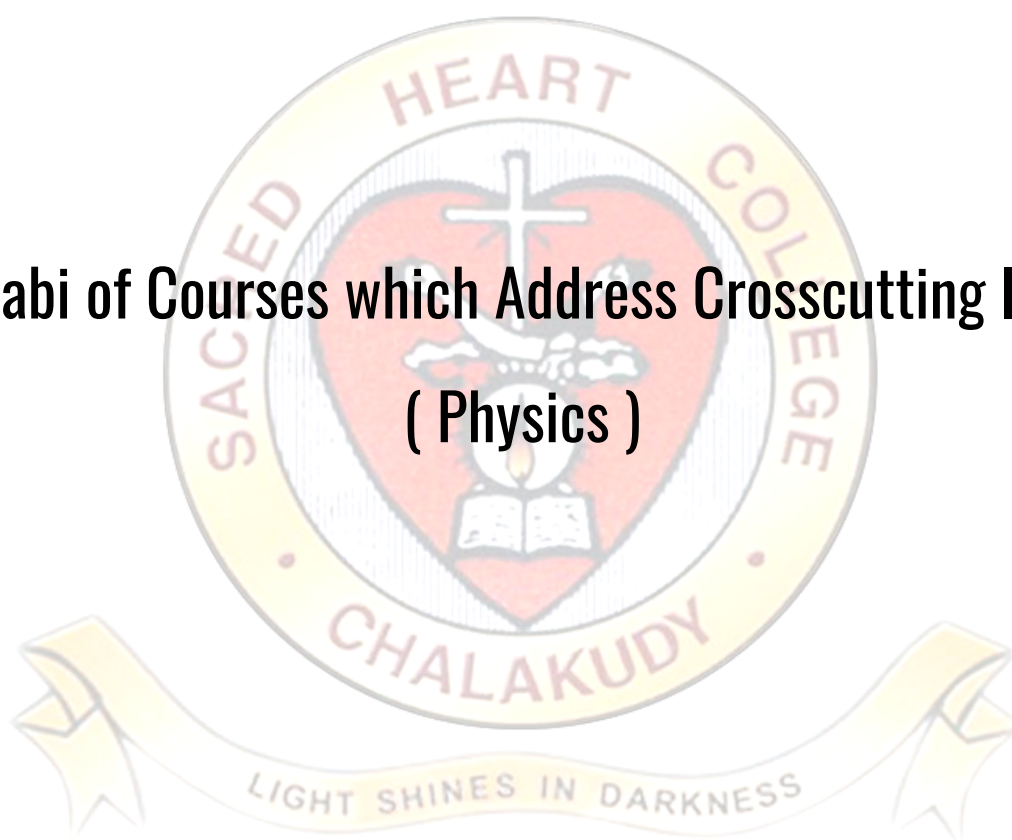


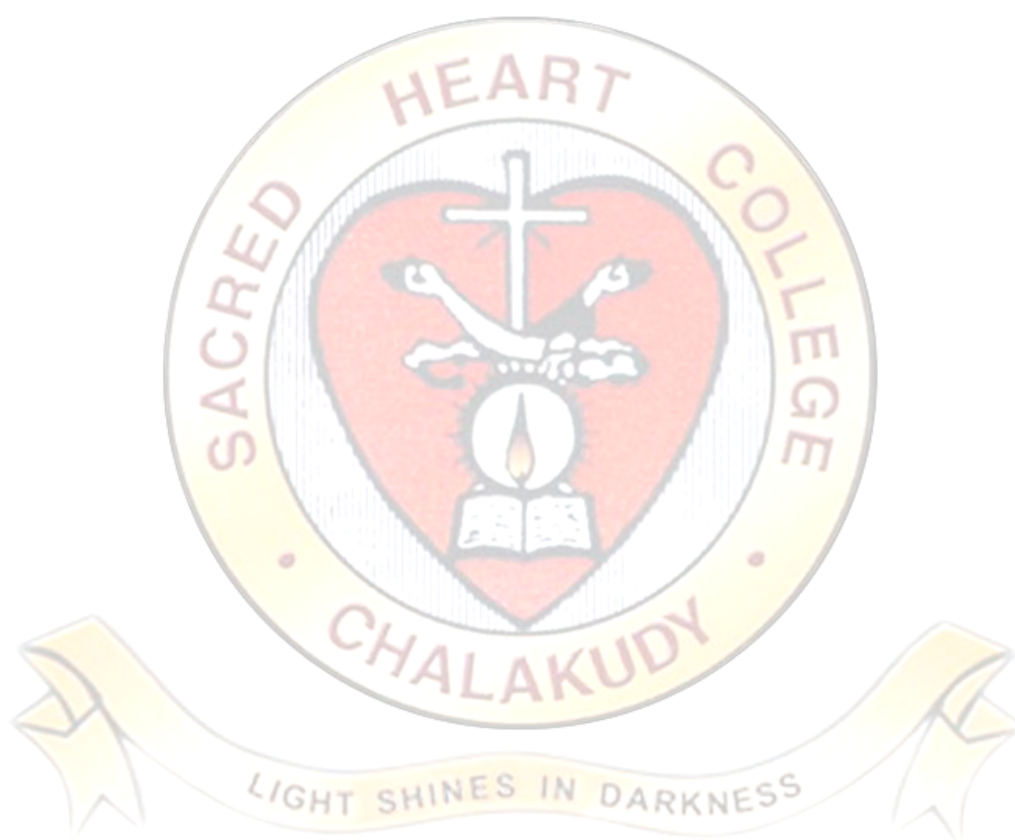
**Syllabi of Courses which Address Crosscutting Issues  
( Physics )**



**1.3.1 Courses which address cross cutting issues relevant to Gender, Environment and Sustainability, Human Values and Professional Ethics into the Curriculum**

<b>Sl.No</b>	<b>Name of the Course</b>	<b>Course Code</b>	<b>Name of the Programme</b>	<b>Specify the issue(s) dealing with</b>
<b>1.</b>	<b>Non Conventional Energy Sources</b>	<b>PH5 D01(1)</b>	<b>BSc.Physics</b>	<b>Environment and sustainability</b>
<b>2.</b>	<b>Methodology of Science and Basic Mechanics</b>	<b>PHY1 B01</b>	<b>BSc.Physics</b>	<b>Professional Ethics</b>
<b>3.</b>	<b>Environment Studies (Audit course)</b>	<b>EO1</b>	<b>BSc.Physics</b>	<b>Environment and sustainability</b>
<b>4.</b>	<b>Disaster Management (Audit course)</b>	<b>EO2</b>	<b>BSc.Physics</b>	<b>Human Values</b>
<b>5.</b>	<b>Human Rights or Intellectual Property Rights or Consumer protection (Audit course)</b>	<b>EO3</b>	<b>BSc.Physics</b>	<b>Human Values</b>

6.	<b>Gender studies or Gerontology</b> <b>(Audit course)</b>	<b>EO4</b>	<b>BSc.Physics</b>	<b>Gender roles and Human Values</b>
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**UNIVERSITY OF CALICUT**

