSE 3	PPUFTD1	Basics Nuclear Physics	3	3+0+0	30	70	100
		PPUFLD2	Basics Nuclear Physics Lab	2	0+0+2	30	70	100
	Seminar	PPUFS01#	Seminar	2		30	70	100
	Dissertation	PPUFD01#	Dissertation/ project work followed by seminar	7		30	70	100
			Total	**23**				**600**
Ability Enhancement Course (AEC) offered by Department								
1	AEC	AECPP01	Indian Contribution to Physics	2	2+0+0	30	70	100
2	AEC	AECPP02	Physics for Sustainable Future	2	2+0+0	30	70	100
Skill Enhancement Course offered by Department								
1	SEC	SECPP01	Analytical Techniques in Physics	2	1+0+1	30	70	100
2	SEC	SECPP02	Renewable Energy and Energy harvesting	2	1+0+1	30	70	100
Generic Elective offered by Department								
1	GE	PPUATG1	Mechanics	3	3+0+0	30	70	100
		PPUALG1	Mechanics Lab	2	0+0+2	30	70	100
2	GE	PPUBTG2	Electricity and Magnetism	3	3+0+0	30	70	100
		PPUBLG2	Electricity and Magnetism Lab	2	0+0+2	30	70	100
3	GE	PPUCTG3	Thermal Physics	3	3+0+0	30	70	100
		PPUCLG3	Thermal Physics Lab	2	0+0+2	30	70	100
4	GE	PPUDTG4	Elements of Modern Physics	3	03+0+0	30	70	100
		PPUDLG4	Elements of Modern Physics Lab	2	0+0+2	30	70	100

AEC -1: Indian Contribution to Physics **Credits = 2 (2+0+0)**

Course Code: AECPP01

Course Objectives

- This course would empower the student to understand the ancient contribution of India towards Classical Physics.
- It will also enable the students to analysis Vaiseshika Darshan originated by Kanada with the principles of Classical Physics.
- The students will also be able to understand the great contribution of Indian Physicists towards the growth of Science and Technology

Learning Outcomes

- Upon successful completion of this course, students will be able to understand understand the ancient contribution of India towards Classical Physics.
- It will also enable the students to analysis Vaiseshika Darshan given by Kanada with the principles of Classical Physics.
- The students will also be able to understand the great contribution of Indian Physicists towards the growth of Science and Technology

Unit -1

- Need to understand the ancient contribution of India towards Classical Physics.
- Devlopment of Classical Physics in Western civilization, Ancient Engineering, temples, Dam, Monastery etc.
- Basic framework of Classical Physics of ancient indian origin.
- vaisheshika darshan- introductioncommentries on important vaisheshika sutras
- Dharma of physical world, Kanada atomic theory of universe, importance of ancient thoughts in this context.

Unit -2

- Contributions of contemporary indian physicists towards the growth of science and technology:
  a) Dr. C.V. Raman (1888-1970), and discovery of Raman effect.
  b) Satyendranath Bose (1894-1974), Bose-Einstein condensate.
  c) Dr. Chandrashekhar (1910-1995) and Chandrashekhar limit in Astrology.
  d) Dr. Meghnad Saha (1893-1956) and Saha Ionization equation.
  e) Dr. H.J.Bhabha (1909-1966)
  f) Vikram Sarabhai (1919-1971)
  g) G.N. Ramachandran (1922-2001)
  h) Jayant Narlikar (1938)

i)

SEC -1: Analytical Techniques in Physics **Credits = 1 (1+0+0)**

Course Code: SECPP01

Course Objective

- The course focuses on the properties, functions of the internal structure, and arrangement of atoms in a crystalline material. It offers an insight into how x-ray diffraction, can solve crystallographic issues related to single and poly-crystalline material, right from the base. This course will also cover the basic principles and techniques of scanning electron microscopy and Atomic Force microscopies along with demonstrations on the instrument details and imaging experiments. The sample preparation techniques for the microstructural analysis and surface Morphology analysis will be discussed. Structural studies by Fourier transform IR (FTIR) and Raman spectroscopies will be discussed.

Course learning outcomes:

- Students will have achieved the ability to: 1. apply appropriate characterization techniques for microstructure examination at different magnification level and use them to understand the microstructure of various materials 3. Determine crystal structure of specimen and estimate its crystallite size by X-ray Diffraction technique 4. Use appropriate spectroscopic technique to measure vibrational / electronic transitions.

