Teaching and Examination scheme of UG

SEM III and IV

2023-24

INSTITUTE OF SCIENCE, NAGPUR
(An Autonomous Institute of Government of Maharashtra)

DEPARTMENT OF PHYSICS

Teaching and Examination scheme
Name of Course (Subject): PHYSICS
Programme Outcomes (PO):

On completion of the B.Sc. PHYSICS students will be able to:

1. Develop Understanding of advanced concepts of physics
2. Solve the problems in physics.
3. Demonstrate the concepts of physics by performing experiments.
4. Develop algorithm using programming techniques for numerically solving physics problems.
5. Design and find solutions to innovative problems based on physics.
6. Pursue advanced studies and research in physical sciences.

B.Sc. Sem - III (Major, Minor from Basket)

Level 5.0

Sr No	Course Category	Name of the course (Title of the Paper)	Course code	Teaching Scheme (hrs)			Total Credit	Evaluation Scheme			
				Theory	Tutorial	Practical		Duration of Examination (Hrs)	End Semester Evaluation (ESE)	Continuous Internal Evaluation (CIE)	Minimum Passing Marks
				Th	Tu	P					
1	DSC	Electrostatics and Magneto-statics	B-PH231T	2	--	--	2	2	40	10	20
		Modern Optics	B-PH232T	2	--	--	2	2	40	10	20
		Lab	B-PH233P	--	--	4	2	4 – 6	40	10	25
2	Minor	Static Electricity and Magnetism	B-PH234T	2	--	--	2	2	40	10	20
		Optics	B-PH235T	2	--	--	2	2	40	10	20
		Lab	B-PH236P	--	--	4	2	4 - 6	40	10	25
3	GE	Physics of Planet Earth	B-PH237T	2	--	--	2	2	40	10	20
4	VSEC	C Programming	B-PH238P	--	--	4	2	4-6	40	10	25
5	AEC	Second Language		2	--	--	2	2	40	10	20
6	FP	Field Project	B-PH239P	--	--	4	2	4-6	25	25	25
7	CC	NSS 3/NCC 3 / Sports 3/ Cultural 3		--	--	4	2	--	25	25	25
Total				**12**	**--**	**20**	**22**	**--**	**410**	**140**	**--**

B.Sc. Sem-IV (Major, Minor from Basket)

Level 5.0

Sr No	Course Category	Name of the course (Title of the Paper)	Course code	Teaching Scheme (hrs)			Total Credit	Evaluation Scheme			
				Theory	Tutorial	Practical					
				Th	Tu	P		Duration of Examination (Hrs)	End Semester Evaluation (ESE)	Continuous Internal Evaluation (CIE)	Minimum Passing Marks
1	DSC	Introduction to Quantum Mechanics	B-PH241T	2	--	--	2	2	40	10	20
		Basic Electronics	B-PH242T	2	--	--	2	2	40	10	20
		Lab	B-PH243P	--	--	4	2	4 – 6	40	10	25
2	Minor	Concepts in Quantum Mechanics	B-PH244T	2	--	--	2	2	40	10	20
		Fundamentals of Electronics	B-PH245T	2	--	--	2	2	40	10	20
		Lab	B-PH246P	--	--	4	2	4-6	40	10	25
3	GE	Introduction to astronomy	B-PH247T	2	--	--	2	2	40	10	20
4	VSEC	Computer hardware and maintenance	B-PH248P	--	--	4	2	4-6	40	10	25
5	AEC	Second Language		2	--	--	2	2	40	10	20
6	CEP	Community Service	B-PH249P	--	--	4	2	--	25	25	25
7	CC	NSS 3/NCC 3 / Sports 3/ Cultural 3		--	--	4	2	--	25	25	25
Total				**12**	**--**	**20**	**22**	**--**	**410**	**140**	**--**

Table showing total marks in theory and Practical semester wise

Semester	Theory	Practical	Total Marks
I	425	125	550
II	425	125	550

Total Credits: 1. Three Year UG Degree Program: 132
2. Four Year UG Degree Program: 172