**B.Sc. PHYSICS**

**(CORE AND COMPLEMENTARY PROGRAMMES)**

**SYLLABUS & MODEL QUESTION PAPERS**

**w.e.f 2019 admission onwards**

**CBCSSUG Regulations 2019**

## B.Sc. DEGREE PROGRAMME (PHYSICS CORE)

### COURSE STRUCTURE

Semester	Course Code	Course Title	Total hours	Hours/ Week	Credits
1	A 01	Common Course I – English	72	4	4
	A 02	Common Course II – English	90	5	3
	A 07	Common Course III – Language other than English	72	4	4
	PHY1 B01	Core course I - Methodology of Science and Basic Mechanics	36	2	2
		Core Course V - Practical I	36	2	*
		1 <sup>st</sup> Complementary Course I - Mathematics	72	4	3
		2 <sup>nd</sup> Complementary Course I	36	2	2
		2 <sup>nd</sup> Complementary Course Practical I	36	2	*
	EO1	Environment Studies	-	-	4**
		<b>Total</b>	<b>450</b>	<b>25</b>	<b>18</b>
2	A 03	Common Course IV – English	72	4	4
	A 04	Common Course V – English	90	5	3
	A 08	Common Course VI – Language other than English	72	4	4
	PHY2 B02	Core Course II - Mechanics	36	2	2
		Core Course V - Practical I	36	2	*
		1 <sup>st</sup> Complementary Course II - Mathematics	72	4	3
		2 <sup>nd</sup> Complementary Course II	36	2	2
		2 <sup>nd</sup> Complementary Course Practical II	36	2	*
	E02	Disaster Management			4**
		<b>Total</b>	<b>450</b>	<b>25</b>	<b>18</b>
3	A 05	Common Course VI – English	90	5	4
	A 09	Common Course VIII - Language other than English	90	5	4

	PHY3 B03	Core Course III – Electrodynamics-I	54	3	3
		Core Course VI– Practical I	36	2	*
		1 <sup>st</sup> Complementary Course III – Mathematics	90	5	3
		2 <sup>nd</sup> Complementary Course III	54	3	2
		2 <sup>nd</sup> Complementary Course Practical III	36	2	*
	E03	Human Rights or Intellectual Property Rights or Consumer protection			4**
		<b>Total</b>	<b>450</b>	<b>25</b>	<b>16</b>
4	A 06	Common Course IX – English	90	5	4
	A 10	Common Course X - Language other than English	90	5	4
	PHY4 B04	Core Course IV - Electrodynamics II	54	3	3
	PHY4 B05	Core Course Practical V – Practical I	36	2	5
		1 <sup>st</sup> Complementary Course IV– Mathematics	90	5	3
		2 <sup>nd</sup> Complementary Course IV	54	3	2
		2 <sup>nd</sup> Complementary Course Practical IV	36	2	4
	E04	Gender studies or Gerontology			4**
		<b>Total</b>	<b>450</b>	<b>25</b>	<b>25</b>
5	PHY5 B06	Core Course VI - Computational Physics	54	3	3
	PHY5 B07	Core Course VII - Quantum Mechanics	54	3	3
	PHY5 B08	Core Course VIII - Optics	54	3	3
	PHY5 B09	Core Course IX- Electronics (Analog and Digital)	54	3	3
		Open Course – (course from other streams)	54	3	3
		Core Course Practical XIV - Practical II	72	4	*
		Core Course Practical XV- Practical III	72	4	*
		Core Course XVII Project/Research methodology	36	2	*
		<b>Total</b>	<b>450</b>	<b>25</b>	<b>15</b>
6	PHY6 B10	Core Course X - Thermodynamics	54	3	3
	PHY6 B11	Core Course XI -Statistical Physics, Solid State Physics, Spectroscopy and Photonics	54	3	3
	PHY6 B12	Core Course XII - Nuclear Physics and Particle Physics	54	3	3

	PHY6 B13	Core Course XIII - Relativistic Mechanics and Astrophysics	54	3	3
	PHY6 B14	Core Course XIV (Elective:EL1 / EL2 / EL3)	54	3	3
	PHY6 B15	Core Course Practical XV – Practical II	72	4	5
	PHY6 B16	Core Course Practical XVI – Practical III	72	4	5
	PHY6 B17 (P/R)	Core Course XVII Project/Research methodology Tour report	36	2	2 1
		<b>Total</b>	<b>450</b>	<b>25</b>	<b>28</b>
<b>Total Credits</b>					<b>120</b>

**Tour report shall be evaluated with Practical III**

\*Credit for practical / project to be awarded only at the end of Semester 4 and Semester 6.

\*\*Mandatory audit courses for the program, but not counted for the calculation of SGPA or CGPA.

Student can attain only pass (Grade P) for these courses.