Unit – I: Structure and Microstructure analysis by X-ray and electron diffraction: The geometry of crystals and reciprocal lattice, Basics of x-rays and their production and detection, X-ray diffraction, Determination of crystal structure: Qualitative and quantitative analysis, Particle size determination by x-rays, X-rays and stress analysis,

Unit – II: Scanning electron microscopy techniques and Composition analysis by Energy dispersive X-ray (EDX): Introduction to Scanning electron microscopy, Basic principles and components, Different examination modes (Bright field illumination, Oblique illumination, Dark field illumination, Phase contrast,Instrumental details and image formation, Energy-dispersive x-ray spectroscopy (paired with scanning electron microscopy) analysis to gain elemental information about samples.

Unit – III: Structural studies by Fourier transform IR (FTIR) and Raman spectroscopies: Basics of Fourier Transform Infrared (FT-IR) spectrometry,Different regions in infrared radiations, Modes of vibrations in diatomic molecule. characteristic absorption bands, Instrumental details, Qualitative treatment of Rotational Raman effect, Vibrational Raman spectra, Stokes and anti-Stokes lines; their intensity difference, Instrumental details& data accusation process.

Unit – IV: Ultra-violet and Visible Absorption Spectroscopy: Principle of UV Spectroscopy, Beer's Law and Quantitation, Deviations and limitations to Beer's Law, Instrumentation for UV-VIS spectroscopy i) Components and design ii) Actual commercial instruments, Methods and applications of absorption spectroscopy

Reference Books:

1. Li, Lin, Ashok Kumar Materials Characterization Techniques Sam Zhang; CRC Press, (2008).
2. Cullity, B.D., and Stock, R.S., "Elements of X-Ray Diffraction", Prentice-Hall, (2001).

SEC -1: Analytical Techniques in Physics Lab **Credits = 1 (0+0+1)**

Course Code: SECPP01

1. Study X-ray diffraction for the purpose of (a) identifying (cubic) crystal systems, (b) determining the lattice constant, a,
2. Study scanning electron microscopy (SEM) technique to obtain real space atomic resolution images of conductive surfaces, Energy-dispersive x-ray spectroscopy (paired with scanning electron microscopy) analysis to gain elemental information about samples.
3. Observation and analysis of a given Spectra to understand IR & Raman spectroscopy. .
4. StudyUltra-violet and Visible Absorption Spectroscopy for finding the bandgap of a given sample. (Only Data Analysis)

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Ability Enhancement Course (AEC) offered by Department for the Pool AEC courses of the University

AEC -1: Physics for Sustainable Future **Credits = 2 (2+0+0)**

Course Code: AECPP02

Course Objectives

- The students will explore the physics of energy, learning to calculate the energy content of a wide variety of systems such as speeding cars, toasty houses and hot tubs, wind, solar illumination, nuclear powerplants
- To study the basic concepts to the various energy production schemes and usages found in our lives.
- This course is meant to provide a scientific foundation for understanding the energy issues facing our country and world so that students will be able to make informed decisions regarding and participate in the ongoing debate surrounding this important global issue.
- The course goals are for each student to learn how to understand and analyze issues related to energy production and usage and its influence on the environment around us (both local and global).

Learning Outcome:

By the end of the course, the student will be able to:

- Discuss the side–effects of energy production and use, and estimate energy content and conversion.
- Explain the physical concept of energy and identify it in the world around us.
- Analyze the energy usage in our lives and be well informed on the topic of energy, its use in our society, and the impacton our environment.
- Participate in the ongoing global debate and make smart decisions.

Unit – I: Fundamental laws of Nature

Basic laws of Nature that govern all energy transformations like: statisticsand data, the second law of thermodynamics, exponential grow depletion time of a non–renewable resource, principles of relativity and anti–matter.

Unit – II: Need of energy and power losses

Power transmission and power loss.The status and current developments of energy in third–world countries.Power requirements and basics of related terminologies.

Unit – III: Nuclear Energy

Radiation and human health, radioactive wastes, history and future of nuclear power technologies, nuclear fuel resources, processing, use, and disposal. Fission and fusion power, three key issues related to reprocessing, storage and disposal.

