

**VIVEKANANDHA COLLEGE OF ARTS &  
SCIENCES FOR WOMEN**

**(AUTONOMOUS)**

**SCHEME OF EXAMINATIONS UG**



**PG AND RESEARCH DEPARTMENT OF PHYSICS**

**B.Sc., DEGREE – OBE SYLLABUS**

**2018 - 2019**

## **About the College**

Vivekanandha College of Arts and Sciences for Women (Autonomous) was established and hailed into Women's Educational Service in the Year 1995. Angammal Educational Trust Chaired by the great Educationalist 'VidhyaRathna' Prof.Dr. M. KARUNANITHI, B.Pharm., M.S., Ph.D., D.Litt., sponsors this college and other institutions under the name of the great Saint Vivekanandha. Our institutions are situated on either side of TiruchengodeNamakkal Main Road at Elayampalayam, 6 kms away from Tiruchengode. This is biggest women's college in India with more than 7500 girl students and more than 18 departments. The strength of the college was just 65 at the time of its establishment. With the dedication, work, sacrifice and long vision of the chairman, this institution has grown into a Himalaya stage. As a result of which UGC, New Delhi, awarded 2f and 12b, extended Autonomous status for second cycle. The National Assessment and Accreditation Council reaccredited with grade 'A' for its successful performance.

As an Autonomous Institution, academic professionals of the college framed Curriculum and Syllabi in consultation with all its stakeholders to cater the needs of the young women to fulfil the women empowerment and present Industrial needs to the local benefits. The students are empowering with confidence and required skills to face the society.

## **Quality Policy**

To provide professional training by establishing a high level centre of learning that provides quality education at par with the international standards and Provide excellence education with well equipped infrastructure to all the rural women.

## **Our Vision**

To be an academic institution exclusively for women, in dynamic equilibrium with the social and economic environment, strive continuously for excellence in education, research and technological service to the nation.

## Our Mission

The mission of our institution is to discover, teach and apply knowledge for the intellectual, cultural, ethical, social and economic growth of women students.

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3	Malayalam - II	
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6	English – II: Foundation English - II	

7	Core - II: Heat and Thermodynamics	
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9	Allied Mathematics – II	
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7	Core III: Optics	
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4	Hindi - IV	
5	French - IV	
6	English – IV: Foundation English - IV	
7	Core – IV: Mechanics	
8	Core Practical - II	
9	Allied Chemistry - II	
10	Allied Chemistry Practical - I	
11	SBEC – II: Energy Physics	
12	NMEC – II: Industrial Chemistry - II	
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1	COURSE PATTERN WITH PAPERS	
2	Core – V: Electricity and Magnetism	
3	Core – VI: Basic Electronics	
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5	Elective – I: Quantum Mechanics and Relativity	
6	SBEC – III: Digital Electronics	
7	SBEC – IV: Bio Medical Instrumentation	
8	Core Practical – III	

9	Core Practical - IV	
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1	COURSE PATTERN WITH PAPERS	
2	Core - VIII: Atomic Physics	
3	Core - IX: Nuclear Physics	
4	Elective – II: Electronics and Communication	
5	Elective – III: Numerical Methods	
6	SBEC – V: Microprocessor and its Application	
7	SBEC – VI: Electrical Appliances	
8	Core Practical - III	
9	Core Practical - IV	

# REGULATIONS

## I. SCOPE OF THE COURSE

**B.Sc. (Physics)**, the recent developments in Physical sciences, has been included in the enriched syllabus to meet out the present day needs of academic and research, institutions and industries. The program expects a serious commitment of the student to take up challenging study schedules and assignments. The course involves a blend of theoretical education and practical training which run concurrently for a period of three years and equips a student with knowledge, ability, skills and other qualities required for a professional accountant.

The uniqueness of the program is its content and topic coverage, the teaching methodology and the faculty. The syllabus has been designed at a level equal to that of professional courses. The teaching methodologies include classroom lectures, industrial visits, orientation, internship, case study and research work. Focus is also on developing soft skills of the students. For Core subjects, Outsource Guest Lectures by Industrialists and Professional Men will be arranged to enable the students to get wider exposure.

## II. SALIENT FEATURES

- ✓ Course is specially designed for a higher level Career Placement.
- ✓ Special Guest lectures from Industrialists will be arranged.
- ✓ Exclusively caters to students interested in pursuing higher studies.
- ✓ Special Industry Orientations and Training are parts of the Degree Course.
- ✓ Project work is included in the syllabus to enhance conceptual, analytical & deductive skills.

## III. OBJECTIVES OF THE COURSE

- ✓ The new syllabus throws light on the recent and emerging areas of Physics.
- ✓ Enable the students understand Physics and make them more relevant to the society.
- ✓ Develop the analytical ability in students so that they are become objective in solving problems.
- ✓ Help the students learn practical skills in a better way.
- ✓ Inculcate research aptitude in students.
- ✓ Enable the students to go to higher levels of learning Physics.
- ✓ Improve the employability of the students.
- ✓ To inspire the students to apply their knowledge gained for the development of society in general.

## IV. ELIGIBILITY FOR ADMISSION

Candidates seeking admission to the first year Degree course (B.Sc. Physics) shall be required to have passed Higher Secondary Examination with Physics as one of the Subjects conducted by the Government of Tamil Nadu.

## V. DURATION OF THE COURSE

- ✓ The course shall extend over a period of three academic years consisting of six semesters. Each academic year will be divided into two semesters. The First semester will consist of the period from July to November and the Second semester from December to March.
- ✓ The subjects of the study shall be in accordance with the syllabus prescribed from time to time by the Board of Studies of Vivekanandha College of Arts and Sciences for Women with the approval of Periyar University.
- ✓ Each subject will have six hours of lecture per week apart from practical training at the end of each semester.

## VI. CONTINUOUS INTERNAL ASSESSMENT

The performance of the students will be assessed continuously and the Internal Assessment Marks will be as under:

1. Average of three Test - 15 Marks	
2. Assignment	- 5 Marks
3. Attendance	- 5 Marks
	.....
Total	= 25 Marks
	.....

The distribution of attendance marks is given as follows,

76-80 %	- 1 Mark
81-85 %	- 2 Marks
86-90 %	- 3 Marks
91-95 %	- 4 Marks
96-100 %	- 5 Marks

## VII. Question Paper Pattern:

### Question Paper Pattern for the Examinations

**Time: 3 Hours**

**Maximum Marks: 75**

**Part A:** Answer all the following Questions (choose the best answer) (20 x 1 = 20 Marks)

**Part B:** Answer all questions (Either or type) (5 x 5 = 25 Marks)

**Part C:** Answer any three of the following questions (3 x 10 = 30 Marks)

## VIII. PASSING MINIMUM

In the University Examinations, the passing minimum shall be 40 % out of 75 Marks for theory (30 marks) and 40% out of 60 marks for practical. (24 Marks).

## **IX. ELIGIBILITY FOR EXAMINATION**

A candidate will be permitted to appear for the University Examination only on earning 75 % of attendance and only when her conduct has been satisfactory. It shall be open to grant exemption to a candidate for valid reasons subject to conditions prescribed.

## **X. CLASSIFICATION OF SUCCESSFUL CANDIDATES**

Successful candidates passing the examination of Core Courses (main and allied subjects) and securing marks

- a) 75 % and above shall be declared to have passed the examination in first class with Distinction provided they pass all the examinations prescribed for the course at first appearance itself.
- b) 60% and above but below 75 % shall be declared to have passed the examinations in first class without Distinction.
- c) 50% and above but below 60% shall be declared to have passed the examinations in second class.
- d) All the remaining successful candidates shall be declared to have passed the examinations in third class.
- e) Candidates who pass all the examinations prescribed for the course at the first appearance itself and within a period of three consecutive academic years from the year of admission only will be eligible for University rank.

## **XI. COMMENCEMENT OF THESE REGULATIONS**

These regulations shall take effect from the academic year 2018 - 2019 (i.e.,) for the students who are to be admitted to the first year of the course during the academic year 2018 - 2019 and thereafter.



## XII. COURSE PATTERN

**VIVEKANANDHA COLLEGE OF ARTS AND SCIENCES FOR WOMEN  
(AUTONOMOUS)  
SYLLABUS FRAME WORK 2018 – 2019 Onwards**

Subjects	Inst. Hour/Week	Credit	Exam ours	Internal	External	Total Marks	Subjects	Inst. Hour/Week	Credit	Exam ours	Internal	External	Total Marks
<b>YEAR - I</b>													
<b>Semester - I</b>							<b>Semester - II</b>						
Language I	6	3	3	25	75	100	Language II	6	3	3	25	75	100
English I	6	3	3	25	75	100	English II	6	3	3	25	75	100
Core I	5	5	3	25	75	100	Core II	5	5	3	25	75	100
Core I Practical	3	0	3	-	-	-	Core I Practical	3	3	3	40	60	100
Allied I	5	3	3	25	75	100	Allied II	5	3	3	25	75	100
Allied I Practical	3	0	3	-	-	-	Allied I Practical	3	4	3	40	60	100
Valued Added Course	2	2	3	25	75	100	Valued Added Course	2	2	3	25	75	100
<b>Total</b>	<b>30</b>	<b>16</b>	<b>21</b>	<b>125</b>	<b>375</b>	<b>500</b>	<b>Total</b>	<b>30</b>	<b>23</b>	<b>21</b>	<b>205</b>	<b>495</b>	<b>700</b>
<b>I YEAR TOTAL</b>									<b>39</b>	<b>42</b>	<b>330</b>	<b>870</b>	<b>1200</b>
<b>YEAR - II</b>													
<b>Semester - III</b>							<b>Semester - IV</b>						
Language III	6	3	3	25	75	100	Language IV	6	3	3	25	75	100
English III	6	3	3	25	75	100	English IV	6	3	3	25	75	100
Core III	4	5	3	25	75	100	Core IV	4	5	3	25	75	100
Core II Practical	3	-	3	-	-	-	Core II Practical	3	3	3	40	60	100
Allied III	4	3	3	25	75	100	Allied IV	4	3	3	25	75	100
Allied II Practical	3	-	3	-	-	-	Allied II Practical	3	3	3	40	60	100
SBEC I	2	2	3	25	75	100	SBEC II	2	2	3	25	75	100
NMEC I	2	3	3	25	75	100	NMEC II	2	3	3	25	75	100
<b>Total</b>	<b>30</b>	<b>19</b>	<b>24</b>	<b>150</b>	<b>450</b>	<b>600</b>	<b>Total</b>	<b>30</b>	<b>25</b>	<b>24</b>	<b>230</b>	<b>570</b>	<b>800</b>
<b>II YEAR TOTAL</b>									<b>44</b>	<b>48</b>	<b>380</b>	<b>1020</b>	<b>1400</b>
<b>YEAR - III</b>													
<b>Semester - V</b>							<b>Semester - VI</b>						
Core V	5	5	3	25	75	100	Core VIII	5	5	3	25	75	100
Core VI	5	5	3	25	75	100	Core IX	5	5	3	25	75	100
Core III Practical	3	-	3	-	-	-	Core III Practical	3	4	3	40	60	100
Core IV Practical	3	-	3	-	-	-	Core IV Practical	3	4	3	40	60	100
Core VII	5	5	3	25	75	100	Elective II	5	5	3	25	75	100
Elective I	5	5	3	25	75	100	Elective III	5	5	3	25	75	100
SBEC III	2	2	3	25	75	100	SBEC V	2	2	3	25	75	100
SBEC IV	2	2	3	25	75	100	SBEC VI	2	2	3	25	75	100
							Extension work	-	1	-	-	-	-
<b>Total</b>	<b>30</b>	<b>24</b>	<b>24</b>	<b>150</b>	<b>450</b>	<b>600</b>	<b>Total</b>	<b>30</b>	<b>33</b>	<b>24</b>	<b>230</b>	<b>570</b>	<b>800</b>
<b>TOTAL CREDIT FOR THE COURSE</b>									<b>140</b>	<b>138</b>	<b>1090</b>	<b>2910</b>	<b>4000</b>

### Distribution of Duration and Credit under Different Papers

Part	Paper	Hours/Week	Weeks/Semester	Hour/Paper	No. of Papers	Credit/Paper	Total Hours	Total credit
I	Language	4	15	60	4	3	240	12
II	English	4	15	60	4	3	240	12
III	Core paper	5	15	75	9	5	675	45
III	Core practical	3	15	45	4	3/4	180	14
III	Allied	5	15	75	4	3	300	12
III	Allied practical	6	15	90	2	3	180	6
IV	Value Education	4	15	60	2	2/4	120	6
IV	SBEC	2	15	30	6	2	180	12
III	Elective	3	15	60	2	5/4	120	14
IV	NMEC	2	15	30	2	3	60	6
IV	Extension work	1	15	15	1	1	15	1
<b>TOTAL</b>								<b>140</b>

