SYLLABUS

for

Semester II

Program: B. Sc.

Course: Physics

Effective from

Academic Year

2024-25

B. Sc. (Physics) SEMESTER II
COURSE TITLE: Physics Paper - III
COURSE CODE: PHYMJ-S2P3-3CR24 [CREDITS - 03]

CC III	Course Code: PHYMJ-S2P3-3CR24

Course Learning Outcomes

At the end of this course, learners will be able to

- apply the concepts of voltage and current sources, Thevenin's and Norton's theorems.
- analyse the characteristics of diodes and transistor
- understand the difference among free, damped and forced oscillations
- analyse the properties of an oscillator
- estimate the physical properties of planets such as temperature, albedo, solar day etc.
- interpret the different phenomena and nuclear fusion reaction in the Sun.

Unit I	Electronics	[15L]

Learning Objective:

This unit is intended to

- familiarize the students with the concepts of voltage and current sources, Thevenin's and Norton's theorems.
- illustrate the characteristics of diodes and transistor

Learning Outcomes:

At the end of this unit, learners will be able to

- apply the concepts of voltage and current sources, Thevenin's and Norton's theorems.
- analyse the characteristics of diodes and transistor.

1.1	Voltage Sources (1.3), Current Sources (1.4), Thevenin's Theorem (1.5), Norton's Theorem (1.6). Zener Diode (5-1), Loaded Zener Regulator (5-2), Light-Emitting Diodes (LEDs) (5-8), Seven-Segment Display, Photodiode (5.10).	**[4L]**
1.2	Unbiased Transistor (6.1), Biased Transistor (6.2), Transistor Currents (6.3), CE connection (6.4), Base Curve (6.5), Collector Curve (6.6), Transistor approximation (6.7), Load line (6.11), Operating point (6.12).	**[6L]**
1.3	Phototransistor, opto-coupler and its application (7.4), Voltage divider Bias (7.5), VDB analysis (7.6), Q point and design of biasing circuit (7.7).	**[5L]**

Text book:

Electronics Principles, Albert Malvino and David Bates, 8th Ed., John Wiley & Sons, Inc. 2015.

Unit II	Free and Forced Oscillations	[15L]

Learning Objective:

This unit is intended to

- familiarize the students about the free, damped and forced oscillations
- make them learn resonance in its different cases.

Learning Outcomes:

At the end of this unit, learners will be able to

- understand the difference among free, damped and forced oscillations
- learn effects of damping on the properties of the oscillator
- revise the phenomenon of resonance and apply it in various cases.

2.1	Free oscillation (2.1), damped motion (2.2), energy of damped motion (2.3), forced oscillations and resonance (2.4), analysis of forced vibrations (2.5), analogy between mechanical and electrical quantities (2.6), amplitude and velocity resonances (2.7), power considerations in forced vibration and resonance (2.8), nature of resonance (2.9), phase relations in forced vibrations (2.10), comparison of amplitude and velocity resonances (2.11), coupled vibrations (2.12).	**[15L]**

Text book:

A treatise on Oscillations, waves and acoustics by D. Chattopadhyay, 1st Ed., Books and Allied (P) Ltd. 2016.

Unit III	**Astrophysics**	**[15L]**

Learning Objective:

This unit is intended to

- study the physical properties of planets.
- study the orbital motion of planets of our solar system.
- understand the rotational motion of planets and explain the magnetic field of planets.
- describe the different layers of Sun.
- explain the different phenomena on Sun such as sunspots, solar flares, prominences.

Learning Outcomes:

At the end of this course, learners will be able to

- estimate the physical properties of planets such as temperature, albedo, solar day etc.
- understand curst, core of the earth and its magnetic field.
- understand about core and differentiate different layers of the Sun.
- explain the different phenomena and nuclear fusion reaction in the Sun.

3.1	**Planets:** Interior planets, Exterior planets; crust, mantle and core of the Earth; Different region of earth's atmosphere; Rotation of Earth, Magnetosphere; Van Allen Belts- Aurora. **The Sun:** Structure of Photosphere, Chromosphere, Corona, Sunspots, Solar Flares, Solar Prominences, Solar Plages.	**[15L]**

Text book:

Schaum's Outline of Astronomy: Stacy E. Palen, McGraw-Hill Publishing Company Limited, 2020.

Reference Books:

1. Electronic devices and circuit theory by R. L. Boylestad and L. Nashelsky, 4th Ed., Pearson 1987.
2. Basic Electronics by B. L. Theraja, 1st Ed., S. Chand & Co. 2008.
3. Waves and oscillations by Subrahamanyam and Brij Lal, 2nd Ed., S. Chand & Co. 2018.
4. An Introduction to Astrophysics: Baidyanath Basu, Tanuka Cattopadhyay and Sudhindra Nath Biswas, 2nd Ed., Prentice Hall India Learning Private Limited 2010.
5. An Introduction to Astronomy and Astrophysics: Pankaj Jain, 1st Ed., CRC Press Publishing Company 2015.

Note: Each unit carries equal weightage of total marks of the course.