Unit – IV: Renewable Energy

Types of renewable energies. Fundamentals of solar and wind energies and their environmental advantages/disadvantages. General characteristics of passive and active solar thermal energy, power generation with thermal solar energy, and solar photovoltaic systems. Wind tower and turbine design and their sustainability attributes.

Books Recommended:

1. University Physics with Modern Physics, Fourtheenth Edition, By Pearson.
2. Solar energy - Suhas P Sukhative Tata McGraw - Hill Publishing Company Ltd.
3. Sustainable Energy Si Edition by Dunlap R A, Cengage Learning.
4. Textbook of Renewable Energy by S. C. Bhatia, R. K. Gupta, Woodhead Publishing India PVT.

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Skill Enhancement Course (SEC) offered by Department for the Pool SEC courses of the University

SEC : Renewable Energy and Energy Harvesting **Credits = 2 (2+0+0)**

Course Code: SECPP02

Course Outcomes:

- To understand the Energy policies and to know some of the renewable energy sources such as solar energy, off-shore wind energy, tidal energy, biogas energy and hydroelectricity.
- Illustrate Photovoltaic conversion mechanism.
- Appraise wind energy conversion and ocean energy
- Conversion of vibration into voltage using piezoelectric materials,
- Conversion of thermal energy into voltage using thermoelectric modules.
- 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.

Unit – I: Introduction to Energy Policy:

Overview of world energy scenario; Energy Demand- present and future energy requirements; Review of conventional energy resources, Global warming; Green House Gas emissions, impacts, mitigation; sustainability; Clean Development Mechanism (CDM); Prototype Carbon Fund (PCF). Need and characteristics of photovoltaic (PV) systems, PV modules and sun tracking systems (6)

Unit – II: Renewable Energy Sources & Instruments: Solar, wind, small hydro, biomass, geothermal and ocean energy, energy flow in ecosystem, Solar Energy Resources, Solar radiation: Spectrum of EM radiation, sun structure and characteristics.
Sunshine recorder, Pyranometer, Pyrheliometer, Albedometer, Radiation measurement stations, solar radiation data. (8)

Unit – III: Photovoltaic Materials and Devices:

Bulk and thin film forms of materials, single crystal and polycrystalline, amorphous and nano-crystalline semiconductor materials, Intrinsic, extrinsic and compound semiconductor, Electrical and optical properties of photovoltaic / semiconductor materials, p-n junction: homo and hetero junctions; solar cell design, Dark and illumination characteristics; Principle of photovoltaic conversion of solar energy, various parameters of solar cell. (8)

Unit – IV: Solar Thermal Conversion:

Solar radiation, its measurements and prediction; Solar thermal collectors- flat plate collectors, concentrating collectors; solar heating of buildings; solar still; solar water heaters; solar driers; conversion of heat energy in to mechanical energy, solar thermal power generation systems.
Introduction to Geothermal Energy, Hydro Energy and Piezoelectric Energy harvesting (8)

Reference Books

1. Non-conventional energy sources - G.D Rai - Khanna Publishers, New Delhi
2. Solar energy - M P Agarwal - S Chand and Co. Ltd.
3. Solar energy - Suhas P Sukhative Tata McGraw - Hill Publishing Company Ltd.
4. Godfrey Boyle, "Renewable Energy, Power for a sustainable future", 2004, Oxford

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5. University Press, in association with The Open University. Dr. P Jayakumar, Solar Energy: Resource Assesment Handbook, 2009
6. J.Balfour, M.Shaw and S. Jarosek, Photovoltaics, Lawrence J Goodrich (USA).
7. on- conventional energy resources, B H Khan, Tata McGraw-Hill Publication 2006, ISBN 0-07-060654-42
8. Renewable Energy Resources Paperback John Twidell and Tony Weir ,Routledge, Taylor& Francis, 2015
9. Solar Photovoltaic's: Fundamentals, Technologies And Applications, CHETAN SINGH SOLANKI, PHI Learning Pvt. Ltd., Third Edition 2015
10. Non – Conventional Energy Resources: G. D. Rai, KhannaPublishers,2008.
11. Solar Energy Fundamentals, Technology, and Systems, Klaus JägerOlindoIsabella Arno H.M. SmetsRenéA.C.M.M. van SwaaijMiroZeman Delft University of Technology, 2014

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