### XIII. LIST OF CORE PAPERS:

S.No	Course Code	Course Title
1.	18U1PHC01	Properties of Matter and Acoustics
2.	18U2PHC02	Heat and Thermodynamics
3.	18U3PHC03	Optics
4.	18U4PHC04	Mechanics
5.	18U5PHC05	Electricity and Magnetism
6.	18U5PHC06	Basic Electronics
7.	18U5PHC07	Solid State Physics
8.	18U6PHC08	Atomic Physics
9.	18U6PHC09	Nuclear Physics

### XIV. LIST OF ELECTIVES

S.No	Course Code	Course Title
1.	18U5PHE01	Quantum Mechanics and Relativity
2.	18U6PHE02	Electronics and Communication
3.	18U6PHE03	Numerical Methods
4.	18U5PHE04	Nanoscience
5.	18U6PHE05	Astrophysics
6.	18U6PHE06	Mathematical Physics

#### **XV. LIST OF SKILL BASED ELECTIVES**

<b>S.No</b>	<b>Code</b>	<b>Course Title</b>
1	18U3PHS01	Laser Technology
2	18U4PHS02	Energy Physics
3	18U5PHS03	Digital Electronics
4	18U5PHS04	Bio medical Instrumentation
5	18U6PHS05	Microprocessor and its application
6	18U6PHS06	Electrical Appliances

#### **XVI. NON MAJOR ELECTIVE COURSE**

<b>S.No</b>	<b>Code</b>	<b>Course Title</b>
1	18U3PHN01	Essentials of Electricity
2	18U4PHN02	Physics in Everyday Life

#### **XVII. ALLIED PHYSICS**

<b>S.No</b>	<b>Code</b>	<b>Course Title</b>
1	18U1PHA01	Allied Physics – I
2	18U2PHA02	Allied Physics - II

## SEMESTER - I

<b>Programme Code</b>	B.Sc.,	<b>Programme Title</b>	<b>Bachelor of Science (Physics)</b>	
<b>Course Code</b>	21U1PHC01	<b>Title</b>	<b>Batch</b>	2021 – 2024
<b>Hrs/Week</b>	5	<b>CORE I: PROPERTIES OF MATTER AND ACOUSTICS</b>	<b>Semester</b>	I
			<b>Credits</b>	5

### COURSE OBJECTIVES

To acquire the basic knowledge about

1. To enable the students in order to learn the basic principles.
2. To understand the concepts of properties of matter and acoustics.

### COURSE OUTCOMES (CO)

<b>CO Number</b>	<b>CO Statement</b>	<b>Knowledge Level</b>
CO1	Be familiar with the basic concepts and basic formalisms of elastic properties.	K2
CO2	Basic ideas of Bending of Beams.	K1
CO3	Understand the dimensions of surface tension.	K2, K3
CO4	Know the definition and basic laws Viscosity.	K1, K2
CO5	Finding applications of the sound.	K3, K3

### **UNIT – I: Elasticity**

**12**

Stress - Strain diagram - Different moduli of Elasticity – Factors affecting elasticity - work done per unit volume in shearing strain - Relation between Elastic moduli - Poisson's ratio - Twisting couple on a wire - work done in twisting ; Torsional pendulum - Determination of rigidity modulus - static torsion method with scale and telescope.

### **UNIT – II: Bending of Beams**

**12**

Bending of beams - Expression for bending moment - Depression of the loaded end of the cantilever Young's modulus by measuring the tilt in a loaded cantilever – Uniform and

Non uniform bending – theory - experiment pin and microscope and scale and telescope method  
- Determination of Young's modulus by Koenig's method.

### **UNIT – III: Surface Tension**

**12**

Definition and dimensions of surface tension - Angle of contact and its determination - formation of drops- excess pressure inside the soap bubble – excess pressure inside the curved liquid surface - Experiment study of variation of surface tension with temperature - drop weight method of determining surface tension and interfacial surface tension – Quincke's method - angle of contact of mercury.

### **UNIT – IV: Viscosity**

**12**

Newton's law of viscous flow - Coefficient of critical velocity - Poiseuille's formula coefficient of viscosity – correction for the formula - determination of co-efficient of viscosity by capillary flow method - comparison of viscosities – Oswald's viscometer - Stoke's method for the coefficient of a highly viscous liquid - variation of viscosity with temperature and pressure - viscosity of gases - Mayer's formula for the rate of flow of a gas through a capillary tube.

### **UNIT – V: Sound and Acoustics**

**12**

Newton's Formula for velocity of sound – Effect of Temperature, Pressure - propagation of wave motion - mode of propagation - Frequency, Wavelength & velocity of sound waves – Sonometer - determination of frequency – Melde's apparatus – transverse and longitudinal waves.

Reverberation and time of reverberation - derivation of Sabine's formula, determination of absorption Coefficient. Ultrasonics – production, properties and applications.

### **BOOKS FOR STUDY:**

1. Elements of properties of matter by D.S. Mathur, S. Chand and Co., 10th edition, (1984).
2. Properties of Matter by R. Murugesan, S. Chand and Co., (2004).
3. Properties of Matter by Brijlal & N. Subramaniam, S. Chand and Co., (2005).
4. Properties of Matter and Acoustics by R. Murugesan, S. Chand and Co., (2005).

5. A Text Book of Sound by N. Subramaniam and Brijlal, S. Chand and Co., (2004).

**BOOKS FOR REFERENCE:**

1. Fundamentals of General Properties of Matter, H. R. Gulati, S. Chand and Co., (2005).
2. A Text Book of Sound, R .L. Saighal, S. Chand and Co., (2005).
3. Acoustics, Waves and Oscillations, S. N. Sen, New Academic Science, (2013).

**Online Sources:**

1. [www.khanacademy.org/science/physics/elasticity/surface\\_tension](http://www.khanacademy.org/science/physics/elasticity/surface_tension)
2. [www.khanacademy.org/science/physics/viscosity/acoustics](http://www.khanacademy.org/science/physics/viscosity/acoustics)

**Mapping with Programme Outcomes**

<b>PO CO</b>	<b>P01</b>	<b>P02</b>	<b>P03</b>	<b>P04</b>	<b>P05</b>
<b>CO1</b>	S	M	M	L	M
<b>CO2</b>	M	S	S	L	S
<b>CO3</b>	L	L	S	L	M
<b>CO4</b>	M	M	M	L	S
<b>CO5</b>	S	S	S	L	S

S - Strong; M - Medium; L - Low

## SEMESTER - II

<b>Programme Code</b>	B.Sc.,	<b>Programme Title</b>	<b>Bachelor of Science (Physics)</b>	
<b>Course Code</b>	18U2PHC02	<b>Title</b>	<b>Batch</b>	2018-2021
		<b>CORE – II: HEAT AND THERMODYNAMICS</b>	<b>Semester</b>	II
<b>Hrs/Week</b>	5		<b>Credits</b>	5

### Course Objective

To enable the students in order to learn the basic principles and concepts of Heat and Thermodynamics

### Course Outcomes (CO)

CO Number	CO Statement	Knowledge level
CO1	Be familiar with the basic concepts and basic formalisms of specific heat.	K2, K4
CO2	Basic ideas of thermodynamics and entropy.	K1
CO3	Understand the central concepts and basic formalisms of low temperature physics.	K2, K4
CO4	Know the definition and basic laws in thermal physics.	K1, K2
CO5	Finding applications of the physical quantities.	K3, K4

### Unit I: Thermometry and Calorimetry

12

Platinum resistance thermometer, correction, disadvantages, definition of specific heat capacity, determination of specific heat capacity by Newton's law of cooling, two specific heat capacities of gas, determination of  $C_v$  by Joly's differential steam calorimeter, determination of  $C_p$  by Regnault's method.

### Unit II: Thermodynamics

10

Zeroth and first law of thermodynamics-reversible and irreversible processes- second law of thermodynamics-Carnot's engine- efficiency.



Entropy-change of entropy in reversible and irreversible processes- temperature-entropy diagrams–third law of thermodynamics-Maxwell’s thermodynamic relations

### **Unit III: Low Temperature Physics**

**14**

Joule–Thompson effect- porous plug experiment-liquefaction of gases- Helium I & II–adiabatic demagnetization–superconductivity–refrigerator.

### **Unit IV: Transmission of Heat**

**14**

Definition–conduction, convection and radiation-thermal conductivity-Lee’s disc method–lapse rate–stability of the atmosphere-Greenhouse effect-Radiation- black body radiation Wein’s law–Raleigh Jean’s law–Planck’s law–Stefan’s law– pyrometry –solar constant–Angstrom pyrhelimeter-water flow pyrhelimeter.

### **Unit V: Statistical Thermodynamics**

**10**

Bose-Einstein Distribution law-Fermi-Dirac Distribution Law-Energy relations-Helmholtz function, Gibb’s function, enthalpy, Tds equation, Clausis-Clapeyron latent heat equation, specific heat relation.

#### **Books for Study:**

1. Heat and Thermodynamics, Brij Lal and Subramaniam, S. Chand and Co (2004).
2. Heat and Thermodynamics, D.S. Mathur, S. Chand and Co., (2004).
3. Thermal physics, R. Murugesan, S. Chand and Co., (2004).
4. University Physics, Richard Wolfson, Addison Wesley-Pearson (2011).

#### **Books for References:**

1. BrijLal and Subramaniam & P. S. Hemn, Heat and Thermodynamics, Revised and Multicolour Edition (2007).
2. D.S. Mathur, Heat and Thermodynamics S. Chand & Company, 5<sup>th</sup> Edition (2008).
3. Sharma J.K & Sarkar K.K. Thermodynamics and Statistical Physics Himalaya Publishing House, 3<sup>rd</sup> Edition (1991).

#### **Online Sources:**

1. <https://www.khanacademy.org/science/physics/thermodynamics>
2. <https://www.khanacademy.org/science/physics/thermodynamics/laws-of-thermodynamics/v/macrostates-and-microstates>

**Mapping with Programme Outcomes**

<b>PO CO</b>	<b>PO1</b>	<b>PO2</b>	<b>PO3</b>	<b>PO4</b>	<b>PO5</b>
<b>CO1</b>	M	S	S	L	S
<b>CO2</b>	S	M	M	L	M
<b>CO3</b>	M	S	S	L	S
<b>CO4</b>	S	S	S	L	S
<b>CO5</b>	M	M	S	L	M

S - Strong; M - Medium; L - Low

### SEMESTER – III

<b>Programme Code</b>	B.Sc.,	<b>Programme Title</b>	<b>Bachelor of Science (Physics)</b>	
<b>Course Code</b>	18U3PHC03	<b>Title</b>	<b>Batch</b>	2018 – 2021
<b>Hrs/Week</b>	5	<b>CORE - III: OPTICS</b>	<b>Semester</b>	III
			<b>Credits</b>	5

#### Course Objectives

1. The aim of the course is to introduce the students to the optics.
2. Acquire basic knowledge of the optical instrument, propagation of light, nature and behavior of light and its application etc.

#### Course Outcomes (CO)

<b>CO Number</b>	<b>CO Statement</b>	<b>Knowledge Level</b>
CO1	Learn the fundamental principles of geometrical optics.	K1,K2
CO2	Understand the central concepts and basic formalisms of diffraction.	K1,K4
CO3	Import knowledge about the intensity variation of light due to interference.	K2,K4
CO4	Understand the intensity variation of light due to Polarization.	K2,K4
CO5	Study the applications of various optical instruments.	K3,K4

#### **UNIT – I: Geometrical Optics**

**12**

Characteristic of Light – Reflection – Refraction - Dispersion through a prism – Dispersive power - Combination of two small angled prisms to produce dispersion without deviation – Constant Deviation Spectrometer - Deviation without dispersion – Direct vision Spectrometer - Spherical aberration in lenses – Methods of minimizing spherical aberration – Condition for

minimum spherical aberration in the case of two lenses separated by a distance – Chromatic aberration in lenses – Condition for achromatism of two thin lenses (in contact and out of contact) – Coma.

## **UNIT – II: Diffraction**

**12**

Diffraction – Coherence - Phase difference and Path difference – Fresnel & Fraunhofer diffraction - Rectilinear Propagation of light – Zone plate – Fraunhofer diffraction at a single slit - Theory of plane transmission grating - Normal incidence and oblique incidence - Condition for absence of spectra - Overlapping spectra - Grating at oblique incidence - Diffraction due to straight edge - Prism and grating spectra - Dispersive power of grating - Determination of wavelength of light using transmission grating.