Abbreviations:
Generic/Open Electives: OE, Vocational Skills & Skill Enhancement Courses: VSEC, Vocational Skill Courses: VSC, Skill Enhancement Courses: SEC, Ability Enhancement Courses: AEC, Indian Knowledge Systems: IKS, Value Education Courses: VEC, On Job Training (Internship/Apprenticeship): OJT, Field Project: FP, Community Engagement & Service: CEP, Co-curricular Courses: CC, Research Methodology: RM, Research Project: RP

SUBJECT: PHYSICS

B.SC. –II SEMESTER - III

DSC: BPH231T : PAPER- I (Electrostatics and Magneto-statics)

Marks- 40 **Time- 30 hours**

OBJECTIVES:

1. To disseminate the knowledge of electric field and dielectrics
2. To disseminate the fundamental knowledge of magnetism and magnetostatics
3. Provide opportunities for scientific study and creativity

OUTCOMES:

1. Students gain knowledge of electric field and dielectrics
2. They gain knowledge of magnetism and magnetostatics
3. Apply the knowledge to solve problems based on above properties to strengthen their concepts

Unit I: **7.5 hrs.**

Electrostatics: Coulombs law in vacuum in vector form, Force between two charges, Electric field intensity, Electric potential, Electric field intensity due to a point charge, Electric dipole, Electric dipole moment, Electric field intensity due to an electric dipole, Electric field as a negative gradient of potential, Conservative nature of the electric field.

Unit II: **7.5 hrs.**

Dielectric: Introduction, definition of polar and non polar molecules, Polarization of charges in a dielectric, Clausius - Mossotti equation, Three electric vectors D, E and P and relation between them, Concept of capacitance, Parallel plate capacitor without and with dielectric, application of Gauss's law to parallel plate capacitor.

Unit III: **7.5 hrs.**

Magnetism: Introduction, Magnetic materials, Langevin's theory of diamagnetism, its application as superconductor, Critical magnetic field and Meissner effect, Langevin's theory of para magnetism, Ferromagnetism, Ferromagnetic domain, Curie temperature, Ferrimagnetism, Ferrites and its applications, Antiferromagnetism, Neel temperature.

Unit IV **7.5 hrs.**

Magnetostatics: Concept of magnetic field, Lorentz force equation, Magnetic dipole moment, angular momentum and gyromagnetic ratio, Biot- Savart's law, It's applications (B due to steady current in a long straight wire, B along the axis of circular coil), Ampere's law, It's applications(B for a solenoid, A Toroid), Magnetization current, Magnetic vectors, Gauss law of magnetization.

References and Text books:

1. Electricity and Magnetism, by D. C. Tayal
2. Electricity and Magnetism, by Rakshit, Chottopadhay
3. Electricity and Magnetism, by S. S. Atwood.
4. Electricity and Magnetism, by K. K. Tewari.
5. University physics, by J. C. Upadhyay, Himalaya publications.
6. Foundation of Electrodynamics, by Theory, Rietz and Millford.

SUBJECT: PHYSICS

B.SC. –II SEMESTER - III

DSC: BPH232T: PAPER- II (Modern optics)

Marks- 40 **Time- 30 hours**

OBJECTIVES:

1. To disseminate the knowledge of optical phenomenon
2. To disseminate the fundamental knowledge of electromagnetic waves
3. Provide opportunities for scientific study and creativity

OUTCOMES:

1. Students gain knowledge of interference, diffraction and polarization
2. They gain knowledge of e.m. wave
3. Apply the knowledge to solve problems based on above properties to strengthen their concepts

Unit I: **7.5 hrs.**

Interference of light: Introduction, Interference in equal thickness thin film, Phase change on reflection, refraction and transmitted system. Newton's ring and its application to determine the wavelength and refractive index, Michelson Interferometer and its application to wavelength determination and wavelength difference, Fabry- Parrot Interferometer and its application.

Unit II: **7.5 hrs.**

Diffraction of light: Introduction, Fresnel's diffraction: Half period zones, Zone plates, Diffraction due to straight edge and due to narrow slit.

Fraunhoffer diffraction: Fraunhoffer diffraction at a single slit, at circular aperture, Plane diffraction grating and its application, Resolving power of grating, Rayleigh's criterion for resolution.

Unit III: **7.5 hrs.**

Polarization: Introduction, Brewster's law, Polarization by scattering (concept only), Blue color of the sky (only idea), Uniaxial and biaxial crystal, positive and negative crystal, ordinary and extraordinary rays, Nicol prism, its application as an analyzer and polarizer, Double refraction in uniaxial crystal, phase retardation plate (Half and Quarter wave), Double prism.