Question Paper Template

Unit	Remembering/ Knowledge (1)	Understanding (2)	Applying (3)	Analysing (4)	Evaluating (5)	Creating (6)	Total marks
I	20%	30%	25%	25%	-	-	100%
II	20%	30%	25%	25%	-	-	100%
III	40%	40%	20%	-	-	-	100%

Mapping of CLOs and PSOs

Course Learning Outcomes	Programme Outcomes					
	1	2	3	4	5	6
• apply the concepts of vector algebra and vector calculus	√	√		√		
• understand and apply Newton's laws of motion in three dimension and apply the concept of momentum conservation	√	√		√		
• interpret two-particle and many particle systems	√	√		√		
• classify various elastic properties of solids	√	√		√		

B. Sc. (Physics) SEMESTER II

COURSE TITLE: Physics Paper - IV

COURSE CODE: PHYMJ-S2P4-3CR24 [CREDITS - 03]

CC IV	Course Code: PHYMJ-S2P4-3CR24

Course Learning Outcomes

After the successful completion of the course, learners will be able to

- interpret the basic concepts of physical optics, including Huygens' principle and interference and its types
- apply second law of thermodynamics
- understand Carnot engine and its applications
- extract the wave properties of particles.

Unit I	Physical Optics	[15L]

Learning objectives:

The unit is intended to

- familiarize the students with wave nature of light
- comprehend that light exhibits wave-like properties, including interference and diffraction
- get familiar with phenomenon of interference and its types
- understand Huygens's principle, the wave equation and the concept of coherence
- apply wave optics principles to analyse and solve problems related to interference.

Learning outcomes:

The learners will be able to

- understand Huygens' theory and its application in understanding wave propagation
- demonstrate proficiency in calculating and interpreting interference patterns resulting from the superposition of two coherent sinusoidal waves
- comprehend the concept of coherence and its significance in producing stable interference patterns, enabling them to analyze and predict interference
- gain familiarity with the operation and applications of Fresnel's biprism
- understand interference by plane film due to plane wave
- analyse interference patterns produced by thin films under illumination by a point source, including phenomena such as Newton's rings and their applications
- understand the relationship between the thickness of thin films, interference patterns, and the resulting colours observed, enabling them to predict and explain colour changes in thin films.

1.1	Introduction (12.1), Huygens' theory (12.2), superposition of two sinusoidal waves (13.5), coherence (14.3), interference of light waves (14.4), the interference pattern (14.5), the intensity distribution (14.6), Fresnel's biprism (14.8).	**[8L]**

1.2	Introduction (15.1), interference by a plane parallel film when illuminated by a plane wave (15.2), interference by a plane parallel film when illuminated by a point source (15.7), colours of thin films (15.9), Newton's rings (15.10).	**[7L]**

Text book:
Optics by Ajoy Ghatak 6th Ed., McGraw Hill Edu. Pvt. Ltd. 2017.

Unit II	**Thermodynamics II**	**[15L]**

Learning objectives:
This unit is intended to

- have an in-depth study of laws of thermodynamics and entropy
- foster an intuitive grasp of Carnot engines and refrigerators.

Learning outcome:
After the successful completion of the unit, learners will be able to

- recognize the distinction between reversible and irreversible processes and understand the concept of entropy production and its relation to irreversibility
- demonstrate a clear understanding of entropy as a measure of disorder or randomness in a system
- apply second law of thermodynamics
- interpret the second law in terms of heat engines, refrigerators, and heat pumps.
- understand the statistical view of entropy.

2.1	The second law of thermodynamics (24.4), entropy and the performance of engines (24.5), entropy and the performance of refrigerators (24.6), the efficiencies of real engines (24.7), the second law revisited (24.8), a statistical view of entropy (24.9).	**[15L]**

Text book:
Introduction to Electrodynamics by David J. Griffiths, 3rd Ed., PHI Learning Pvt. Ltd. 2010.

Unit III	**Modern Physics II**	**[15L]**

Learning objectives:
This unit is intended to

- familiarize students with the wave properties of particles
- make them understand the significance of phase and group velocities
- aware them of uncertainty principle and train them to use its different forms while solving problems
- make them learn the case of particle in a box and quantization of its various properties.

Learning outcome:
After the successful completion of the unit, learners will be able to

- understand the nature of de Broglie waves and its properties
- develop an idea of wave packet and group velocity
- solve the particle in a box problem and learn the effect of boundary conditions on the behaviour of the confined particle
- apply uncertainty principle to solve various problems.

3.1	de Broglie Waves (3.1), waves of what? (3.2), describing a wave (3.3), phase and group velocities (3.4), particle diffraction (3.5), particle in a box (3.6), uncertainty principle I (3.7), uncertainty principle II (3.8), applying the uncertainty principle (3.9).	**[15L]**

Text book:

Concepts of Modern Physics by A. Beiser 6th Ed., McGraw Hill Edu. Pvt. Ltd. 2003.