## **UNIT - III: Interference**

**12**

Interference - Superposition of waves – Young’s double slit experiment – Wave front divisions – Condition for interference – Techniques for obtaining interference Fresnel’s biprism - Determination of wave length of monochromatic light - Michelson Interferometer – Fabryperot interferometer.

## **UNIT – IV: Polarization**

**12**

Polarization - Transverse wave - Double refraction - Ordinary ray and extra ordinary ray - Huygens explanation in uniaxial crystals - Quarter wave plate & Half wave plate - Production and detection of Plane, circularly, Elliptically polarized light - Babinet’s Compensator - Nicol prism -Optical Activity - Specific rotation - Laurent’s half shade polarimeter.

## **UNIT – V: Optical Instruments**

**12**

Eye pieces - Huygens and Ramsens - Comparison - Resolving Power - Rayleigh’s Criterion – Resolving power of Telescope, Microscope, Grating and Prism – Holography – Principle - Recording and Reconstruction - Properties - Applications.

Power point presentation, Seminar, Quiz, Assignment.
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### **Book for Study:**

1. A Text book of Optics – Subramanyam, Brij Lal and Avadhanulu, S. Chand & Co., New Delhi, (2007).
2. Optics and Spectroscopy - R. Murugesan and Kiruthiga Sivaprasath, S. Chand & Co., New Delhi, (2006).

### **Book for Reference:**

1. Optics by Ghatak. A, Tata McGraw Hill, New Delhi, (2009).

**Online Sources:**

1. <https://www.khanacademy.org/science/physics/geometric-optics>
2. <http://nptel.ac.in/courses>

**Mapping with Programme Outcomes**

<b>PO</b> <b>CO</b>	<b>P01</b>	<b>P02</b>	<b>P03</b>	<b>P04</b>	<b>P05</b>
<b>C01</b>	S	S	S	L	S
<b>C02</b>	S	M	S	L	S
<b>C03</b>	M	S	S	L	S
<b>C04</b>	M	S	S	M	S
<b>C05</b>	L	M	S	M	S

S - Strong; M - Medium; L - Low

### SEMESTER - III

<b>Programme Code</b>	B.Sc.,	<b>Programme Title</b>	<b>Bachelor of Science (Physics)</b>	
<b>Course Code</b>	18U3PHS01	<b>Title</b>	<b>Batch</b>	2018 - 2021
<b>Hrs/Week</b>	2	<b>SBEC - I: LASER TECHNOLOGY</b>	<b>Semester</b>	III
			<b>Credits</b>	2

#### Course Objectives

1. To enable the students to understand of the fundamental principles underlying the operation of lasers and their Spectroscopic applications.
2. To describe the various interactions of light and matter and to Understand the use of laser technology in spectroscopic and industrial applications.

#### Course Outcomes (CO)

<b>CO Number</b>	<b>CO Statement</b>	<b>Knowledge Level</b>
CO1	To study the basic knowledge about energy levels of atoms and molecules.	K1,K2
CO2	Understand the basic principles and characteristics of lasers.	K1,K2
CO3	To Understand and explain the principles of solid state, gas and semiconductor lasers.	K3,K4
CO4	To learn about gas and liquid laser source.	K3,K4
CO5	Study the applications of laser.	K3

#### **Unit – I: Basic Concepts**

**8**

Energy levels of atoms and molecules - Absorption and Emission of Light - Spontaneous and Stimulated emission - Active medium - Population inversion - Pumping mechanisms - Einstein's coefficients and relation.

**UNIT – II: Laser Characteristics****7**

Basic characteristics - Spatial and Temporal coherence - Beam quality and Output characteristics - Beam divergence and Focusing using optical system - Types of laser based output beam - Continuous pulsed lasers – Ultra short pulses.

**UNIT – III: Solid State Lasers****7**

Introduction, Nd - YAG Laser and Semiconductor diode lasers, construction - Energy level diagram - Excitation mechanisms and Application.

**UNIT – IV: Gas and Liquid Lasers****7**

He - Ne, CO<sub>2</sub> and Dye laser – Construction - Energy level diagram - Excitation mechanisms and Application.

**UNIT – V: Laser Applications****7**

Industrial Applications: Laser in industry - Laser welding - Laser cutting and Laser drilling - Laser marking - Lasers in communication - Lasers in medicine.

**Books for Study:**

1. Optical fiber and Laser, Principles and Applications - Anuradha De, New Age International Pvt Ltd., (2010).
2. Optics and Spectroscopy – R. Murugesan & Kiruthiga Sivaprasath, S. Chand & Company, (2010).
3. Elements of Spectroscopy – Gupta, Kumar & Sharma, Pragati Prakashan, (2009).

**Books for Reference:**

1. Laser Systems and Applications - Nityan and Chowdry and RichaVerma, PHI, (2011).
2. An introduction to Lasers – N. Avadhanulu, Chand & Company, (2001).

**Online Sources:**

1. <https://onlinecourses.nptel.ac.in>
2. <https://theopenacademy.com/content/lecture-4-laser-fundamentals-iii-cont>

**Mapping with Programme Outcomes**

<b>PO</b> <b>CO</b>	<b>P01</b>	<b>P02</b>	<b>P03</b>	<b>P04</b>	<b>P05</b>
<b>C01</b>	S	S	S	L	S
<b>C02</b>	S	S	S	L	S
<b>C03</b>	M	M	S	L	S
<b>C04</b>	M	M	S	M	S
<b>C05</b>	L	M	S	L	S

S - Strong; M - Medium; L - Low



### SEMESTER - III

<b>Programme Code</b>	B.Sc.,	<b>Programme Title</b>	<b>Bachelor of Science (Physics)</b>	
<b>Course Code</b>	18U3PHN01	<b>Title</b>	<b>Batch</b>	2018 - 2021
<b>Hrs/Week</b>	2	<b>NMEC - I: ESSENTIALS OF ELECTRICITY</b>	<b>Semester</b>	III
			<b>Credits</b>	2

#### Course Objectives

1. To acquire knowledge about Handling and identifying electrical instruments.
2. To Know about the principle used in the storage of electricity

#### Course Outcomes (CO)

<b>CO Number</b>	<b>CO Statement</b>	<b>Knowledge Level</b>
CO1	To learn the basic concepts of electricity	K1,K2
CO2	To study the basics of unit and measurements of electricity.	K1,K2,K4
CO3	To learn about generation of electricity.	K1,K2
CO4	To impart the knowledge about electric energy storage devices.	K1,K2,K4
CO5	To know the features and operations of domestic electrical appliances.	K1,K2,K4

#### **UNIT – I: Electricity- An Introduction 4**

Electricity - Ohms law - Electric charge - Coulomb's law - Principle and types of Resistors and Capacitors.

#### **UNIT – II: Electricity- Units and Measurements 5**

Current – Voltage – Units - Measuring meters: Galvanometer – Voltmeter – Ammeter - Multimeter.

#### **UNIT – III: Generation of Electricity 5**

Preference for electricity - Sources of generation of electricity – Conventional - Nuclear Power stations – Non - conventional - Photovoltaic cells.

## **UNIT – IV: Storage and Conservation of Electricity 4**

Primary cells - Daniel cell - Lechlanche cell - Secondary cells - Lead cell – Nickel - Cadmium cell - Rechargeable cell - Conservation of electricity.

## **UNIT – V: Domestic Electrical Appliances 6**

Principle and Operation of electrical bulbs – Fans - Mixer grinder – Refrigerator - Air conditioner – UPS – Stabilizer - Microwave Oven.

### **Books for Study:**

1. Electricity and Magnetism - R. Murugesan, S. Chand & Co., (2005).
2. Electricity and Magnetism- Brijlal and Subramaniam, S. Chand & Co., (2005).

### **Books for Reference:**

1. A Text Book of Electrical Technology, Theraja. A. L. Theraja. B. K, S. Chand & Co., (2010).
2. Electricity and Magnetism- N. Nagarathinam and N. Lau, S. Chand & Sons, (2007).

### **Online Sources:**

1. <https://www.khanacademy.org/science/ap-physics-1/ap-circuits-topic/current-ap>
2. <http://nptel.ac.in/courses>

### **Mapping with Programme Outcomes**

<b>PO</b> <b>CO</b>	<b>P01</b>	<b>P02</b>	<b>P03</b>	<b>P04</b>	<b>P05</b>
<b>CO1</b>	S	S	S	L	S
<b>CO2</b>	S	S	S	L	S
<b>CO3</b>	S	S	S	L	S
<b>CO4</b>	S	S	S	L	S
<b>CO5</b>	S	S	S	L	S

S - Strong; M - Medium; L – Low

## SEMESTER - IV

<b>Programme Code</b>	<b>B.Sc.,</b>	<b>Programme Title</b>	<b>Bachelor of Science (Physics)</b>	
<b>Course Code</b>	<b>18U4PHC04</b>	<b>Title</b>	<b>Batch</b>	2018-2021
<b>Hrs/Week</b>	5	<b>CORE IV: MECHANICS</b>	<b>Semester</b>	IV
			<b>Credits</b>	5

### Course Objectives

1. To enable the students in order to learn the basic principles, theory and concepts of mechanics.
2. To gain knowledge by the students in order to learn the operating principles of machines used in daily life
3. To acquire basic knowledge of working of machines.

### Course Outcomes

On the successful completion of the course, students will be able to

<b>CO Number</b>	<b>CO Statement</b>	<b>Knowledge level</b>
CO1	Outline the Relative motion, Inertial and non-inertial reference frames.	K1, K3, K4
CO2	Understand the conservation laws and gravitation.	K1, K4
CO3	To know the laws of friction and hydrodynamics.	K1, K3
CO4	Understand the formulation of classical mechanics and its	K1, K2, K3
CO5	Study the experimental analysis of matter waves.	K1, K4

### **UNIT – I: Laws of Motion and dynamics of Rigid bodies**

**12**

Motion in two and three dimensions–relative motions–uniform circular motion–force and motions–Newton’s law–mass inertia and force–gravitational force–applications of Newton’s second law–collision–kinetic energy in collision.

Moment of inertia-theorems of moment of inertia-energy of rotating rigid body- Gyroscopes-Newton's law of universal gravitation-inertia and gravitational mass-motion in gravitational field due to a solid sphere and circular disc- Deduction of Newton's law of gravitation from Kepler's law.

**UNIT – II: Conservation Laws and Centre of Gravity**

**12**

Laws of conservation of mass, energy-linear momentum-angular momentum – angular acceleration and torque.

Centre of gravity of a body–distinction between centre of gravity and centre of mass–centre of gravity of solid cone, solid hemisphere, hollow hemisphere and a tetrahedron.

**UNIT – III: Friction and Hydrodynamics**

**12**

**Friction :** Laws of friction, angle of friction, cone of friction, equilibrium of a body on a rough inclined plane acted upon by an external force–friction dynamometer –friction clutch.

**Hydrodynamics:** Stream line flow- Equation of continuity of flow–energy of the liquid, Bernoulli's theorem- Applications of Bernoulli's theorem, venturimeter, pitot tube.

**UNIT – IV: Classical Mechanics**

**12**

Mechanics of system of particles–constraints-classification, generalized coordinates-transformation equation-principle of virtual work-D'Alembert's principle-derivation of Lagrange's equation of motion- formulation of conservation theorems-generalized momentum-energy and linear momentum-Application-Atwood's machine.

**UNIT-V: Quantum Mechanics**

**12**

Introduction–Inadequacy of classical mechanics- Matter waves De Broglie wavelength-Davission and Germer's experiment-G.P Thomson experiment- Uncertainty principle-Heisenberg's  $\gamma$  ray microscope- Determination of position.

**Books for Study:**

1. Mechanics and Mathematical Methods, R. Murugesan, S. Chand and Co., (2005).
2. Dynamics, Narayanamurthy, National Publishing Company, 8<sup>th</sup> Edition, (2005).
3. Statics, Hydrostatics and Hydrodynamics, Narayanamurthy and Nagarathnam, National Publishing Company, (2002).
4. Quantum Mechanics–Satyaprakash& Swati saluja, Knrn Publication, (2015).

**Books for Reference:**

1. Classical Mechanics by H.Goldstein Addition Wesley Publications (2005)
2. Mechanics - D.S. Mathur , S. Chand and Co, (2006).
3. Modern Physics- R. Murugesan and Kiruthika sivaprasath, S. Chand and Co, (2014).