**Semester 1 | Core Course I****PHY1B01: METHODOLOGY OF SCIENCE AND BASIC MECHANICS****36 hours (Credit - 2)**

	<b>Course Outcome</b>	<b>PSO</b>	<b>CL</b>	<b>KC</b>	<b>Class Sessions allotted</b>
<b>CO1</b>	Understand the features, methods and limitations of science	PSO1	U	C	6
<b>CO2</b>	Understand and apply the basic concepts of Newtonian Mechanics to physical systems	PSO1	Ap	C, P	10
<b>CO3</b>	Understand and apply the basic idea of work-energy theorem to physical systems	PSO1	Ap	C,P	8
<b>CO4</b>	Understand and apply the rotational dynamics of rigid bodies	PSO1	Ap	C,P	8
<b>CO5</b>	Understand the basic ideas of elasticity	PSO1	U	C	4

**Unit 1 – Methodology of Science****6 Hours**

Science as facts, science as generalization, Some distinctions when describing science, Science as a social activity, scientific revolutions and paradigms, Science and pseudo-science, Science and democratic development, The limitations of science-presuppositions, fundamental questions on reality: Rationality, Description, Causality - Prediction and Explanation in science - Mathematics and science, Hypothesis, Theories and laws, Verification, Falsification, Acceptance - Peer Review in Science - Scientific method.

[Sections 2.2.1 to 2.2.5, 2.3.1, 2.4.1, 2.5.1 to 2.5.4, 2.6.1 to 2.6.4, 2.8.1 to 2.8.4, 3.1 to 3.3, 4.1 to 4.4 & 7.1 of Research Methodology : The Aims, Practices and Ethics of Science by Peter Pruzan]

**Unit 2 – Newton's Laws****10 Hours**

Newton's First Law, Second Law and Third Law – Astronauts in space : Inertial systems and fictitious forces – Standards and units – Some applications of Newton's laws – The astronauts' tug of war, Freight train, Constraints, Block on string, The whirling block, The conical pendulum – The everyday forces of physics – Gravity and Weight; Gravitational force of a sphere; Turtle in an elevator; Gravitational field – Electrostatic force – Contact forces; Block and string; Dangling rope; Whirling rope; Pulleys; Tension and Atomic forces; Normal force; Friction; Block and wedge with friction; Viscosity – Linear restoring force; Spring and block : The equation for simple harmonic motion; Spring and gun : Illustration of initial conditions – Dynamics of a system of particles – The



Bola – Centre of mass – Drum major's baton – Centre of mass motion – Conservation of momentum – Spring Gun recoil

[Sections 2.1 to 2.5, 3.1 to 3.3 of An Introduction to Mechanics (1<sup>st</sup>Edn.) by Daniel Kleppner and Robert J. Kolenkow]

### **Unit 3 – Work and Energy**

**8 Hours**

Integrating the equation of motion in one dimension – Mass thrown upward in a uniform gravitational field; Solving the equation of simple harmonic motion – Work-energy theorem in one dimension – Vertical motion in an inverse square field – Integrating the equation of motion in several dimensions – Work-energy theorem – Conical pendulum; Escape velocity – Applying the work-energy theorem – Work done by a uniform force; Work done by a central force; Potential energy – Potential energy of a uniform force field; Potential energy of an inverse square force – What potential energy tells us about force – Stability – Energy diagrams – Small oscillations in a bound system – Molecular vibrations – Nonconservative forces – General law of conservation of energy – Power

[Sections 4.1 to 4.13 of An Introduction to Mechanics (1<sup>st</sup>Edn.) by Daniel Kleppner and Robert J. Kolenkow. The problems in chapter 5 should be discussed with this.]

### **Unit 4 – Angular Momentum**

**8 Hours**

Angular momentum of a particle – Angular momentum of a sliding block; Angular momentum of the conical pendulum – Torque – Central force motion and the law of equal areas – Torque on a sliding block; Torque on the conical pendulum; Torque due to gravity – Angular momentum and fixed axis rotation – Moments of inertia of some simple objects – The parallel axis theorem – Dynamics of pure rotation about an axis – Atwood's machine with a massive pulley – The simple pendulum – The physical pendulum – Motion involving both translation and rotation – Angular momentum of a rolling wheel – Drum rolling down a plane – Work-energy theorem for a rigid body – Drum rolling down a plane : energy method – The vector nature of angular velocity and angular momentum – Rotation through finite angles – Rotation in the xy-plane – Vector nature of angular velocity – Conservation of angular momentum