Reference Books:

- University Physics by H. D. Young, R. A. Freedman and A Lewis Ford, 13th Ed. Pearson Education, 2013.
- Fundamentals of Optics by F. Jenkins and H White, 4th edition, McGraw Hill Education, 2017.
- Heat and Thermodynamics by Mark W. Zemansky and Richard H. Dittman 7th Ed., McGraw Hill Edu. Pvt. Ltd. 1997.
- Modern Physics by Kenneth Krane 4th Ed., Wiley, 2019.
- Modern Physics by Jeremy Bernstein, Paul Fishbane, Stephan Gaziorowicz, Pearson, 2000.

Note: Each unit carries equal weightage of total marks of the course.

Question Paper Template

Unit	Remembering/ Knowledge (1)	Understanding (2)	Applying (3)	Analysing (4)	Evaluating (5)	Creating (6)	Total marks
I	20%	30%	25%	25%	-	-	100%
II	20%	30%	25%	25%	-	-	100%
III	20%	30%	25%	25%	-	-	100%

Mapping of CLOs and PSOs

Course Learning Outcomes	Programme Outcomes					
	1	2	3	4	5	6
• interpret the basic concepts of physical optics, including Huygens' principle and interference and its types	√	√		√		
• apply second law of thermodynamics	√	√		√		
• understand Carnot engine and its applications	√	√		√		
• extract the wave properties of particles	√	√		√		

B. Sc. (Physics) SEMESTER II

COURSE TITLE: Physics Practical - III

COURSE CODE: PHYMJ-S2PR3-1CR24 [CREDITS - 01]

CC Practical III	Course Code: PHYMJ-S2PR3-1CR24

Course Learning Outcomes

After the successful completion of the course, learner will be able to

- demonstrate practical skills
- correlate the physics theory concepts through practical.

1	To identify the terminals of various active components and method of using them appropriately.
2	To study half wave rectifier with various filters.
3	To study full wave rectifier with various filters.
4	To study zener diode as a voltage regulator
5	To study characteristics of a BJT (CE configuration).
6	To determine the capacitance of a capacitor by discharging it through a voltmeter.
7	Study of Melde's experiment (with constant mass)
8	Study of Melde's experiment (with constant length)
9	To study the oscillations of mass-spring system.
10	To study resonator.

Reference Books:

- Advanced Practical Physics by B. L. Worsnop and H. T. Flint, 3rd Ed., Asia Publishing House, New Delhi, 2021
- B. Sc. Practical Physics by C. L. Arora, S. Chand & Co., Reprint Ed., 2010
- University Practical Physics by D. C. Tayal, Edited by Ila Agarwal, 1st Ed., Himalayan Publishing House, 2000.
- A Laboratory Manual of Physics for Undergraduate Classes by D. P. Khandelwal, 1st Ed., Vani Publication House, New Delhi, 1985.
- B. Sc. Practical Physics by Geeta Sanon, 1st Ed., R. Chand & Co., 2007.

Note:

- The duration of each experiment is of 2 hours. Two such experiments are to be performed by each student per week.
- In the external exam, a student will have to perform two experiments, one from each group. The experiment will be of 2-hour duration.
- There should be two examiners, one for each group, in the external examination.

- There should not be more than 10 students per examiner per session in the external examination.

Unit	Remembering/ Knowledge (1)	Understanding (2)	Applying (3)	Analysing (4)	Evaluating (5)	Creating (6)	Total marks
Practical III	25%	25%	20%	20%	5%	5%	100%

Mapping of CLOs and PSOs

Course Learning Outcomes	Programme Outcomes					
	1	2	3	4	5	6
• demonstrate practical skills	√	√	√	√	√	√
• correlate the physics theory concepts with appropriate practical	√	√			√	

B. Sc. (Physics) SEMESTER II

COURSE TITLE: Physics Practical - IV

COURSE CODE: PHYMJ-S2PR4-1CR24 [CREDITS - 01]

CC Practical IV	Course Code: PHYMJ-S2PR4-1CR24

Course Learning Outcomes

After the successful completion of the course, learners will be able to:

- demonstrate practical skills
- correlate the physics theory concepts through practical

1	To study decay of current in an RC circuit.
2	To verify Thevenin's theorem.
3	To verify Nortan's theorem.
4	To verify maximum power transfer theorem.
5	To determine Planck's constant using LED.
6	To study characteristics of photocell.
7	To study Edser's 'A' pattern.
8	To study characteristics of solar cell.
9	Study tour and report submission.
10	

Reference Books:

- Advanced Practical Physics by B. L. Worsnop and H. T. Flint, 3rd Ed., Asia Publishing House, New Delhi, 2021
- B. Sc. Practical Physics by C. L. Arora, S. Chand & Co., Reprint Ed., 2010
- University Practical Physics by D. C. Tayal, Edited by Ila Agarwal, 1st Ed., Himalayan Publishing House, 2000.
- A Laboratory Manual of Physics for Undergraduate Classes by D. P. Khandelwal, 1st Ed., Vani Publication House, New Delhi, 1985.
- B. Sc. Practical Physics by Geeta Sanon, 1st Ed., R. Chand & Co., 2007.

Note:

- The duration of each experiment is of 2 hours. Two such experiments are to be performed by each student per week.
- In the external exam, a student will have to perform two experiments, one from each group. The experiment will be of 2-hour duration.
- There should be two examiners, one for each group, in the external examination. There should not be more than 10 students per examiner per session in the external examination.