### Mapping with Programme Outcomes

<b>PO</b> <b>CO</b>	<b>P01</b>	<b>P02</b>	<b>P03</b>	<b>P04</b>	<b>P05</b>
<b>CO1</b>	M	S	S	L	S
<b>CO2</b>	S	M	M	L	M
<b>CO3</b>	S	S	S	L	M
<b>CO4</b>	M	S	S	L	S
<b>CO5</b>	S	S	S	L	M

S - Strong; M - Medium; L - Low

## SEMESTER - IV

Programme Code	B.Sc.,	Programme Title	Bachelor of Science (Physics)	
Course Code	18U4PHS02	Title	Batch	2018-2021
Hrs/Week	2	SBEC: ENERGY PHYSICS	Semester	IV
			Credits	2

### Course Objectives

To enable the students to aware about renewable energy types, energy resources and conservation of energy

### Course Outcomes

On the successful completion of the course, students will be able to

CO Number	CO Statement	Knowledge level
CO1	To know the basic concept of energy sources.	K1,K2
CO2	To understand the principles of solar thermal energy and its various applications.	K1,K3
CO3	To learn the principles of photovoltaic cells and its classification.	K1,K2
CO4	To study about introduction of biomass energy and its uses.	K1, K3
CO5	To study the basic of energy consumption, conservation.	K1,K3

### UNIT - I: Introduction to Energy Sources

8

Classification of Energy sources-Energy consumption as a measure of prosperity-Worlds reserve of commercial energy sources and their availability-wind energy-ocean thermal energy conversion(OTEC)-Tidal energy(basic ideas)- Geothermal energy-Global warming-Renewable energy resources-advantages- Obstacles.

**UNIT - II: Solar Thermal Energy****7**

Renewable energy sources-Solar radiation at the Earth's surface- Applications: Solar water heater, Solar space heating and cooling, distillation, green houses-solar thermal technologies-solar cooker.

**UNIT - III: Photovoltaic Power Generation****7**

Photo voltaic effect-performance of cell-choice of materials for a solar cells-Basic requirement for obtaining an effective solar cell-Principles, types and power generation-characteristics, efficiency of solar cell generation

**UNIT - IV: Biomass Energy****7**

Biomass energy-classification-Photosynthesis-Biomass conversion technology -Biogas generation-applications

**UNIT - V: Energy Consumption, Conservation and Options****7**

Conservation of energy- Patterns of Energy consumption in domestic, Industrial, transportation and agricultural sectors- conservation principles and energy audit in these sectors-Energy options for developing countries.

**Books for Study:**

1. S. P. Sukhatme, Solar energy, Tata McGraw Hill Publishing Company, 2<sup>nd</sup> Edition (1997).
2. G.D. Rai, Non Conventional Energy Sources, Ed. IV, Khanna publishers, (2007).
3. G.N. Tiwari, solar energy, Ed.,2004.

**Books for reference:**

1. B. H. Khan, Non Conventional Energy Sources, Tata McGraw Hill, Ed.II, (2012).
2. D. S. Chauhan, S. K. Srivastava, NonConventional Energy Sources Ed.V, (2004).

**Mapping with Programme Outcomes**

<b>PO CO</b>	<b>P01</b>	<b>P02</b>	<b>P03</b>	<b>P04</b>	<b>P05</b>
<b>CO1</b>	S	S	S	L	M
<b>CO2</b>	S	S	S	L	M
<b>CO3</b>	M	M	S	M	M
<b>CO4</b>	S	S	M	L	S
<b>CO5</b>	S	S	S	L	S

S - Strong; M - Medium; L - Low

## SEMESTER – IV

<b>Programme Code</b>	<b>B.Sc.,</b>	<b>Programme Title</b>	<b>PHYSICS</b>	
<b>Course Code</b>	<b>18U4PHN02</b>	<b>Title</b>	<b>Batch</b>	2018 - 2021
<b>Hrs/Week</b>	2	<b>NMEC-II: PHYSICS IN EVERYDAY LIFE</b>	<b>Semester</b>	IV
			<b>Credits</b>	2

### Course Objectives

To acquire knowledge about

- Different topics such as Mechanics which deals with principle and working of machines,
- Properties of matter which deals with behaviour of matter, and also the principle of heat,
- a small introduction about optics and optical devices and also basic concepts of electricity.

### Course Outcomes

On the successful completion of the course, students will be able to

<b>CO Number</b>	<b>CO Statement</b>	<b>Knowledge level</b>
CO1	Study the basic knowledge about mechanics.	K1, K4
CO2	Understand the fundamentals of properties of matter and sound.	K1, K2
CO3	To know the basic knowledge of heat and its measurements.	K1, K2, K4
CO4	Understand the basic concept of light.	K1, K2
CO5	Acquire basic knowledge about electricity and magnetism.	K1, K3, K4



**UNIT – I: Mechanics****4**

Motion, Force, Work, Power and Energy-Mass and Weight-Newton's law of motion-System of Forces-weight of a body in a lift-Gravitation-planetary motion and earth satellites-communication satellites.

**UNIT – II: Properties of Matter& Sound****5**

Three states of matter-binding forces –Archimedes Principle-applications- Pascal law-capillary action-Surface Tension-Dimension of Surface Tension- Bernoulli's principle – Viscosity-Bunsen Burner.

Sound reverberation-acoustics of building-intensity of sound-loudness of sound – noise pollution.

**UNIT – III: Heat****5**

Definition-Measurement of heat and temperature-types of thermometers- platinum resistance thermometer-Clinical Thermometer-Expansion of solid, liquid & gas- Change of sign conversion.

**UNIT – IV: Light****5**

Reflection-Refraction-Laws of refraction-Reflection through a lens-Image formation by a lens- Effect of silvering one of the refracting surface of a lens- determination of focal length of a convex lens by displacement method-Refractive index – Digital camera.

**UNIT – V: Electricity and Magnetism****5**

Colomb's law-Ohm's law-Kirchaff laws-electric power-electrical safety-electromagnetic induction-Faraday's Law-Lenz Law-transformers-Carey-Foster Bridge-temperature coefficient of resistance-potentiometer. Properties of dia, para, ferromagnetism- CT scan.

**Books for Study:**

1. A Text book of Physics - D.C. Agarwal., (Volume-I), (1989).
2. A text book in Electrical technology – B.L. Teraja, S. Chand & Co., New Delhi (2006).
3. Electricity and Magnetism, Brijlal and Subramaniam, S. Chand & Co., (2008).
4. Properties of Matter & Acoustics, R. Murugesan. S. Chand, (2005).

**Mapping with Programme Outcomes**

<b>PO CO</b>	<b>P01</b>	<b>P02</b>	<b>P03</b>	<b>P04</b>	<b>P05</b>
<b>CO1</b>	S	M	M	M	M
<b>CO2</b>	S	S	S	L	S
<b>CO3</b>	S	S	S	M	M
<b>CO4</b>	S	M	M	L	S
<b>CO5</b>	S	S	S	L	S

S - Strong; M - Medium; L - Low

## SEMESTER - II

<b>ProgrammeCode</b>	<b>B.Sc</b>	<b>Programme Title</b>	<b>Bachelor of Science (Mathematics &amp; Chemistry)</b>	
<b>Course Code</b>	18U2PHA02	<b>Title</b>	<b>Batch</b>	2019-2022
<b>Hrs/Week</b>	5	<b>ALLIED PHYSICS - II</b>	<b>Semester</b>	II
			<b>Credits</b>	5

### Course Objectives

To acquire knowledge about

1. Different topics such as Atomic Physics basic idea of structure and atom.
2. Solid state Physics which deals with behavior of crystal structure and different types of Bonding.
3. A small introduction about Basic Electronics and Digital Electronics.

<b>CO Number</b>	<b>CO Statement</b>	<b>Knowledge level</b>
CO1	To learn the basic concept of structure and functions of atoms.	K1,K2,K4
CO2	Understand the properties of nuclei.	K1, K2, K4
CO3	Outline the importance of solid state physics in the modern society	K1, K2, K4
CO4	To know about the electronic circuits and its operation.	K1, K2
CO5	Understand the application of electronics with mathematical computation.	K1, K2, K3

### UNIT – I:

12

**Atomic Physics:** Introduction to atomic physics-Bohr's theory and Somerfield theory- Vector atom model-Spatial quantization-Spinning electron-Quantum numbers associated with Vector atom model-Pauli's exclusion principle- Stern-Gerlach experiments.

### UNIT-II:

10

**Nuclear Physics:** Introduction-Classification of nuclei-General properties of nucleus-Binding energy-Nuclear stability-Nuclear models-liquid drop model-Shell model-Nuclear radiation detectors-Ionization chamber-Geiger Muller counter.

**UNIT – III:**

**10**

**Solid State Physics:** Introduction to crystals-Periodic array of atoms-Unit cell-Basis-lattice-types-Two dimensional and three dimensional lattices-Seven crystal systems-Bonding in crystals-ionic bond-covalent bond-metallic bond-molecular bond- hydrogen bond.

**UNIT – IV:**

**14**

**Basic Electronics:** Semi Conductor Physics–Intrinsic and Extrinsic semi conductor–P type and N type semi conductor-construction and characteristics of FET Operational amplifiers- basic operations.

**UNIT – V:**

**14**

**Digital Electronics:** Binary, Octal, Hexadecimal number and their inter conversion-Laws of Boolean algebra-De-Morgans theorem–NAND/NOR gate as universal building blocks-Simplification of Boolean expression–Amplitude modulation–Modulation factor–Frequency modulation.

**Books for Study:**

1. Modern physics – R. Murugesan, S. Chand & Co., 12<sup>th</sup> Edition, (2004).
2. Digital principles and applications – Malvino & Leach, TMH, (2000).
3. Principles of Electronics – V.K. Metha, S. Chand & Co., (2001).
4. Solid state Physics- S. L. Kakani, C. Hemrajani, Sultan Chand & Sons, 4<sup>th</sup> edition (2005).
5. Solid state Physics- S.O. Pillai, New Age International Publishers, 6<sup>th</sup> edition, (2011).

**Books for Reference:**

1. Fundamentals of General Properties of Matter, H.R. Gulati, S. Chand and co., (2005).
2. Thermal physics, R. Murugesan, Kiruthiga sivaprasath, (2004).
3. Modern physics, R. Murugesan, S. Chand, (2013).

**Mapping with Programme Outcomes**

<b>PO CO</b>	<b>P01</b>	<b>P02</b>	<b>P03</b>	<b>P04</b>	<b>P05</b>
<b>CO1</b>	S	S	M	M	M
<b>CO2</b>	S	S	M	L	M
<b>CO3</b>	S	L	S	L	M
<b>CO4</b>	S	M	M	M	S
<b>CO5</b>	S	S	M	L	S

S - Strong; M - Medium; L - Low

## SEMESTER - V

<b>Programme Code</b>	<b>B.Sc.,</b>	<b>Programme Title</b>	<b>Bachelor of Science (Physics)</b>	
<b>Course Code</b>	18U5PHC05	<b>Title</b>	<b>Batch</b>	2018 - 2021
<b>Hrs/Week</b>	5	<b>CORE – V: ELECTRICITY AND MAGNETISM</b>	<b>Semester</b>	V
			<b>Credits</b>	5

### Course Objectives

- To gain knowledge about the principle and working of electrical circuits.
- Acquire basic knowledge about handling electrical circuits.
- Know about types of electricity.

### Course Outcomes (CO)

<b>CO Number</b>	<b>CO Statement</b>	<b>Knowledge Level</b>
CO1	To study about introduction of electrostatics and its applications.	K1,K3
CO2	To gain knowledge about effect of electric field and magnetic field.	K1,K3
CO3	To study the relation between thermal energy and Electric current.	K1,K2
CO4	To understand the basics of Alternating current and its measurements.	K1,K3
CO5	To acquire knowledge about electrical measurements devices and its uses.	K1,K2,

### **Unit - I: Electrostatics**

**12**

Introduction - Electric field and Electric intensity – Force between a point charge and linear charge distribution - Electrostatic potential - Potential and intensity at a point due to a dipole - Electric potential at a point due to an electric quadrupole and a charged sphere - Electric potential energy - Energy of a system of charges-Gauss theorem - Applications of gauss theorem - Coulomb’s law-Mechanical force experienced by unit area of a charged surface - Energy stored per unit volume in an electric field – Principle of a Capacitor - Capacitance of a spherical and cylindrical capacitor-energy of a charged capacitor - loss of energy due to sharing of charges between two capacitors.

## **Unit - II: Magnetic Effect of Electric Current**

**12**

Faraday's law of electromagnetic induction - Lenz law - Fleming's right hand rule - Oersted's experiment-Laplace's law and Ampere's law - Magnetic field at the centre of a circular coil carrying current-Magnetic field at a point due to a straight conductor carrying current - Magnetic field at a point on the axis of a circular coil carrying current - Magnetic field at a point on the axis of a Solenoid - Force experienced by a conductor carrying current placed in a magnetic field of Uniform Intensity - Force between two conductors carrying current - Self inductance of a solenoid - Mutual Inductance of a pair of solenoids - Theory of Ballistic galvanometer - Damping correction - uses.

