University of Kerala

Discipline	**PHYSICS**				
Course Code	**UK3VACPHY202**				
Course Title	**THE HISTORY OF PHYSICS AND ITS INFLUENCE ON SOCIETY**				
Type of Course	**VAC**				
Semester	**III**				
Academic Level	**200 - 299**				
Course Details	Credit	Lecture per week	Tutorial per week	Practical per week	Total Hours/Week
	3	3 Hrs	-	-	3 Hrs
Pre-requisites					
Course Summary	This course explores the interconnected narratives of physics and human society. Trace the evolution of scientific thought from ancient civilizations to contemporary breakthroughs. Analyse key discoveries, from Babylonian astronomy to Newton's laws and quantum mechanics. Uncover Indian physicist's contributions to modern science and nation-building. Gain insights into technological milestones such as transistors, satellites, and space exploration. Enlighten the mind with a world vision through this course on the history of physics.				

BOOKS FOR STUDY:

1. History of Physics, Florian Cajori, Dover Publications/Maven Books, ISBN-13: 978-9387488472
2. Biographical dictionary of Indian scientists, Anjana Chattopadhyay, Rupa & Company
3. Heat and Thermodynamics, M W Zemansky, McGraw Hill
4. Article: Steps of Power: Note on the history of electrification in India (1883 - 1930), Proceedings of the Indian History Congress, 2017, Vol 78(2107), pp 498-506

5. Nuclear Physics, D C Tayal, Himalaya Publishing House
6. Website of Atomic Energy Regulatory Board, Govt. of India
7. Quantum Mechanics, G Aruldas, PHI Learning Pvt Ltd
8. Article: It's time to go quantum in medicine, J Clin Med, 2023 Jul; 12(13): 4506.
9. A history of the world - Semiconductor Industry, P R Morris, Peter Peregrinus LTD, ISBN: 0863412270
10. Satellite technology: Principles and applications, Anil K. Maini & Varsha Agrawal, John Wiley & Sons

DETAILED SYLLABUS: THEORY

Module	Unit	Content	Hrs	CO No
I		**Birth of physics and early human society (Book 1)**	**5**	
	1	Early civilizations (a) Babelonian & Egyptian (b) Greeks: Aristotle, Archimedes and Heron. Light, Sound, and Atomic theory. Greek physical inquiry and its failure. (c) Romans & Arabs	2	1
	2	Europe during the Middle Ages: Invention of gunpowder, Mariner's Compass, An early concept of Light.	1	2
	3	Contributions of Indians: (a) Aryabhata (b) Brahmagupta (c) Varahamihira (d) Bhaskara	2	1
II		**Renaissance and Newtonian Era (Book 1)**	**6**	
	4	Copernican system: Greek Anticipations of Copernicus, Greek theory of epicycles and eccentrics, Studies of Copernicus, Kepler's Inductive Researches	2	1
	5	Galileo: (a) Experiments at leaning tower (b) The book - Discourses on two new sciences (c) Telescope and studies on the Sun, Moon and Jupiter's satellite	2	1
	6	Mechanics: Laws of Motion, Law of Gravitation, Motion of projectiles	1	3

	7	Light: Velocity of light, Newton's experiments with prism, Huygen's wave theory of light, Reflection telescope.	1	3
III	**Physics in 18th and 19th and early 20th centuries**		**14**	
	8	(a) Laws of thermodynamics (results only) and their implications (qualitative): zeroth law & concept of temperature, first law and conservation of energy, second law & disorder and entropy, third law and idea of absolute zero temperature. (b) Thermometers, Early development of steam engine	3	4
	9	(a) Concept of atoms & molecules (b) Light: Concepts of wave theory of light, solar spectrum, color photography, human eye	2	5
	10	(a) Electricity: Contributions of Benjamin Franklin's experiment, Cavendish, Volta and Coulomb (b) Beginning of electrolysis, voltage cell and storage batteries, Ohm's law	2	5
	11	Evolution of dynamo and alternating current, Transmission of electricity, Invention of telegraph and telephones (Book 1,4)	2	5
	12	History of Electrification in India (Book 1,4)	1	5
	13	(a) Contributions of Becquerel and Curie. Radio activity: alpha, beta and gamma rays (b) Nuclear fission and fusion, Einstein's Mass energy equivalence (Book 1,5)	2	5
	14	Destructive and Peaceful use of nuclear energy Nuclear power plants in India: Their location, capacity, fuel etc (Book 6)	2	5
IV	**Physics in 20th and 21st centuries (Book 7, 8, 9 & 10)**		**11**	
	15	Emergence of quantum mechanics: (a) Max Plank: Light as photons and a new constant - h (b) de Broglie: The idea of matter wave (c) Schrodinger: Wave equation of matter wave (d) Heisnberg: The uncertainty relation and its implications	2	6
	16	Medical application of quantum theory: Mind, diagnosis & DNA (*based on Article: It's time to go quantum in medicine, book 8*)	2	6

	17	Brief discussion on the Invention of transistor & IC chips: Germanium and silicon transistors, monolithic IC's, Full custom & semi custom circuits, microprocessors (*Chapter 4 of book 9)*	2	7
	18	Definition of Satellite. Orbit of satellite, Basic Principles of orbiting satellite - Newton's Law of Gravitation & Newton second law of motion.	2	7
	19	(a) History of the Evolution of Satellites: Early Communications, Meteorology & Scientific Exploration, Non-geosynchronous Communication Satellites, Emergence of Geosynchronous Communication Satellites, International Communication Satellite Systems, Domestic Communication Satellite Systems (Book 10) (b) Indian Space programmes: Cartosat, Astrosat, Chandrayan I & II, Aditya L1 (refer any relevant source)	3	7
V*	**Indian contributions in the modern era (Book 2 and any other resource)**		**9**	
	20	Three major discoveries (results only) by Indian scientists in modern physics & their implications: (a) Bose-Einstein statistics & Bosons (b) Raman effect & Raman spectroscopy (c) Chandrasekhar limit & death of stars	3	8
	21	Brief discussion on the contribution of Indian scientists & their role in nation building: (a) Homi J Baba & Indian atomic energy research (b) Vikram Sarabahi & his contribution to the development of ISRO (c) J V Narlikar and IUCAA	3	8
	22	Eminent scientists from Kerala and their contribution: (a) R S Krishnan (b) E C G Sudarshan (c) T Padmanabhan	3	8