Question Paper Template

Unit	Remembering/ Knowledge (1)	Understanding (2)	Applying (3)	Analysing (4)	Evaluating (5)	Creating (6)	Total marks
Practical IV	25%	25%	20%	20%	5%	5%	100%

Mapping of CLOs and PSOs

Course Learning Outcomes	Programme Outcomes					
	1	2	3	4	5	6
• demonstrate practical skills	√	√	√	√	√	√
• correlate the physics theory concepts with appropriate practical	√	√			√	

B. Sc. (Physics) SEMESTER II

COURSE TITLE: Physics Paper - II

COURSE CODE: PHYMN-S2P2-2CR24 [CREDITS - 02]

MN II	COURSE CODE: PHYMN-S2P2-2CR24	
Course Learning Outcomes		
At the end of this course, learners will be able to • understand the basic concepts of geometrical optics, such as Fermat's principle and its applications • understand the laws of reflection and refraction • extract the basic concepts of temperature and laws of thermodynamics.		
Unit I	**Geometrical Optics**	**[15L]**
Learning objectives: This unit is intended to • make the students familiarize with the behaviour of light rays and ray tracing techniques • introduce to them the techniques of formation of images by mirrors and lenses • apply them solving optical problems • analyse optical phenomena, such as reflection, refraction, dispersion, etc. • make them understand how light behaves and how it can be manipulated using geometric optics principles.		
Learning outcomes: After the successful completion of the unit, learners will be able to • understand optical elements and describe behaviour of light ray such as how light rays reflect, refract and disperse when interacting with optical elements • calculate properties such as the position, size, orientation and nature of images formed (virtual or real) by optical systems • gain skill to solving optical problems and understanding of optical instruments, such as different lenses, microscopes, telescopes and camera based on geometric optics.		
1.1	Introduction (3.1), laws of reflection and refraction from Fermat's principle (3.2).	**[2L]**
1.2	Introduction (4.1), refraction at a single spherical surface (4.2), reflection by a single spherical surface (4.3), the thin lens (4.4), the principle foci and the focal length of a lens (4.5), the Newton's formula (4.6), lateral magnification (4.7), aplanatic points of a sphere (4.8).	**[13L]**
Text book: Optics by Ajoy Ghatak, 6th Ed., McGraw-Hill Education. 2017.		
Unit II	**Thermodynamics**	**[15L]**
Learning objectives:		

This unit is intended to

- provide an in-depth study of thermodynamics by covering its fundamental principles and concepts extensively
- establish a solid foundation and equipping students with the necessary skills to apply thermodynamic principles effectively in various field of study
- foster an intuitive grasp of thermodynamics by prioritizing the underlying Physics.

Learning outcome:

After the successful completion of the unit, learners will be able to

- explain the basic concepts of thermodynamic such as temperature, pressure, system, properties, process, state, cycles and equilibrium
- identify situations of thermal equilibrium and describe the factors influencing it
- define energy transfer through mass, heat and work for closed and control volume systems
- apply the first law of thermodynamics on closed and control volume systems
- recognize the distinction between reversible and irreversible processes and understand the concept of entropy production and its relation to irreversibility.

2.1	Temperature and thermal equilibrium (21.1), measuring temperatures (21.3), thermal expansion (21.4).	**[3L]**
2.2	Heat: Energy in Transit (23.1) The Transfer of Heat (23.2), The First Law of Thermodynamics (23.3), Heat Capacity and Specific Heat (23.4), Work Done on or by an Ideal Gas (23.5), The Internal Energy of an Ideal Gas (23.6), Heat Capacities of an Ideal Gas (23.7), applications of the first law of thermodynamics (23.8).	**[12L]**

Text book:

Physics by Halliday, Resnick and Krane, Vol. 1, 5th Ed., Wiley 2017.

Reference Books:

- University Physics by H. D. Young, R. A. Freedman and A. Lewis Ford, 13th Ed., Pearson Education, 2013.
- Fundamentals of Optics by F. Jenkins and H. White, 4th Ed., McGraw Hill Education, 2017.
- Heat and Thermodynamics by Mark W. Zemansky and Richard H. Dittman 7th Ed., McGraw Hill Edu. Pvt. Ltd. 1997.

Note: Each unit carries equal weightage of total marks of the course.

Question Paper Template

Unit	Remembering/ Knowledge (1)	Understanding (2)	Applying (3)	Analysing (4)	Evaluating (5)	Creating (6)	Total marks
I	20%	30%	25%	25%	-	-	100%
II	20%	30%	25%	25%	-	-	100%

Mapping of CLOs and PSOs

Course Learning Outcomes	Programme Outcomes					
	1	2	3	4	5	6
• understand the basic concepts of geometrical optics, such as Fermat's principle and its applications	√	√		√		
• understand the laws of reflection and refraction	√	√		√		
• extract the basic concepts of temperature and laws of thermodynamics	√	√		√		