## **Unit - III: Heating Effect of Electric Current**

**12**

Introduction - Heat developed in a conductor carrying current - Callendar and Barnes Continues flow method - Temperature of a conductor carrying electric current - Applications of heating effect of electric current - Measurement of Electric power.

Thermoelectricity: Seebeck effect - Laws of thermo emf-intermediate metals, intermediate temperature - S.G. Starling method for Peltier and Thomson effect - Thermodynamics of thermocouple - Determination of  $\pi$  and  $\sigma$  - Thermoelectric diagrams and their uses.

## **Unit - IV: Alternating Current Circuits**

**12**

AC- measurement of AC - Power factor - RMS, Average value of current and emf-LR, LC, **CR** and LCR Circuits (Series and Parallel) - Growth and decay - Power factor in LR and CR circuits - AC and DC motors - Types of windings -Series, Parallel and Compound Windings -Transformers and its Uses\_Three phase, delta and star connections - Choke coil - Tesla coil- Skin effect.

## **Unit - V: Electrical Measurements**

**12**

Definitions - Practical units - Laws of resistance - Current density - Kirchoff's laws - Whetstone's Bridge - Sensitiveness of a Wheatstone's Bridge - Carey-Foster's Bridge - Determination of temperature coefficient - Kelvin's Double Bridge - Potentiometer - determination of internal resistance of a cell - Comparison of EMF's of Two cells - Measurement of thermo emf - Measurement of potential difference and current - Calibration of Voltmeter and Ammeter (High and low range).

Power point presentation, Seminar, Quiz, Assignment
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**Books for Study:**

1. Electricity and Magnetism – R.Murugesan, S. Chand, (2008).
2. Electricity and Magnetism, Brijlal and Subramaniam, S. Chand & Co, New Delhi (2016).

**Books for Reference:**

1. Fundamentals of Magnetism and Electricity - D.N.Vasudeva S.Chand, (2002).
2. Electricity and Magnetism - Nagaratanam and Lakshminarayanan, 3rd revised edition, The National Pub. Co. (1994).
3. Electricity and Magnetism - K.K Tewari, S.Chand, (2009).

**Mapping with Programme Outcomes**

<b>PO CO</b>	<b>P01</b>	<b>P02</b>	<b>P03</b>	<b>P04</b>	<b>P05</b>
<b>CO1</b>	S	M	S	M	S
<b>CO2</b>	S	M	S	M	S
<b>CO3</b>	S	S	S	M	S
<b>CO4</b>	S	M	S	M	S
<b>CO5</b>	S	S	S	L	S

S - Strong; M - Medium; L – Low



## SEMESTER - V

<b>Programme Code</b>	<b>B.Sc.,</b>	<b>Programme Title</b>	<b>Bachelor of Science (Physics)</b>	
<b>Course Code</b>	18U5PHC06	<b>Title</b>	<b>Batch</b>	2018 - 2021
<b>Hrs/Week</b>	5	<b>CORE – VI: BASIC ELECTRONICS</b>	<b>Semester</b>	V
			<b>Credits</b>	5

### Course Objectives

To acquire the basic knowledge about

- Basic knowledge of p-n junction diode, different rectification Process.
- Knowledge on Fabrication of a transistor, different Configuration, Biasing, h parameters and learn the different applications of FET.
- Studying the amplitude and frequency response of common amplification circuits.
- Applying theories for different classes of amplifiers
- Understanding negative and positive feed backs for electronic components.

### Course Outcomes (CO)

<b>CO Number</b>	<b>CO Statement</b>	<b>Knowledge Level</b>
CO1	To study the basic ideas about the Semiconductor and devices.	K1,K2
CO2	To learn about the construction and operation of transistor and JFET.	K1,K3
CO3	To acquire knowledge about construction and operations of various type of Amplifier and oscillators.	K2,K4
CO4	To study about the Construction, working, characteristics of Semiconductor devices.	K1,K3
CO5	To learn about Linear ICs and Operational Amplifiers.	K3,K5

### **Unit - I: Introduction to Semiconductor**

**10**

Semiconductors \_Introduction- Energy band diagram description of semiconductors- Intrinsic semiconductor - Extrinsic Semiconductor – n-type semiconductor - p-type

semiconductor - Charge on n-type and p-type semiconductors - Majority and minority carriers – pn junction - Volt-ampere I-V characteristics of pn junction - Zener diode - LED - Photo diode – Schottky diode Tunnel diode.

## **Unit - II: Transistor**

12

Transistor - Basic configurations - CB,CE and CC mode - Transistor action - Relation between  $\alpha$ ,  $\beta$  and  $\gamma$  - DC load line - DC bias and stabilization -operating point- AC load line, transistor biasing - Fixed bias - Voltage divider bias – Transistor as a two part network - h parameter –Field Emission Transistor (FET) – principle and working.

## **Unit - III: Amplifiers and Oscillators**

14

### **Amplifiers:**

Amplifiers – Definition of gain, Frequency response, decibel and band width - Classification of amplifiers - Single stage and Multi stage RC couples CE amplifier - Class A,B,C - Power amplifiers - Feedback amplifier - General theory of feedback - Principles of negative voltage feedback – Advantages - Emitter follower.

### **Oscillators:**

Oscillators - Criteria for oscillation - Construction and operation of Hartley Oscillator - Colpitt's Oscillator - Wien's Bridge Oscillator - Phase Shift Oscillator - Piezo-Electric Oscillator.

## **Unit - IV: Semiconductor Devices**

14

Construction, working, characteristics, parameters and applications of FET – MOSFET - Comparison between FET and Transistor – Solar cell Photodiode - LED - Tunnel diode – Photo transistor - UJT - UJT relaxation oscillator – SCR - SCR as a switch.

## **Unit - V: Linear ICs and Operational Amplifiers**

10

Op amp - Pin configuration - Characteristics of Op amp - Virtual ground -Off-set voltage - Inverting amplifier - Non- inverting amplifier - Differential amplifier - Common mode rejection ratio – Application - op-amp as Adder-Subtractor – Integrator – Differentiator – Comparotor- Multivirators- IC 741 Astable, Monostable and Bistable multivibrators.

Power point presentation, Seminar, Quiz, Assignment
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### **Books for Study:**

1. V K Mehta, Principles of Electronics, S.Chand and Company Ltd., (2012).

2. B.L. Theraja, Basic Electronics (Solid state), S. Chand & Co., (2006).

**Books for References:**

1. Hand book of Electronics by Gupta Kumar, Published by Pragati Prakashan, (2010).
2. D. Chattopadhyay et al., Foundations of Electronics 2<sup>nd</sup> edition, Wiley Eastern Ltd, New Delhi, (1988).
3. Gupta & Kumar, Hand book of Electronics, Pragati Prakhasan, Meerut, (2012).

**Mapping with Programme Outcomes**

<b>PO CO</b>	<b>PO1</b>	<b>PO2</b>	<b>PO3</b>	<b>PO4</b>	<b>PO5</b>	<b>PO15</b>
<b>CO1</b>	<b>S</b>	<b>S</b>	<b>M</b>	<b>S</b>	<b>L</b>	<b>L</b>
<b>CO2</b>	<b>S</b>	<b>S</b>	<b>M</b>	<b>S</b>	<b>S</b>	<b>L</b>
<b>CO3</b>	<b>S</b>	<b>S</b>	<b>S</b>	<b>L</b>	<b>L</b>	<b>L</b>
<b>CO4</b>	<b>S</b>	<b>S</b>	<b>M</b>	<b>S</b>	<b>S</b>	<b>L</b>
<b>CO5</b>	<b>S</b>	<b>L</b>	<b>S</b>	<b>M</b>	<b>S</b>	<b>L</b>

S - Strong; M - Medium; L – Low

## SEMESTER - V

Programme Code	B.Sc.,	Programme Title	Bachelor of Science (Physics)	
Course Code	18U5PHC07	Title	Batch	2018 - 2021
Hrs/Week	5	CORE – VII: SOLID STATE PHYSICS	Semester	V
			Credits	5

### Course Objectives

To acquire knowledge of;

- ✓ To know the formation and structure of different solid materials.
- ✓ To motivate the students in order to apply the principles of Solid State Physics in their research studies.

### Course Outcomes (CO)

CO Number	CO Statement	Knowledge Level
CO1	Students will gain knowledge of basic theories of solid state structure	K1,K2
CO2	Students acquire knowledge of X-rays and crystal defect	K2,K4
CO3	Understand the basic knowledge of different magnetic materials and their properties	K2,K3
CO4	Understand the basics of dielectrics and their properties	K1,K3
CO5	Acquiring the knowledge of advanced materials and their uses	K2,K3

### **Unit – I: Crystal structure**

14

Crystalline and Amorphous solids - Crystal structure: basis and crystal structure - Primitive lattice cell and unit cell - Bravais lattices in two dimensions and in three dimensions – Lattice planes and Miller indices - interplanar distance - spacing between planes in SC, FCC and BCC - Atomic packing - Atomic radius-lattice constant and density - Crystal structures (SC, HCP, FCC, BCC) - other cubic structures Diamond, Sodium chloride and Caesium chloride.

### **Unit-II: Crystallography and Crystal Imperfections**

12

**X-rays:** Bragg's law - Laue method - Rotating crystal method - Powder photograph method.

**Bonding in Solids:** (Qualitative Treatment) Ionic-Covalent - Metallic-Molecular bonds.

**Crystal Defects:** (Qualitative Study): Frenkel defect - Schottky defect - Edge dislocation - Screw dislocation.

### **Unit III: Magnetic Properties**

12

Different types of magnetic materials - classical theory of diamagnetism (Langevin's theory) - Langevin's theory of paramagnetism - Weiss theory of paramagnetism - quantum theory of ferromagnetism - anti ferromagnetism - ferrites-general properties of superconductivity - Meissner effect - thermal properties - entropy - specific heat -energy gap - isotope effect - BCS theory - Type I and II superconductors- Application of Superconductors

### **Unit IV: Dielectrics**

12

Definition of dielectrics - Different types of electric polarization - Frequency and temperature effects on polarization - Dielectric loss - Clausius - Mosotti relation - Determination of dielectric constant - Dielectric breakdown - Properties of different types of insulating materials.

### **Unit V: Advanced materials**

10

Nanomaterials-Polymers – Ceramics - super strong materials - cermet's high temperature materials -thermoelectric materials – electrets - nuclear engineering materials - plastics metallic glasses -optical materials - fiber optic materials & uses.

Power point presentation, Seminar, Quiz, Assignment
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### **Books for Study:**

1. Solid State Physics by Gupta, Kumar, Nath& Co., (2013).
2. Introduction to Solid State Physics, Charles Kittel, John Wiley & Sons, 8th Edition, (2004).
3. Solid State Physics, S. O. Pillai, New Age International (P) Limited, (2006).

### **Books for Reference:**

1. Science and Engineering, V. Raghavan, Prentice Hall (India) Ltd., (2004).
2. Modern Physics R. Murugeshan and KiruthigaSivaprasath, S. Chand &

Co, New Delhi, (2016).

3. Material Science - M. Arumugam, Anuradha Agencies, (2004).
4. Introduction to Solids - Leonid V. Azaroff, Tata Mc-Graw Hill, (2004).
5. Solid State Physics - A.J. Deckker, Macmillan India, (2004). Online Sources:

**Online Courses:**

**Mapping with Programme Outcomes**

<b>PO CO</b>	<b>PO1</b>	<b>PO2</b>	<b>PO3</b>	<b>PO4</b>	<b>PO5</b>
<b>CO1</b>	<b>S</b>	<b>M</b>	<b>S</b>	<b>M</b>	<b>M</b>
<b>CO2</b>	<b>M</b>	<b>L</b>	<b>M</b>	<b>M</b>	<b>L</b>
<b>CO3</b>	<b>L</b>	<b>S</b>	<b>M</b>	<b>M</b>	<b>M</b>
<b>CO4</b>	<b>L</b>	<b>S</b>	<b>M</b>	<b>L</b>	<b>S</b>
<b>CO5</b>	<b>L</b>	<b>L</b>	<b>S</b>	<b>M</b>	<b>S</b>

S - Strong; M - Medium; L - Low

## SEMESTER - V

<b>Programme Code</b>	<b>B.Sc.,</b>	<b>Programme Title</b>	<b>Bachelor of Science (Physics)</b>	
<b>Course Code</b>	18U5PHE01	<b>Title</b>	<b>Batch</b>	2018 - 2021
<b>Hrs/Week</b>	5	<b>ELECTIVE - I: QUANTUM MECHANICS AND RELATIVITY</b>	<b>Semester</b>	V
			<b>Credits</b>	5

### Course Objectives

- To account for the concepts, language and formalism of basic quantum mechanics.
- To focus in more or less equal parts on the fundamental principles of the theory and on elementary applications of those principles.
- To develop the problem solving ability.
- To describe the importance of quantum physics in nature, engineering and society.