[Sections 6.1 to 6.7, 7.1, 7.2 and 7.5 of An Introduction to Mechanics (1<sup>st</sup>Edn.) by Daniel Kleppner and Robert J. Kolenkow]

### **Unit 5 – Properties of matter**

**4 Hours**

Elasticity, Different types of elasticity, Poisson's ratio, Twisting couple on a cylinder, Torsion pendulum, Determination of rigidity modulus, Bending of beams, Bending moment, Cantilever

loaded at free end, Depression of a beam supported at the ends and loaded at the centre (weight of the beam neglected), Determination of  $Y$  by bending of a beam.

[Relevant portions from Chapter 8: Elements of properties of matter by D.S Mathur]

**Books of Study:**

1. Research Methodology: The Aims, Practices and Ethics of Science – Peter Pruzan – Springer International Publishing Ltd., 2016.
2. An Introduction to Mechanics, 1<sup>st</sup>Edn. – Daniel Kleppner and Robert J. Kolenkow – McGraw-Hill
3. Elements of properties of matter by D.S Mathur

**Reference Books:**

1. An Introduction to the History and Philosophy of Science – R. V. G. Menon – Dorling Kindersley (India) Pvt. Ltd.
2. Science Rules: A Historical Introduction to Scientific Methods – Peter Achinstein – Johns Hopkins University Press.
3. Berkeley Physics Course: Vol.1: Mechanics, 2<sup>nd</sup>Edn. – Kittel *et al.* – McGraw-Hill
4. Mechanics : D S Mathur
5. NPTEL video lectures available online

**Mark distribution for setting Question paper.**

Unit/ chapter	Title	Marks
1	Methodology of Science	12
2	Newton's Laws	22
3	Work and Energy	18
4	Angular Momentum	18
5	Properties of matter	9
<i>Total Marks *</i>		79

\*Total marks include that for choice of questions in sections A, B and C in the question paper.

## Semester 5 | Open Course I

### **PHY5D01(1): NON CONVENTIONAL ENERGY SOURCES**

**54 hours (Credit – 3)**

	<b>Course Outcome</b>	<b>CL</b>	<b>KC</b>	<b>Class Sessions allotted</b>
<b>CO1</b>	Understand the importance of non conventional energy sources	U	C	4
<b>CO2</b>	Understand basic aspects of solar energy	U	C	12
<b>CO3</b>	Understand basic principles of wind energy conversion	U	C	10
<b>CO4</b>	Understand the basic ideas of geothermal and biomass energy and recognize their merits and demerits	U	C	16
<b>CO4</b>	Understand the basic ideas of oceans and chemical energy resources and recognize their merits and demerits	U	C	12

#### **Unit 1**

**4 Hours**

**Energy Resources-Non Conventional Energy Sources-Renewable and Non-Renewable energy sources.**

(Section 1.3, 1.4 and 1.5 from Non- Conventional Energy Sources and Utilisation by R.K.Rajput, S.Chand Publishers, 1<sup>st</sup> Edition.)

#### **Unit 2**

##### **Solar energy**

**12 Hours**

**Solar Energy Terms and Definitions- Solar Constant, Solar radiation measurements, Solar energy collector, Physical principle of the conversion of solar radiation in to heat, solar air heaters and drying, solar cookers, solar distillation, solar furnaces, solar greenhouses, solar power plants, solar photovoltaic cells(no need of mathematical equations)**

(Section 2.2.1 and 2.2.2, 2.3, 3.1.2, 3.1.3-3.1.5, 3.2, 3.3.1-3.3.3, 3.4.1-3.4.10, 4.16, 4.17, 4.18, 4.19, 4.20, 4.21.4, 4.21.8, 4.21.9, 4.21.10, 4.21.4 from Non- Conventional Energy Sources and Utilisation by R.K.Rajput, S.Chand Publishers, 1<sup>st</sup> Edition.)