B. Sc. (Physics) SEMESTER II
COURSE TITLE: Physics Practical - II
COURSE CODE: PHYMN-S2PR2-2CR24 [CREDITS - 02]

MN Practical II	Course Code: PHYMN-S2PR2-2CR24

Course Learning Outcomes

After the successful completion of the course, learners will be able to:

- demonstrate practical skills
- correlate the physics theory concepts through practical

1	To determine the modulus of rigidity of a wire using torsional pendulum.
2	To determine the modulus of rigidity of rod by Searle's apparatus.
3	To determine elastic constant (Y) by Searle's method.
4	To determine elastic constant (η) by Searle's method.
5	To determine force constant (k) of a spring.
6	To determine refractive index of liquid using lens.
7	To determine of focal length of lens using lens Gauss' equation.
8	To determine of focal length of a convex lens and a plano-convex lens using auto-correlation method.
9	To determine "Y" of a cantilever.
10	To determine "Y" of a beam supported at two ends.
11	To determine the focal length of a convex lens using two pins.
12	To determine angle of a prism using spectrometer.
13	To study heat transfer by natural radiation.
14	To study Newton's law of cooling.
15	To study heat transfer by conduction.
16	To study heat transfer by natural convection.
17	To study Binomial probability distribution.
18	To determine Young's modulus by bending (at the center of a beam)
19	To study wattage of lamp.
20	To study the law of refraction.

Reference Books:

- Advanced Practical Physics by B. L. Worsnop and H. T. Flint, 3rd Ed., Asia Publishing House, New Delhi, 2021
- B. Sc. Practical Physics by C. L. Arora, S. Chand & Co., Reprint Ed., 2010
- University Practical Physics by D. C. Tayal, Edited by Ila Agarwal, 1st Ed., Himalayan Publishing House, 2000.
- A Laboratory Manual of Physics for Undergraduate Classes by D. P. Khandelwal, 1st Ed., Vani Publication House, New Delhi, 1985.
- B. Sc. Practical Physics by Geeta Sanon, 1st Ed., R. Chand & Co., 2007.

Note:

- The duration of each experiment is of 2 hours. Two such experiments are to be performed by each student per week.
- In the external exam, a student will have to perform two experiments, one from each group. The experiment will be of 2-hour duration.
- There should be two examiners, one for each group, in the external examination.
- There should not be more than 10 students per examiner per session in the external examination.

Question Paper Template

Unit	Remembering/ Knowledge (1)	Understanding (2)	Applying (3)	Analysing (4)	Evaluating (5)	Creating (6)	Total marks
Practical III	25%	25%	20%	20%	5%	5%	100%

Mapping of CLOs and PSOs

Course Learning Outcomes	Programme Outcomes					
	1	2	3	4	5	6
• demonstrate practical skills	√	√	√	√	√	√
• correlate the physics theory concepts with appropriate practical	√	√			√	

B. Sc. (Physics) SEMESTER II

COURSE TITLE: Space Science-II

COURSE CODE: PHYMDC-S2P1-4CR24 [CREDITS - 04]

MDC II	COURSE CODE: PHYMDC-S1P1-4CR24	
Course Learning Outcomes		
At the end of this course, students will be able to • understand the formation of different kinds of star and their process of evolution. • classify the stars with the help of H-R diagram. • relate formation of different kinds of star such as white dwarf, red-giant, Neutron star and Black-hole • understand the structure of Galaxy. • interpret the rate of expansion of Universe at large scale & estimate age and size of Universe. • apply the concept of magnitude scale in determining the distance of star. • classify the different binary stars. • determine the masses of components of binary stars.		
Unit I	**Evolution of Star**	**[15L]**
Learning objectives: This unit is intended to • understand the formation of different kinds of star and their process of evolution • familiarise with the formation of different celestial object depending upon their mass • classify the stars with the help of H-R diagram • understand the stability of the star due to the mechanical pressure and gravitational pull • differentiate formation of different stars such as white dwarf, red-giant, neutron star, black hole etc.		
Learning outcomes: At the end of this unit, learners will be able to • interpret the Steller evolution • relate the stability of star with the mechanical pressure and gravitational pull • identify different stars with help of H-R diagram.		
1	**Stellar Evolution:** Why do stars evolve? How do stars evolve?, Stars < (less than) 8 Solar mass, Stars > (greater than) 8 Solar Mass, Supernovae, Where do we come from?, Hertzsprung–Russell diagram, Main sequence stars. **Stellar Remnants:** Degenerate Gas Pressure, Detail study of White dwarfs, Neutron Stars, and Black holes, Chandrashekhar's Limit, Schwarzschild radius.	**[15L]**
Text Book: Schaum's Outline of Astronomy: Stacy E. Palen, McGraw-Hill Publishing Company Limited, 2020		