### Course Outcomes (CO)

<b>CO Number</b>	<b>CO Statement</b>	<b>Knowledge Level</b>
CO1	Able to explain the fundamental principles of quantum theory, such as complementarity, correspondence, and uncertainty, as well as their experimental roots.	K1, K2
CO2	Utilize the postulates of quantum mechanics to describe quantum systems and determine their properties, including the results of measurements. Use operator techniques to solve relevant problems.	K2
CO3	Construct Schrodinger equation and illustrate the solutions of exactly solvable models in quantum mechanics	K1, K3
CO4	Become familiar with the basic problems of quantum mechanics for which exact solutions of the Schrödinger equations are possible.	K3, K4, K5
CO5	Making familiar with the fundamental principles of the general theory of relativity and to know the meaning of basic concepts like inertial frames, transformations, etc.,	K1, K2, K5

**Unit - I: Wave Nature of Matter****10**

Mechanics - Comparison of Classical and Quantum ideas -Dual nature of matter - Expression for de-Broglie wavelength – de-Broglie concept of stationary orbits - G.P Thomson experiment - Expression for group velocity - Group Velocity for de-Broglie waves - Relation between wave velocity and group velocity - Wave packet -Important applications of the quantum theory of radiation.

**Unit - II: Wave Mechanics – I****14**

Comparison of Classical and Quantum ideas - Heisenberg's Uncertainty Principle - Physical significance of Heisenberg's Uncertainty relation- Illustration of Uncertainty principle: Gamma ray microscope - Diffraction of a beam of electrons by a slit –Applications of Heisenberg's Uncertainty Principle -Operators in quantum mechanics: Operators for Momentum, Kinetic energy, Total energy - Linear operator - Adjoint operators –Ladder operators  $L_+$ ,  $L_-$  –Commutators - Commutation relation between position and momentum - Commutation relation between Spin and Angular momentum.

**Unit - III: Wave Mechanics – II****10**

Wave function for a free particle - Physical interpretation of wave function - Equation of motion of matter waves: Schrodinger equations (Time Independent and Time Dependent Equations, For free particle) – Properties of wave function -Orthogonal, Normalized and Orthonormal wave function - Expectation values of dynamical quantities - Probability current density - Ehrenfest's theorem– Spherically symmetric systems - Hydrogen atom - Helium atom - Eigen value and Eigen function equation.

**Unit - IV: Physical Applications of Schrodinger Equations Wave Mechanics****14**

Application of Schrodinger's equation to one dimensional problems –The free particle - Finite **square well** potential - particle in a rectangular Potential step - Reflection and Transmission co-efficient of rectangular potential barrier - Application of a barrier penetration ( $\alpha$ -decay)- Linear harmonic oscillator - Rigid rotator–Applications of perturbation theory: Helium atom-Eigen value and Eigen function equations.

**Unit - V: Relativity****10**

Special theory of relativity - Postulates of special theory of relativity - Length contraction - Time dilation - Reference systems - Inertial and Non-inertial frames - Galilean transformation equations - Lorentz transformation equations - The Ether hypothesis - The



Michelson - Morley experiment-- variation of mass with velocity - Mass-Energy relation- Elementary ideas of general theory of relativity.

Power point presentation, Seminar, Quiz, Assignment

**Books for Study:**

1. G. Aruldass, Quantum Mechanics, Prentice-Hall of India Pvt. Limited, (2002).
2. Relativity and Quantum Mechanics, P.K. Palanisamy, ScitechPublications (India) Pvt Ltd, Kumbakonam, (2007).
3. Quantum Mechanics, S.L. Gupta, V. Kumar, H.V. Sharma and R.C. Sharma, Jai Prakash Nath& Co., Meerut (2001-2002).

**Books for Reference:**

1. Modern Physics, R. Murugesan, S.Chand& Co., New Delhi, (2005).
2. Modern Physics, R. Murugesan and KiruthigaSivaprasath, S. Chand & Co, New Delhi, (2016).
4. Quantum Mechanics, Satya Prakash, Swati Saluja, Published by KedarNathRam Nath, (2019).
5. Quantum Mechanics, V. Devanathan, Narosa Pub. House, Chennai, (2005).

**Mapping with Programme Outcomes**

<b>PO</b> <b>CO</b>	<b>P01</b>	<b>P02</b>	<b>P03</b>	<b>P04</b>	<b>P05</b>
<b>CO1</b>	M	S	L	L	L
<b>CO2</b>	M	M	L	L	L
<b>CO3</b>	M	L	M	S	M
<b>CO4</b>	M	L	M	L	M
<b>CO5</b>	M	S	L	M	M

S - Strong; M - Medium; L - Low

## SEMESTER - V

<b>Programme Code</b>	<b>B.Sc.,</b>	<b>Programme Title</b>	<b>Bachelor of Science (Physics)</b>	
<b>Course Code</b>	18U5PHS03	<b>Title</b>	<b>Batch</b>	2018 - 2021
<b>Hrs/Week</b>	2	<b>SBEC – III: DIGITAL ELECTRONICS</b>	<b>Semester</b>	V
			<b>Credits</b>	2

### Course Objectives

To give description for the students in order to

- Learn the logic circuits.
- Acquire basic knowledge of binary addition.
- Understand the action and application of counters.
- Get a deep knowledge of various memories used in computer circuits.

### Course Outcomes (CO)

<b>CO Number</b>	<b>CO Statement</b>	<b>Knowledge Level</b>
CO1	Students Understand the structure of various number system.	K1, K5
CO2	Students understand the logic gates.	K1, K2
CO3	Ability to design and solve the Boolean Algebra simplification and karnaugh maps.	K1, K3
CO4	Learn the working principle of shift register and its types.	K1, K2
CO5	Students get the knowledge about the timing circuits and flipflops.	K2, K3

#### **Unit – I: Number System and Codes**

**5**

Binary, Decimal, octal, Hexadecimal –inter conversion-Gray code-Excess-3 code-ASCII code.

#### **Unit – II: Logic Gates**

**5**

The basic Gates (OR, AND, NOT), Universal logic gates - NAND/NOR- DEMORGAN'S Theorems - XOR and XNOR Gates - Half adder - Full adder - Half subtractor - Full subtractor using logic gates.

**Unit – III: Combination of Logic Circuits**

**5**

Laws of Boolean algebra - Solving Boolean expressions - Karnaugh map – min term(2,3 and 4 variables) – SOP - K-MAP - K-MAP - simplification using max term (2,3 and 4 variables)-incomplete specification function.

**Unit – IV: Registers**

**4**

Shift registers - Series and Parallel loading – Counters - 4 bit binary ripple counter - BCD counter - Ring counter.

**Unit – V: Timing Circuits and Flip-Flops**

**5**

555 Timer – Astable, Monostable and Bistable - Multivibrators - R-S Flip-Flop, D Flip-Flop, J-K Flip-Flop, Master-Slave Flip-Flop.

Power point presentation, Seminar, Quiz, Assignment
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**Books for Study:**

1. Digital electronics Circuits and system –V.K.Puri-McGraw HillPublishing Company
2. Digital Principles and Applications, Donald P. Leach and Albert P. Malvino, 5<sup>th</sup> (1994).
3. Digital Electronics, D. A. Godse and A.P. Godse, Technical Publlsher, Pune, (2008).
4. Digital Electronics, Virendra Kumar, New Age International Publishers, (2007).
5. Digital Electronics, Avinashi Kapoor and L. K. Maheswari, Principles and Practice, Macmillan India Limited, (2004).
6. V. Vijayendran, Digital Fundamentals. S. Viswanathan Printers and Publishers Pvt. Ltd., (2009).

**Books for References:**

1. Integrated circuits, K.R Botkar, Khanna Publications, (1987).
2. Integrated Electronics, Analog and Digital Circuits and Systems, J. Millman and C. C. Halkias, Tata McGraw - Hill Education, New Delhi, (1991).
3. Morris Mano, Digital Logic and Computer Design, Pearson Education (2004).

### Mapping with Programme Outcomes

<b>PO CO</b>	<b>P01</b>	<b>P02</b>	<b>P03</b>	<b>P04</b>	<b>P05</b>
<b>C01</b>	M	S	S	M	M
<b>C02</b>	M	S	L	M	L
<b>C03</b>	M	M	M	M	S
<b>C04</b>	M	S	M	M	M
<b>C05</b>	S	M	M	M	M

## SEMESTER - V

<b>Programme Code</b>	<b>B.Sc.,</b>	<b>Programme Title</b>	<b>Bachelor of Science (Physics)</b>	
<b>Course Code</b>	18U5PHS04	<b>Title</b>	<b>Batch</b>	2018 - 2021
<b>Hrs/Week</b>	2	<b>SBEC - IV:  BIO - MEDICAL INSTRUMENTATION</b>	<b>Semester</b>	V
			<b>Credits</b>	2

### Course Objectives

- To Study the function of various transducer and electrodes in Medicine.
- To Understand the Working Principles of various medicine instruments.
- Updating the knowledge in ultrasonic and X-ray measurements in Medicine.

### Course Outcomes (CO)

<b>CO Number</b>	<b>CO Statement</b>	<b>Knowledge Level</b>
CO1	To study the various electrode in medicine.	K1
CO2	To Understand the principles of various medicine instruments.	K2, K3
CO3	To apply the aid devices for medicine instruments.	K4
CO4	To Understand the medical equipments in medical fields.	K2, K3
CO5	To measure the ultrasonic and X-ray in Medicine.	K5

### **Unit – I: Biopotential Electrodes**

**5**

Design of medical instruments - Components of the bio-medical instrument System – Electrodes – Theory - Micro electrodes – depth and needle electrodes – Body surface electrodes – pH Electrodes .

### **Unit – II: Biopotential Recorders**

**5**

Electrocardiography (ECG) – Electroencephalogram (EEG) - Electromyography (EMG) - Electroretinography (ERG) - Electrooculography (EOG).

### **Unit – III: Physiological Aid Devices**

**4**

Pacemakers – External and Internal Pacemakers - Types of pacemakers - Different modes of operation - Artificial heart valves - Anesthesia machine – Measurement of Blood Pressure and Blood flow.

**Unit - IV: Specialised Medical Equipment****4**

Blood cell counter - Electron microscope - X-Ray machine – Image intensifiers – Angiography.

**Unit – V: Safety Instrumentation****6**

Radio Monitoring instruments - Microshock and Macroshock – Endoscopes - Computer Tomography - Ultrasonic image instrumentation - MRI instrumentation.

Power point presentation, Seminar, Quiz, Assignment

**Books for Study:**

1. Bio-Medical Instrumentation, Dr. M. Arumugam, Anuradha Agencies, (2002).
2. Bio Instrumentation, John G. Webster, editor John Wiley & Sons, Inc, (2004).
3. Biological Instrumentation and methodology, P.K. Bajpai, S Chand & Co, (2010).
4. Medical Instrumentation: Application and Design, John G. Webster, John Wiley & Sons Inc, Fourth Edition, (2009).

**Books for Reference:**

1. Bio-medical instrumentation, Dr. M. Arumugam, Anuradha Agencies, (2009).
2. Handbook of Biomedical Instrumentation, Dr R.S. Khandpur: Blood Cell Counters, Chapter (McGraw-Hill Professional, Third Edition, (2014).
3. Handbook of Biomedical Instrumentation, Dr R.S. Khandpur, McGraw Hill Education (India) Private Limited, Kindle Edition, (2014).

**Mapping with Programme Outcomes**

<b>PO CO</b>	<b>P01</b>	<b>P02</b>	<b>P03</b>	<b>P04</b>	<b>P05</b>
<b>CO1</b>	S	M	M	L	M
<b>CO2</b>	M	S	S	L	S
<b>CO3</b>	L	M	S	S	M
<b>CO4</b>	M	S	S	M	S
<b>CO5</b>	L	L	M	M	M

S - Strong; M - Medium; L – Low

## SEMESTER - VI

<b>Programme Code</b>	<b>B.Sc.,</b>	<b>Programme Title</b>	<b>Bachelor of Science (Physics)</b>	
<b>Course Code</b>	18U6PHC08	<b>Title</b>	<b>Batch</b>	2018 - 2021
<b>Hrs/Week</b>	5	<b>CORE VIII: ATOMIC PHYSICS</b>	<b>Semester</b>	VI
			<b>Credits</b>	5

### Course Objectives

- ✓ To provide a detailed study of atom.
- ✓ To learn the impact of magnetic fields on spectra.
- ✓ To learn the behavior of atom in various states.
- ✓ To provide a knowledge of the application of observed theories.