#### **Unit 3 Wind energy**

**10 Hours**

Introduction, Utilisation aspects of wind energy, Advantages and Disadvantages of wind energy, Environmental impact of wind energy, Sources/Origins of wind, Principle of wind energy conversion

and wind power, Basic components of wind energy conversion system(WECS), Advantages and Disadvantages of WECS, Wind-Electric Generating Power Plant, Wind Energy Economics, Problems in operating large wind power generators.

(Section 5.1-5.6, 5.8, 5.10, 5.11, 5.20, 5.25, 5.26 from Non- Conventional Energy Sources and Utilisation by R.K.Rajput, S.Chand Publishers, 1<sup>st</sup> Edition.)

#### **Unit 4**

**16 Hours**

##### **Geothermal energy**

Introduction to Geothermal energy, Important aspects of Geothermal Energy, Structure of Earth's interior, Geothermal system-Hot Spring structure, Geothermal Resources (Hydrothermal, Geopressured, Petro-thermal system, Magma Resources), Advantages and disadvantages of geothermal energy over other energy forms, application of geothermal energy.

(Section 7.1, 7.2, 7.3, 7.5, 7.8.1, 7.8.2, 7.8.3, 7.8.4, 7.9, 7.10 from Non- Conventional Energy Sources and Utilisation by R.K.Rajput, S.Chand Publishers, 1<sup>st</sup> Edition.)

##### **Energy from biomass:**

Introduction to biomass, Biomass resource, Biomass Conversion process (Densification, Combustion and incineration, Thermo Chemical conversion, Biochemical conversion), Biogas: Biogas Applications, Biogas Plants (Raw materials used, Main Components of a Biogas Plant)

(Section 6.1, 6.2, 6.5.1, 6.5.2, 6.5.3, 6.5.4, 6.6.1, 6.6.2, 6.7.1, 6.7.2, 6.7.3 from Non- Conventional Energy Sources and Utilisation by R.K.Rajput, S.Chand Publishers, 1<sup>st</sup> Edition.)

#### **Unit 5. Energy from Oceans and Thermal and Chemical effects**

**12 Hours**

Ocean Energy, Ocean Energy Sources, Tidal energy, Components of a Tidal Power Plant, Economic aspects of tidal energy conversion, Wave energy, Advantages and disadvantages, Factors affecting Wave energy, Ocean Thermal Energy Conversion (OTEC), Working principle of OTEC, Efficiency of OTEC, Types of OTEC Plants (Closed system, Thermoelectric OTEC system), Advantages and Disadvantages and Applications of OTEC.

Thermo electric effects, Fuel Cells, Hydrogen energy, Nuclear Reactors, Advantages and Disadvantages of Nuclear power plants (Basic Principles/concepts only)

(Section 8.1, 8.2, 8.3.1, 8.3.8, 8.3.14, 8.4.1, 8.4.2, 8.4.3, 8.5.1, 8.5.3, 8.5.4, 8.5.5.1, 8.5.5.5, 8.5.6, 9.2, 9.7.1, 9.7.2, 9.7.3, 10.1, 10.2, 10.3, 11.2.1, 11.5 from Non- Conventional Energy Sources and Utilisation by R.K.Rajput, S.Chand Publishers, 1<sup>st</sup> Edition.)

**Books of study:**

1. Non- Conventional Energy Sources and Utilisation by R.K.Rajput, S.Chand Publishers

**References**

1. Non- Conventional Energy Resources by G. D. Rai, Khanna Publishers, 2008.
2. Solar Energy Fundamentals and application by H.P. Garg and J. Prakash, Tata McGraw- Hill Publishing company Ltd, 1997.
3. Solar Energy by S. P. Sukhatme, Tata McGraw- Hill Publishing company ltd,1997.
4. Solar Energy Utilization by G.D. Rai, Khanna Publishers, 1995.

**Mark distribution for setting Question paper.**

Unit/ chapter	Title	Marks
1	Non Conventional energy	06
2	Solar energy	18
3	Wind energy	15
4	Geothermal energy and energy from biomass	22
5	Energy from Oceans and Chemical energy resources	18
<i>Total Marks *</i>		79

\*Total marks include that for choice of questions in sections A, B and C in the question paper.