Unit II	Cosmology	[15L]
Learning objectives: This unit is intended to • understand the structure of Galaxy • understand the rate of expansion of Universe at large scale • learn the Hubble's Law.		
Learning outcome: At the end of this unit, learners will be able to • understand the formation of Galaxy • explain the expansion of Universe • estimate the age and size of universe.		
2.1	**Galaxies and Clusters:** The Milky Way, Normal Galaxies, Active Galaxies and Quasars. **Cosmology:** Hubble's Law, Hubble's Law and expansion of the universe, Hubble's Law and age of the universe, Hubble's Law and size of the universe, The Big bang, Life in the universe	**[15L]**
Text Book: Schaum's Outline of Astronomy: Stacy E. Palen, McGraw-Hill Publishing Company Limited, 2020		
Unit III	**The Continuous Spectrum of Light**	**[15L]**
Learning objectives: This unit is intended to • make the students familiarize with magnitude scale and its connection to distance of a star • study theory of black body radiation and its application in observing the star		
Learning outcome: At the end of this unit, learners will be able to • apply the concept of magnitude scale in determining the distance of star. • implement the theory of black body radiation in studying physical properties of star		
3.1	**Stellar Parallax** **The magnitude Scale:** Apparent Magnitude, Flux, Luminosity and the Inverse Square Law, Absolute Magnitude, Distance Modulus **Blackbody Radiation:** The Connection between Color and Temperature, Stefan-Boltzmann Equation, The Eve of New World View **The color index:** UBV Wavelength Filters, Color Indices and the Bolometric Correction, Color-Color Diagram	**[15L]**
Text Book: An Introduction to Modern Astrophysics (Second Edition) by Bradley W. Carroll and Dale A. Ostlie , Publisher- Pearson Addison Wesley		
Unit IV	**Binary Systems and Steller Parameters**	**[15L]**
Learning objectives: This unit is intended to		

• introduce the students about the binary systems and stellar parameters.		
Learning outcome: At the end of this unit, learners will be able to • classify the different binary stars. • determine the masses of components of binary stars • apply the concept of redshift in determining the physical properties of binary system.		
4.1	**The Classification of Binary Stars:** Optical doubles, Visual binary, Astrometric binary, Eclipsing binary, Spectrum binary, Spectroscopic binary **Mass Determination Using Visual Binaries** **Eclipsing, Spectroscopic Binaries:** The Effect of Eccentricity on Radial Velocity Measurements, The Mass Function and Mass-Luminosity Relation, Using Eclipses to Determine Radii and Ratios of Temperatures	**[15L]**
Text Book: An Introduction to Modern Astrophysics (Second Edition) by Bradley W. Carroll and Dale A. Ostlie, Publisher- Pearson Addison Wesley		
Reference Books: 1) An Introduction to Astrophysics: Baidyanath Basu, Tanuka Chattopadhyay and Sudhindra Nath Biswas, 2nd Ed., Prentice Hall India Learning Private Limited, 2010. 2) An Introduction to Astronomy and Astrophysics: Pankaj Jain, 1st Ed., CRC Press Publishing Company, 2015.		
Note: Each unit carries equal weightage of total marks of the course.		

Question Paper Template

Unit	Remembering/ Knowledge (1)	Understanding (2)	Applying (3)	Analysing (4)	Evaluating (5)	Creating (6)	Total marks
I	40%	40%	20%	-	-	-	100%
II	40%	40%	20%	-	-	-	100%
III	40%	40%	20%	-	-	-	100%
IV	40%	40%	20%	-	-	-	100%

Mapping of CLOs and PSOs

Course Learning Outcomes	Programme Outcomes					
	1	2	3	4	5	6
• understand the formation of different kinds of star and their process of evolution.	√	√				
• classify the stars with the help of H-R diagram.	√					

• relate formation of different kinds of star such as white dwarf, red-giant, Neutron star and Black-hole	√	√	√			
• understand the structure of Galaxy.	√	√				
• interpret the rate of expansion of Universe at large scale & estimate age and size of Universe.	√	√				
• apply the concept of magnitude scale in determining the distance of star.	√	√				
• classify the different binary stars.	√	√	√			
• determine the masses of components of binary stars.	√	√				

B. Sc. (Physics) SEMESTER II

COURSE TITLE: Digital Electronics

COURSE CODE: PHYMDC-S2P2-4CR24 [CREDITS - 04]

MDC III	COURSE CODE: PHYMDC-S2P2-4CR24	
Course Learning Outcomes		
At the end of this course, students will be able to • develop a comprehensive understanding of binary arithmetic, digital waveform analysis, and number system conversions, which are fundamental for designing and analyzing digital systems and circuits. • gain a solid understanding of basic and advanced digital logic principles, enabling you to design and analyze complex digital circuits effectively. • develop a comprehensive understanding of Boolean simplification techniques and their applications in digital logic design, preparing them for more advanced topics and practical circuit design challenges. • develop a thorough understanding of binary arithmetic and the design of arithmetic circuits, equipping them with the foundational skills necessary for more advanced topics in digital logic and computer engineering.		
Unit I	**Introduction to Digital Concept**	**[15L]**
Learning objectives: This unit is intended to • make students understand binary digits, logic levels, digital waveforms, timing diagrams, and data transfer is crucial for working with digital systems • make them aware of the basis for more advanced topics in digital electronics and computer engineering • make them learn fundamentals to better design, analyze and troubleshoot digital circuits and systems.		
Learning outcomes: At the end of this unit, learners will be able to • develop a comprehensive understanding of binary arithmetic, digital waveform analysis, and number system conversions, which are fundamental for designing and analyzing digital systems and circuits.		
1	**Introduction:** Binary Digits (Bits), logic levels and digital waveforms, waveform carries binary information, timing diagram, data transfer **Number Systems:** Decimal odometer, binary odometer. why binary number system **Conversion of number systems**: decimal to binary, binary to octate, octate to hexa-decimal, BCD, X' 3 code, Gray code.	**[15L]**
Unit II	**Basic and Universal Logic Gates**	**[15L]**

Learning objectives:

This unit is intended to

- understand and apply basic logic gates, universal and special gates and describe the function of these gates (AND, OR, NOT, NAND, NOR, X-OR, X-NOR) and apply them in circuit design and Boolean algebra
- apply the concept of gates in day today application like parity checking, controlled invertor.