### Course Outcomes (CO)

<b>CO Number</b>	<b>CO Statement</b>	<b>Knowledge Level</b>
CO1	Understand the atom models and their importance.	K2
CO2	Describe how photoelectric cell works.	K2
CO3	Acquire the knowledge about vector atom model.	K1,K2
CO4	Have knowledge about Fine Structure of Spectral Lines and calculate the Lande g-factor.	K3
CO5	Understand the basics of X-rays and analyze the characteristics and structure of crystals by XRD technique.	K2,K5

### **Unit - I: Positive Ray Analysis**

**10**

Discovery-Properties of positive rays-  $e/m$  of positive rays - Thomson's Parabola method - Aston's mass spectrograph - Bain's bridge's mass spectrograph - uses of mass spectrographs -Critical potential - Ionization potential - Excitation potential-Methods of excitation - Determination of Critical Potential - Franck and Hertz's experiment.

**Unit - I: Photo Electricity****12**

Photoelectric emission – Laws – Lenard’s experiment – Richardson & Compton experiment - Einstein’s photoelectric equation – Experimental verification of Einstein’s Photoelectric equation by Millikan’s experiment – Photo electric cells – Photo emission cell – Photo Voltaic cell – Photo conductive cell – Applications of Photo electric cell-Photo electric cells and its application.

**Unit - III: Vector Atom Model****10**

Introduction-Sommerfield atom model-Rutherford atom model-Bohr atom model-Variou quantum numbers, Coupling schemes (LS, JJ coupling)- LS and JJ coupling – Pauli’s exclusion principle – Electronic configuration of elements and periodic classification – Magnetic dipole moment of electron due to orbital and spin motion – Bohr magnetron – Stern and Gerlach experiment.

**Unit - IV: Fine Structure of Spectral Lines****15**

Spectral terms and notations – Selection rules – intensity rule and interval rule – Fine Structure of sodium D lines –Fine structure in Alkali spectra – Spectrum of Helium – Zeeman effect – Larmour’s theorem – Debye’s quantum mechanical explanation of the normal Zeeman effect – Anamolous Zeeman effect – theoretical explanation, Lande’s ‘g’ factor and explanation of splitting of D1 and D2 lines of sodium – Paschen back effect and Stark effect.

**Unit - V: X- Rays****13**

Electromagnetic spectrum-Production of X-Rays -Absorption of X-Rays - Bragg’s Law – Bragg’s X-ray spectrometer - Powder crystal method – Origin and analysis of continuous X-ray spectrum and characteristic X-ray spectrum - Mosley’s law and its importance – Mosley’s law (Statement, Explanation and Importance) – Compton effect – Derivation of expression for change in wavelength - its experimental verification.

Power point presentation, Seminar, Quiz, Assignment
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**Books for Study:**

1. Atomic and Nuclear Physics – N.Subramaniam and Brijlal.Published by S Chand & Company Pvt Ltd, (2004).
2. Atomic and Nuclear Physics by H. Semat and J.R. Albright, Chapman and Hall, (2003).



3. Atomic and Nuclear Physics by S.N. Ghoshal, S. Chand & Co, (2004).Online

Sources:

**Books for References:**

1. "Concept of Modern Physics: ArthusBeiser, McGraw Hill Ed.V, (1999).
2. Modern Physics, R. Murugesan, S.Chand& Co., New Delhi, (2005).
3. Modern Physics, R. Murugesan and KiruthigaSivaprasath, S. Chand & Co, New Delhi, (2016).
4. Modern Physics, J.B. Rajam, S. Chand & Co, (2004).

**Mapping with Programme Outcomes**

<b>PO CO</b>	<b>PO1</b>	<b>PO2</b>	<b>PO3</b>	<b>PO4</b>	<b>PO5</b>
<b>CO1</b>	<b>S</b>	<b>M</b>	<b>M</b>	<b>M</b>	<b>M</b>
<b>CO2</b>	<b>S</b>	<b>S</b>	<b>S</b>	<b>S</b>	<b>M</b>
<b>CO3</b>	<b>S</b>	<b>S</b>	<b>M</b>	<b>L</b>	<b>L</b>
<b>CO4</b>	<b>S</b>	<b>L</b>	<b>M</b>	<b>S</b>	<b>S</b>
<b>CO5</b>	<b>S</b>	<b>L</b>	<b>S</b>	<b>M</b>	<b>S</b>

S - Strong; M - Medium; L - Low

## SEMESTER - VI

Programme Code	B.Sc.,	Programme Title	Bachelor of Science (Physics)	
Course Code	18U6PHC09	Title	Batch	2018 - 2021
Hrs/Week	5	CORE - IX: NUCLEAR PHYSICS	Semester	VI
			Credits	5

### Course Objectives

To acquire knowledge and apply it to

- Study the structure of nucleus.
- Know the formation of nucleus and their binding energy.
- To motivate the students to analyze the energy released by the nucleus during the fission and fusion process and therefore understanding the working of Nuclear power stations.

### Course Outcomes (CO)

CO Number	CO Statement	Knowledge Level
CO1	To study the introduction about nucleus and its properties.	K1,K2
CO2	To understand the particle detectors with mechanisms.	K1,K3
CO3	To gain knowledge about natural radioactivity and its decay process.	K1,K2
CO4	To explain the phenomenon of nuclear reactions and nuclear energy level.	K1,K2
CO5	To acquire knowledge of fundamental interaction of elementary particles.	K1,K3

### **Unit –I: Nuclear Properties**

**10**

Constituents of nuclei-Classification and Properties of nuclei-Nuclear mass-Binding energy-Nuclear stability - Mass parabola-Nuclear Size-Nuclear spin-Nuclear isomerism-Nuclear forces-Magnetic dipole moment of nuclei-Parity of nuclei.

Nuclear models: Liquid drop model-Semi empirical mass formula-

**Unit-II: Nuclear Radiations**

**13**

Detectors: Basic principles of particle detectors-Ionization chamber-G.M counter-Characteristics-Proportional counter-Wilson cloud chamber-Bubble chamber - Scintillation counters –Photomultipliers.

Accelerators: Synchrocyclotron-Synchrotron-Electron and proton synchrotron – Betatron.

**Unit – III: Natural Radioactivity**

**10**

Alpha decay-Geiger-Nuttal law-Gamow’s theory of alpha decay-Neutrino theory of beta decay Half life period-Mean life-Decay constant-Relation between them-Fajan’s Soddy displacement law - Magnetic Spectrograph-Gamma emission– Selection rules-Interaction of charged particles with matter-Internal conversion-Law of radioactive disintegration- Law of successive disintegration–Carbon dating.

**Unit – IV: Nuclear Reactions**

**15**

Nuclear reactions–Types-Nuclear energy equations-Calculation of Q–value- Nuclear artificial transmutations -Transuranic elements.

**Nuclear Fission and Fusion**

Bohr-Wheeler’s theory–Fission Process-Chain reactions-Nuclear Reactor-Principle-Pressurized water reactor-Boiling water reactor-Fusion Reactor-Atom bomb-Fusion process-Hydrogen bomb-Carbon-nitrogen cycle, proton-proton cycle -Thermo nuclear reactions -Stellar energy.

**Unit – V: Elementary Particles**

**12**

Introduction - Classifications of elementary particles - Fundamental interactions - Quantum Numbers – Baryon – Lepton – Strangeness – Hypercharge – Isospin - Quark Model - Conservation law – Parity – Charge - CPT Theorem.

Power point presentation, Seminar, Quiz, Assignment
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**Books for Study:**

1. V. Devanathan, Nuclear Physics, Narosa Publishing House, (2006).
2. Nuclear physics by D. C. Tayal, Himalaya Publishing house, 5<sup>th</sup> edition, (2018).
3. Nuclear Physics: An Introduction, S. B. Patel, Wiley-Eastern, New Delhi, (1991).

**Books for Reference:**

1. Modern Physics by R. Murugasen, S. Chand & Co, 8<sup>th</sup> Edition (2001).

2. Concepts of Nuclear Physics, B. L. Cohen, Tata McGraw Hill, New Delhi, (1988).
3. Nuclear Physics: Experimental and Theoretical H. S. Hans, New Age International Publishers, New Delhi, (2001).
4. Elementary Particle Physics: An Introduction, D.C. Cheng and G.K. O'Neill, Addison-Wesley, (1979).
5. Basic Nuclear Physics and Cosmic rays, B.N. Srivatsava, Pragati Prakashan, (2016).

**Mapping with Programme Outcomes**

<b>PO CO</b>	<b>P01</b>	<b>P02</b>	<b>P03</b>	<b>P04</b>	<b>P05</b>
<b>CO1</b>	S	S	S	L	S
<b>CO2</b>	S	M	S	M	S
<b>CO3</b>	S	S	S	M	S
<b>CO4</b>	S	S	S	M	S
<b>CO5</b>	S	M	M	L	M

S - Strong; M - Medium; L – Low

## SEMESTER - VI

Programme Code	B.Sc.,	Programme Title	Bachelor of Science (Physics)	
Course Code	18U6PHE02	Title	Batch	2018 - 2021
Hrs/Week	5	ELECTIVE - II: ELECTRONICS AND COMMUNICATION	Semester	VI
			Credits	5

### Course Objectives

- The basics concepts of modulation of FM and PM.
- Understand the communication elements of modulators.
- Learn the characteristics of antennas and propagation of transmission.
- To apply the types of Communication systems.
- To understand the concept of Fibre optic communication.

### Course Outcomes (CO)

CO Number	CO Statement	Knowledge Level
CO1	To explain the basics concepts of modulation of FM and PM.	K1, K2
CO2	To understand the fundamentals of AM Transmitter and Receiver.	K2,
CO3	To explain the communication elements of modulators.	K2
CO4	To Understand the characteristics of antennas and propagation of transmission.	K1, K2
CO5	To compare the fundamentals of communication systems.	K2, K4

### **Unit – I: Modulation and Demodulation**

**10**

Theory of Modulation – Necessity for modulation - Principles & representation of AM, FM and PM-Modulation factor-Percentage of modulation-Advantage and disadvantage – Demodulation – Transmitted and Essentials of demodulation – AM detector – AGC.

**Unit – II: AM Transmitter and Receiver Fundamentals****13**

Low level modulation – High level modulation – TRF receiver – Super heterodyne principle – Super heterodyne receiver – Double conversion receiver – Image frequency rejection – S/N ratio – Sensitivity – Selectivity – RF amplifier – Mixer – Local oscillator – IF amplifier.

**Unit – III: Communication Elements****11**

Variable frequency oscillator – Reactance modulator – PLL – Frequency multiplier – Power output amplifier – FM limiter – The discriminator – The ratio detector – AFC – Balanced modulator principle – Phase modulator – Frequency divider.

**Unit – IV: Antennas and Propagation****12**

The half wave dipole – Its Characteristics - Impedance and radiation pattern – The folded dipole – Characteristic impedance and radiation pattern –Parabolic reflector antenna - Parasitic array antenna - Features and applications Transmission line – Cable types – Co-axial and wire – pair –Maximum power transfer.

**Unit – V: Communication Types****12**

Communication – Components of a communication system – Wireless communication system Satellite communication fundamentals – Up Link – Down Link – RADAR – Principle - transmitting systems – Fibre optic communication fundamentals – Advantages and disadvantages.

Power point presentation, Seminar, Quiz, Assignment
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**Books for Study:**

1. Electronic Communication, Modulation and Transmission-Robert J. Schoenbeck, Universal Book Stall, Delhi, (1992).
2. Electronic Communication Systems–George Kennedy, Tata McGraw Hill, 4<sup>th</sup> Edition, (2006).
3. Hand book of Electronics-Gupta & Kumar, Pragati Prakashan, (2005).

**Books for References:**

1. Principles of Communication Engineering–Anokh Singh, S. Chand & Co., Delhi (1999).
2. Communication Electronics – N.D. Despande and others–Tat McGraw Hill, (2004).
3. Electronic Communication, Dennis Roddy and John Coolen, Prentice Hall Career and Technology, 4<sup>th</sup> edition, (1995).