COURSE OUTCOMES

No.	Upon completion of the course the graduate will be able to	Cognitive Level	PSO addressed
CO-1	Recall key milestones in the history of physics, including significant discoveries made by ancient civilizations, such as the Babylonians, Egyptians Greeks and Indians	R, U	PSO-4
CO-2	Identify important figures and their contributions to physics during pivotal periods, such as the Renaissance and Newtonian Era, highlighting the work of Copernicus, Galileo, and Newton.	R, U	PSO-4
CO-3	Recognize and explain key principles of classical physics, such as Newton's Laws and Kepler's laws, shaping our understanding of the physical world.	U	POS-1,4
CO-4	Understand the importance of the two fundamental branches which fill the gap between Newton's mechanics and physics of the modern era - namely thermodynamics and electricity.	U,E	POS-1,4
CO-5	Also how for the first time in history, physics started directly influencing the day to day life via steam engine, electrification etc	R,U	POS-1,4
CO-6	Get a glimpse of the most revolutionary discovery in the history of modern physics - quantum mechanics and how profoundly it is influencing human evolution through say medical research.	U,E	POS-1,4
CO-7	Understanding the origin of the semiconductor/electronics industry from physics. Now the basic development of the satellite industry and the physics behind it.	R,U,E	POS-1,4,6
CO-8	Explain the contributions of Indian scientists to physics and their influence on the general public.	U,E	PSO-1,4

R-Remember, U-Understand, Ap-Apply, An-Analyse, E-Evaluate, C-Create

Name of the Course: THE HISTORY OF PHYSICS AND ITS INFLUENCE ON SOCIETY

Credits: 3:0:0 (Lecture: Tutorial: Practical)

CO No.	CO	PO / PSO	Cognitive Level	Knowledge Category	Lecture (L)/ Tutorial (T)	Practical (P)
CO-1	Recall key milestones in the history of physics, including significant discoveries made by ancient civilizations, such as the Babylonians, Egyptians Greeks and Indians	PO 2,6,8 / PSO 4	R, U	F, C	L	-
CO-2	Identify important figures and their contributions to physics during pivotal periods, such as the Renaissance and Newtonian Era, highlighting the work of Copernicus, Galileo, and Newton.	PO 6, 8 / PSO 4	R, U	F, C	L	-
CO-3	Recognize and explain key principles of classical physics, such as Newton's Laws and Kepler's laws, shaping our understanding of the physical world.	PO 6, 8 / PSO 1,4	U	F, C	L	-
CO-4	Understand the importance of the two fundamental branches which fill the gap between Newton’s mechanics and physics of the modern era	PO 6, 8 / PSO 1,4	U,E	F, C	L	-

	- namely thermodynamics and electricity.					
CO-5	Also how for the first time in history, physics started directly influencing the day to day life via steam engine, electrification etc	PO 2,6,8 / PSO 1,4	R,U	F, C	L	-
CO-6	Get a glimpse of the most revolutionary discovery in the history of modern physics - quantum mechanics and how profoundly it is influencing human evolution through say medical research.	PO 6, 8 / PSO 1,4	U,E	F, C, M	L	-
CO-7	Understanding the origin of the semiconductor/electronics industry from physics. Now the basic development of the satellite industry and the physics behind it.	PO 6, 8 / PSO 1,4,6	R,U,E	F, C	L	-
CO-8	Explain the contributions of Indian scientists to physics and their influence on the general public.	PO 2,5,6,8 / PSO 1,4	U,E	F, C, M	L	-

F-Factual, C- Conceptual, P-Procedural, M-Metacognitive

Mapping of COs with PSOs and POs :

	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5	PSO 6	PSO 7	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8
CO-1	-	-	-	3	-	-	-	-	3	-	-	-	1	-	3
CO-2	-	-	-	3	-	-	-	-	-	-	-	-	1	-	3
CO-3	2	-	-	3	-	-	-	-	-	-	-	-	1	-	3
CO-4	2	-	-	3	-	-	-	-	-	-	-	-	1	-	3
CO-5	2	-	-	3	-	-	-	-	1	-	-	-	1	-	3
CO-6	3	-	-	3	-	-	-	-	-	-	-	-	1	-	3
CO-7	3	-	-	3	-	2	-	-	-	-	-	-	1	-	3
CO-8	2	-	-	3	-	-	-	-	2	-	-	2	1	-	3

Correlation Levels:

Level	-	1	2	3
Correlation	Nil	Slightly / Low	Moderate / Medium	Substantial / High

Assessment Rubrics:

- Quiz / Assignment/ Discussion / Seminar
- Midterm Exam
- Programming Assignments
- Final Exam

Mapping of COs to Assessment Rubrics:

CO No	Internal Exam	Assignment	Project Evaluation	End Semester Examinations
CO-1	✓	✓	✓	✓
CO-2	✓	✓	-	✓
CO-3	✓	✓	-	✓
CO-4	✓	✓	-	✓
CO-5	✓	✓	✓	✓
CO-6	✓	-	✓	✓
CO-7	✓	-	-	✓
CO-8	✓	✓	-	-