Learning outcome:

At the end of this unit, learners will be able to

- Understand the basic and advanced digital logic principles, enabling you to design and analyze complex digital circuits effectively.

2.1	**Logic Gates:** Introduction to Basic Logic Operation, Inverter, OR gate, AND Gate **Universal Gates:** NOR Gates, NAND Gates **Special Gates:** Ex-OR gate and its applications - Parity Checker, Controlled Inverter, Ex-NOR gates and its applications.	**[15L]**
Unit III	**Boolean Algebra and K-maps**	**[15L]**

Learning objectives:

This unit is intended to

- gain a comprehensive understanding of Boolean simplification techniques and their applications in digital logic design.

Learning outcome:

At the end of this unit, learners will be able to

- develop a comprehensive understanding of Boolean simplification techniques and their applications in digital logic design, preparing them for more advanced topics and practical circuit design challenges.

3.1	Boolean algebra, De Morgan's theorems, Boolean relations, overview of K-maps, minterms, maxterms, don’t care conditions, K-maps variable, Design examples using K-maps, Ex-OR and Ex-NOR simplification of K-Maps.	**[15L]**
Unit IV	**Arithmetic Logic Unit (ALU)**	**[15L]**

Learning objectives:

This unit is intended to

- ensure that students develop a solid understanding of binary arithmetic and the design of arithmetic circuits, which are fundamental for more advanced digital electronics and computer engineering topics.

Learning outcome:

At the end of this unit, learners will be able to

- develop a thorough understanding of binary arithmetic and the design of arithmetic circuits
- equip them with the foundational skills necessary for more advanced topics in digital logic and computer engineering.

4.1	Binary addition, binary subtraction, binary multiplication, binary division, half adder, full adder, binary adder, signed binary numbers, 1's complement, 2's complement, 2's complement adder-subtractor, BCD adder- subtractor.	**[15L]**

Reference Books:

1) Modern Digital Electronics, Fourth Edition, R P Jain, Tata McGraw Hill Education Private Ltd., New Delhi., 2010
2) Digital Principles and Applications, Seventh Edition, Donald P Leach, Albert Paul Malvino, Goutam Saha., Tata McGraw Hill Education Private Ltd., New Delhi., 2011.

Note: Each unit carries equal weightage of total marks of the course.

Question Paper Template

Unit	Remembering/ Knowledge (1)	Understanding (2)	Applying (3)	Analysing (4)	Evaluating (5)	Creating (6)	Total marks
I	40%	40%	20%	-	-	-	100%
II	40%	40%	20%	-	-	-	100%
III	40%	40%	20%	-	-	-	100%
IV	40%	40%	20%	-	-	-	100%

Mapping of CLOs and PSOs

Course Learning Outcomes	Programme Outcomes					
	1	2	3	4	5	6
• develop a comprehensive understanding of binary arithmetic, digital waveform analysis, and number system conversions, which are fundamental for designing and analyzing digital systems and circuits	√			√		
• Understand the basic and advanced digital logic principles, enabling you to design and analyze complex digital circuits effectively.	√			√		√
• develop a comprehensive understanding of Boolean simplification techniques and their applications in digital logic design, preparing them for more advanced topics and practical circuit design challenges	√	√	√			√
• develop a thorough understanding of binary arithmetic and the design of arithmetic circuits	√					√
• equip them with the foundational skills necessary for more advanced topics in digital logic and computer engineering.	√	√			√	√

B. Sc. (Physics) SEMESTER II
COURSE TITLE: Programming in "C" Language - II
COURSE CODE: PHYSEC-S2P1-2CR24 [CREDITS - 02]

SEC II	Course Code: PHYSEC-S2P1-2CR24

Course Learning Outcomes

After the successful completion of the course, learners will be able to:

- demonstrate practical skills
- correlate the physics theory concepts through practical

Development of algorithm, flow chart and program for the following	
1	Finding Largest/Smallest of a set of integers using Array
2	Reading and printing an n x n matrix
3	Addition/Subtraction of two 3x3 matrices
4	Find median of a set of data
5	Swap two numbers using function
6	Print Fibonacci sequence using function
7	Write a C program to solve the inverse of 2 × 2 matrix.
8	Solve the cosine series using C program
9	Solve the sine series using C program.
10	Find the roots of quadratic equations using C program.
11	Convert the Celsius to Fahrenheit from 0^0 C to 1000^0C in an interval of 1^0C using loop.
12	Find the even and odd numbers from the set of observations.
13	Write a C program for finding the slope and intercept for set of observations.