**Mapping with Programme Outcomes**

<b>PO CO</b>	<b>P01</b>	<b>P02</b>	<b>P03</b>	<b>P04</b>	<b>P05</b>
<b>C01</b>	S	M	L	L	M
<b>C02</b>	S	S	S	L	S
<b>C03</b>	S	M	S	S	M
<b>C04</b>	M	S	S	M	S
<b>C05</b>	M	M	M	M	L

S - Strong; M - Medium; L - Low

## SEMESTER - VI

<b>Programme Code</b>	<b>B.Sc.,</b>	<b>Programme Title</b>	<b>Bachelor of Science (Physics)</b>	
<b>Course Code</b>	18U6PHE03	<b>Title</b>	<b>Batch</b>	2018 - 2021
<b>Hrs/Week</b>	5	<b>ELECTIVE - III: NUMERICAL METHODS</b>	<b>Semester</b>	VI
			<b>Credits</b>	5

### Course Objectives

To acquire knowledge about

- Mathematical equations which can be applied in physical problems.
- To motivate the problem solving ability of students.

### Course Outcomes (CO)

<b>CO Number</b>	<b>CO Statement</b>	<b>Knowledge Level</b>
CO1	Understand the basic of normal equation.	K <sub>3</sub> k <sub>5</sub>
CO2	To get the knowledge about algebraic and transcendental equation.	K <sub>2</sub> K <sub>4</sub>
CO3	To get the ability to solve the linear equations.	K <sub>2</sub> k <sub>5</sub>
CO4	Acquire the knowledge about types of interpolation.	K <sub>3</sub> k <sub>4</sub>
CO5	Analyse and understand the numerical integration.	K <sub>1</sub> k <sub>2</sub>

### **Unit – I: Curve Fitting**

**12**

Introduction-Normal equations - Method of averages – Least square fitting – Straight line fit – nonlinear curve fit - Fitting a parabola.

### **Unit – II: Numerical Solution of Algebraic and Transcendental Equations 12**

The iteration method – Regular Falsi Method – Newton – Raphson method – Euler’s Method - Modified Euler’s method – Rungekutta method for (Second and third orders).



**Unit – III: Simultaneous Linear Equations****12**

Solution of simultaneous linear equation - Gauss elimination method – Jordan method - Jacobi method modification – Gauss – Seidel method of iteration – Matrix method of inversion - eigen value and eigen vectors of a matrix.

**Unit – IV: Interpolation****12**

Linear interpolation – Lagrange interpolation method – Newton forward and backward interpolation formula – Newton’s interpolation formula for unequal intervals.

**Unit – V: Numerical Integration****12**

Newton’s forward and backward difference formula to compute derivatives – Numerical integration: The trapezoidal rule-Simpson’s 1/3 rule – Simpson’s 3/8 rule - Extended Simpson’s rule – Gaussian quadrature formula.

Power point presentation, Seminar, Quiz, Assignment
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**Books for Study:**

1. Introductory Methods of Numerical analysis – S.S. Sastry, Prentice – Hall of India, New Delhi, 3<sup>rd</sup> Edition (2003).
2. M.K. Jain, S.RA.K. Iyengar and R.K. Jain, Numerical Methods for Scientific and Engineering Computation, New Age International, (2003).
3. S.D. Conte, C. Boor, Elementary Numerical Analysis, McGraw –Hill, Singapore, 3<sup>rd</sup> edition, (1981).

**Books for Reference:**

1. Numerical Methods A. Singaravelu – Meenakshi Agency, Chennai, (2001).
2. J.H. Mathews, Numerical Methods for Mathematics, Science and Engineering Prentice-Hall of India, New Delhi, (1998).

**Mapping with Programme Outcomes**

<b>PO CO</b>	<b>P01</b>	<b>P02</b>	<b>P03</b>	<b>P04</b>	<b>P05</b>
<b>C01</b>	M	L	M	M	S
<b>C02</b>	M	M	M	L	L
<b>C03</b>	M	M	M	L	M
<b>C04</b>	M	L	S	M	M
<b>C05</b>	S	M	M	M	M

S - Strong; M - Medium; L - Low

## SEMESTER - VI

Programme Code	B.Sc.,	Programme Title	Bachelor of Science (Physics)	
Course Code	18U6PHS05	Title	Batch	2018 - 2021
Hrs/Week	2	SBEC - V: MICROPROCESSOR AND ITS APPLICATIONS	Semester	VI
			Credits	2

### Course Objectives

On successful completion of this subject the student should have

- The basic knowledge of computers and its processors.
- To operate the processors with basic idea.
- To develop background knowledge and core expertise on Microprocessor 8085.
- To write assembly language programs of Microprocessor for various applications.

### Course Outcomes (CO)

CO Number	CO Statement	Knowledge Level
CO1	To explain the basic concepts of digital fundamentals using microprocessor 8085.	K1
CO2	To compare the fundamentals of architecture of 8085.	K2, K3
CO3	To understand the fundamental of instruction set of 8 bit.	K2, K4
CO4	To explains the basic concepts of counters.	K2
CO5	To compile the ALP for an 8- bit Microprocessor INTEL 8085.	K6

### **Unit – I: Introduction**

**3**

Microprocessor - Evolution of microprocessor - Organization of microcomputer - Microprocessor programming - Assembly language programming.

### **Unit – II: Architecture**

**4**

Intel 8085 Microprocessor Architecture – ALU - Timing and Control unit -Data and Address bus - Pin Configuration - PSW.

**Unit - III: Instruction Set****5**

Intel 8085 Instructions set - Opcode and Operands - Instruction word size - Instruction cycle - Timing diagram - Addressing modes.

**Unit - IV: Memories****5**

Counter – Stack – Subroutines - Stack pointer - Internal data bus –Mnemonics - Communication with microprocessor.

**Unit – V: Assembly Language Programs of 8085****7**

Programs for 8-bit (i) Addition (ii) Subtraction (iii) Multiplication (iv) Division (v) Greatest and Smallest number in an array of 8-bit unsigned numbers (vi) Arranging numbers in Ascending and Descending order (vii) Sum of N-numbers.

Power point presentation, Seminar, Quiz, Assignment

**Books for Study:**

1. B. Ram, Fundamentals of Microprocessor and Microcontrollers, Dhanpat Rai Publications, (2019).
2. P. Mathur, Introduction to Microprocessor, TMH, 3<sup>rd</sup> edition, (2006).
3. M. Gilmore, Microprocessor Principles and Application, TMH, 2<sup>nd</sup> edition, (1995).

**Books for Reference:**

1. Ramesh Gaonkar, Microprocessor Architecture Programming and application, Prentice Hall PTR, 5<sup>th</sup> edition, (2002).
2. A.K. Roy and K.M. Bunchandi, Advanced Microprocessor and peripherals, TMH, 2<sup>nd</sup> edition, (2009).

**Mapping with Programme Outcomes**

<b>PO CO</b>	<b>P01</b>	<b>P02</b>	<b>P03</b>	<b>P04</b>	<b>P05</b>
<b>CO1</b>	S	M	M	L	M
<b>CO2</b>	M	S	S	L	S
<b>CO3</b>	L	M	S	S	M
<b>CO4</b>	M	S	S	M	S
<b>CO5</b>	L	L	M	M	M

S - Strong; M - Medium; L – Low

## SEMESTER - VI

Programme Code	B.Sc.,	Programme Title	Bachelor of Science (Physics)	
Course Code	18U6PHS06	Title	Batch	2018 - 2021
Hrs/Week	2	SBEC - VI: ELECTRICAL APPLIANCES	Semester	VI
			Credits	2

### Course Objectives

- To acquire the basic knowledge about
- Testing of electrical parameters, cables and measurements.
- Select the proper instrument for suitable measurement.
- Trouble shoot the faults in the given power supply circuits.
- Identify various functional blocks/major components/ICs in the given UPS.
- Identify and test various mechanical and electrical modules of the given appliances.
- Identify electronics parts/components/modules of the given appliances.
- Aware of models of different appliances and features.

### Course Outcomes (CO)

CO Number	CO Statement	Knowledge Level
CO1	To learn about basics of electric, induction and dielectric heating.	K1,K2
CO2	To study about basic operation of welding and AC and DC welding techniques.	K2,K4
CO3	To acquire basic knowledge about AC and DC motors for home appliance.	K2,K3
CO4	To learn about common household electric and electronic appliance.	K1,K3
CO5	To know about basic operations common household electric and electronic equipments.	K2,K3

### **Unit – I: Electrical Heating**

**5**

Electrical heating-modes of transfer of heat-methods of electric heating-resistance heating-induction heating-high frequency eddy current heating- dielectric heating.

**Unit – II: Welding****5**

Resistance welding-Electric arc welding-DC and AC welding equipment-Energy storage welding-Occupational hazards due to chemical reactions- Industrial heating and welding.

**Unit – III: Motors****4**

Basics of DC & AC systems - Introduction to AC/DC Motors for Appliances (FHP Motors) - Single Phase Motors (FHP) - DC Motors - Universal Motors.

**Unit – III: Welding****4**

Resistance welding-Electric arc welding-DC and AC welding equipment-Energy storage welding-Occupational hazards due to chemical reactions- Industrial heating and welding.

**Unit – IV: Domestic Appliances I****5**

Theory and principle of operation of fans - Wet grinder - Mixer grinder - Refrigerator - Air conditioner and Air cooler- Battery and battery chargers difference between them.

**Unit – V: Domestic Appliances II****5**

Theory and principle of operation of DVD player-Washing machine- Induction stove - Microwave oven - Vacuum Cleaner - Air Purifier.

Power point presentation, Seminar, Quiz, Assignment
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**Books for Study:**

1. A text book in Electric power, P.L. Soni, P.V. Gupta & V.S. Bhatnagar, 2<sup>nd</sup> Edition (1995).
2. Electrical Appliances: The Complete Guide to the Maintenance and Repair of Domestic Electrical Appliances by Graham Dixon, (1995).

**Books for Reference:**

1. Electricity & Magnetism, R. Murugesan, S. Chand & Co., New Delhi,(2007).
2. Theory of alternating current Machinery, Alexander Langsdort, 2<sup>nd</sup> edition,(2001).

### Mapping with Programme Outcomes

<b>PO CO</b>	<b>PO1</b>	<b>PO2</b>	<b>PO3</b>	<b>PO4</b>	<b>PO5</b>
<b>CO1</b>	S	M	S	M	L
<b>CO2</b>	M	L	M	S	L
<b>CO3</b>	L	S	M	L	L
<b>CO4</b>	M	S	M	L	S
<b>CO5</b>	M	L	S	M	S

S - Strong; M - Medium; L - Low

**Credit: 4**

**Max. Hours: 36**

**PAPER CODE: 17U6PHP03**

**CORE PRACTICAL – III**

**Any 12 Experiments**

1. Cantilever –Young’s modulus mirror and telescope.
2. Deflection magnetometer–M and  $B_H$ –TAN C position.
3. Comparison of mutual inductance –BG.
4. Spectrometer – i-i’ curve.
5. Spectrometer small angled prism.
6. Potentiometer –calibration of high range voltmeter.
7. Lee’s disc–thermal conductivity of a good conductor.
8. Co-efficient of viscosity-under graduated Burette-Radius by Mercury pellet method.
9. FET - Characteristics.
10. UJT - Characteristics.
11. Hartley oscillator.
12. Colpitt’s oscillator.
13. SCR – Characterisitics.
14. Microprocessor 8085–Addition and Subtraction.
15. Microprocessor 8085–Multiplication and Division.

**Book for Refernces:**

1. Practical Physics – C. C. Ouseph, U. J. Rao, V. Vjiayendran, 1<sup>st</sup> Edition, (2015).
2. Advanced Practical Physics, S.P Singh and Pragati Prakashan, 17<sup>th</sup> Edition,  
Vol-I, II.
3. P. R. Sasi Kumar, Practical Physics–PHI, (2011).



**Credit: 4**

**Max. Hours: 36**

**CORE PRACTICAL – IV**

**PAPER CODE: 17U6PHP04**

**Any 12 Experiments**

1. Koenig's method–Uniform Bending.
2. Koenig's method–Non-Uniform Bending.
3. Cantilever–dynamic method.
4. Bifilar pendulum–Parallel threads.
5. Newton's rings–Refractive index of liquid.
6. Spectrometer-Dispersive power of a Grating.
7. Spectrometer –Cauchy's constant.
8. Potentiometer EMF of a thermocouple.
9. Field along the axis of coil–Vibration Magnetometer.
10. Carey foster bridge–temperature coefficient of resistance.
11. Astable multivibrator using 555 timer.
12. Monostable multivibrator using 555 timer.
13. Operational amplifier: Integrator and differentiator.
14. V-I characteristics of LED.
15. RS Flip-Flop using NAND and NOR gates.

**Book for References:**

1. Practical Physics – C. C. Ouseph, U. J. Rao, V. Vjiayendran, 1<sup>st</sup> Edition, (2015).
2. Advanced Practical Physics, S.P Singh, and Pragati Prakashan, 17<sup>th</sup> Edition,  
Vol-I, II.
3. P. R. Sasi Kumar, Practical Physics – PHI, (2011).