Reference Books:

- Computer Programming in C by V. Rajaraman, 2nd Ed., PHI Learning Pvt. Ltd., 1994.

Note:

- The duration of each experiment is of 2 hours. One experiment is to be performed byeach student per week.
- In the external exam, a student will have to perform one experiment. The experimentwill be of 2-hour duration.
- The batch for external examination shall have maximum 20 students.
- There should be two examiners in the external examination.
- There should not be more than 10 students per examiner per session in the externalexamination.

Learning objectives:

This unit is intended to

- familiarize the students with different the programming languages and infer about the flowchart and algorithms
- learn different types of loops
- study array statements
- study control statements and functions

Learning outcomes:

At the end of this unit, learners will be able to

- get to know about different the programming languages and their uses
- interpret flowchart and algorithms
- apply the use different types of loops and array functions
- understand and apply different control statements like if, if-else in more detail
- analyze how function statements work in C-programming

apply the use of different loops like while, do-while and for with array function.

Question Paper Template

Unit	Remembering/ Knowledge (1)	Understanding (2)	Applying (3)	Analysing (4)	Evaluating (5)	Creating (6)	Total marks
% Weightage	20%	30%	26%	24%	-	-	100 %

Mapping of CLOs and PSOs

Course Learning Outcomes	Programme Outcomes					
	1	2	3	4	5	6
• demonstrate practical skills		√	√		√	√
• correlate the physics theory concepts with appropriate practical		√			√	
• apply numerical algorithms into C-program and visualize the results of the computations.		√	√		√	√

B. Sc. (Physics) SEMESTER II
COURSE TITLE: PCB Design and Techniques
COURSE CODE: PHYSEC-S2P2-2CR24 [CREDITS - 02]

SEC III	COURSE CODE: PHYSEC-S2PR2-2CR24	
Course Learning Outcomes		
At the end of this course, students will be able to • learners will be equipped with the skills necessary for effective PCB design, leading to successful project implementation in various applications. • Use software to design the circuit		
	Printed Circuit Design and Techniques (Practical)	**[60L]**
Learning objectives: This unit is intended to • design a small project based on power supply. • Design simple projects using passive and active components like resistor and transistor respectively and digital IC's and analog IC's.		
Learning outcome: At the end of this unit, learners will be able to • Design, build and test and troubleshoot a circuit design built on PCB. • To design hobby project PCB's		
	1. Printed Circuit Design and Techniques such as Layout, Checklist for layout design. 2. To learn express PCB Software to design PCB layout. 3. Design T network on PCB, drill appropriate holes for component connection and solder them on it and test its connection. 4. Design π network on PCB drill appropriate holes through pads for component connection and solder them on it and test its connection. 5. Design Bridge circuit on PCB drill appropriate holes through pads for component connection and solder them on it and test its connection. 6. Design half and full wave rectifier circuit on PCB drill appropriate holes through pads for component connection and solder them on it and test its connection. 7. Design a PCB layout for Filter and Voltage regulator using Zener and 3 pin IC. 8. Design half adder and full adder circuit PCB drill appropriate holes through pads for component connection and solder them on it and test its connection. 9. Design half subtractor and full subtractor circuit PCB drill appropriate holes through pads for component connection and solder them on it and test its connection.	**[60L]**

	10. Design a PCB for Binary to Gray code drill appropriate holes through pads for component connection and solder them on it and test its connection. 11. Design a PCB for Gray to Binary code drill appropriate holes through pads for component connection and solder them on it and test its connection. 12. Design layout on PCB for Power supply drill appropriate holes through pads for component connection and solder them on it and test its connection. 13. Design at least 4 PCB for your Hobby project and demonstrate the project	

Reference Books:

- A Monogram on Electronic design and Principle**,** by Dr.N.C.Goyal (Author), R.K.Khetan (Author), Khanna Publishers Publication, 1 January 2006
- Printed Circuit Boards: Design, Fabrication, and Assembly, by R. Khandpur (Author), (McGraw-Hill Electronic Engineering), September 2005

Note:

➢ The duration of each experiment is of 2 hours. One experiment is to be performed by each student per week.

➢ In the external exam, a student will have to perform one experiment. The experiment will be of 2-hour duration.

➢ The batch for external examination shall have maximum 20 students.

➢ There should be two examiners in the external examination.

➢ There should not be more than 10 students per examiner per session in the external examination.

Question Paper Template

Unit	Remembering/ Knowledge (1)	Understanding (2)	Applying (3)	Analysing (4)	Evaluating (5)	Creating (6)	Total marks
I	10%	10%	20%	10%	20%	30%	100%

Mapping of CLOs and PSOs

Course Learning Outcomes	Programme Outcomes					
	1	2	3	4	5	6
• learners will be equipped with the skills necessary for effective PCB design, leading to successful project implementation in various applications.	√	√	√	√		
• Use software to design the circuit	√	√	√	√		
• Design and bring a prototype electronic circuit for rectifier, filter and regulators		√	√	√	√	√