Unit IV: **7.5 hrs.**

EM Waves: Introduction to EM spectrum related to wavelength, origin and characteristics of EM waves, Physical significance of Maxwell's equations, EM wave equations (in conducting medium and in free space), It's transverse nature, Plane polarized EM wave ($E0/H0=\sqrt{\frac{\mu}{\epsilon}}$), Characteristics impedance of dielectric, Poynting vector, Poynting theorem.

References and Text books:

1. Physics for Degree students for B. Sc. Second year, by C. L. Arora, Dr. P. S. Hemne.
2. Optics and Spectroscopy, by R. Murugeshan , Kiruthign Sivaprakash.
3. Optics, by Brijlal and Subramayam.
4. Optics, by Ajay Ghatak.
5. A text book of optics, by Dr. Subrahmanyam, Brijlal and M. N. Avadhanulu.
6. Optics, by- J. K. Sharma, K. K. Sarkar.
7. Fundamentals of optics, by Jenkins and white.
8. Optics, by D. P. Khandelwal.
9. Electromagnetic field and waves, by Paul Lorrain and Dale R. Corson.
10. Foundation of Electromagnetic theory, by John R. Retitz, Fredrick, J. Milford.
11. Electromagnetic, by B. B. Laud.
12. Electrodynamics, by Jordon

SUBJECT: PHYSICS

B.SC. –II SEMESTER - III

DSC: BPH233P: Practical

1. To determine the horizontal component of Earth's magnetic field and magnetic moment of the magnet.
2. To study the variation of magnetic field along the axis of a current carrying circular coil.
3. Study of magnetic field by vibration magnetometer.
4. To determine the dipole moment of a given liquid.
5. To determine magnetic susceptibility of $FeCl_3$.
6. To determine the radius of curvature of the lower surface of a plano-convex lens by using Newton's ring apparatus.
7. Study of wavelength of light using Newton's ring.
8. To study the variation of the fine width with color of light.
9. To study the characteristics of micro phone.
10. Study of loudspeaker (woofer, squawker, tweeter) as a transducer.
11. Study of Piezoelectric effect.
12. To produce interference pattern using Lloyd's mirror and to determine the wavelength of sodium light.
13. To determine the dispersive power of a prism.
14. Study of polarization of light by reflection (Brewster's law).
15. To find R.I. of glass by using Brewster's law.
16. To determine the resolving power of a grating.
17. To study diffraction at straight edge and to determine the wavelength of monochromatic light.
18. To determine the resolving power of a telescope.
19. Study of wavelength of light using plane diffraction grating.
20. To determine the wavelength of prominent lines of mercury by plane transmission grating.

SUBJECT: PHYSICS

B.SC. –II SEMESTER - III

MINOR: BPH234T : PAPER-III (Static electricity and Magnetism)

Marks- 40 **Time- 30 hours**

OBJECTIVES:

1.To disseminate the knowledge of electric field and dielectrics

2.To disseminate the fundamental knowledge of magnetism and magnetostatics

3.Provide opportunities for scientific study and creativity

OUTCOMES:

1.Students gain knowledge of electric field and dielectrics

2.They gain knowledge of magnetism and magnetostatics

3.Apply the knowledge to solve problems based on above properties to strengthen their concepts

Unit I: **7.5 hrs.**

Electrostatics: Coulombs law in vacuum in vector form, Force between two charges, Electric field intensity, Electric potential, Electric field intensity due to a point charge, Electric dipole, Electric dipole moment, Electric field intensity due to an electric dipole, Electric field as a negative gradient of potential, Conservative nature of the electric field.

Unit II: **7.5 hrs.**

Dielectric: Introduction, definition of polar and non polar molecules, Polarization of charges in a dielectric, Clausius - Mossotti equation, Three electric vectors D, E and P and relation between them, Concept of capacitance, Parallel plate capacitor without and with dielectric, application of Gauss's law to parallel plate capacitor.

Unit III: **7.5 hrs.**

Magnetism: Introduction, Magnetic materials, Langevin's theory of diamagnetism, its application as superconductor, Critical magnetic field and Meissner effect, Langevin's theory of para magnetism, Ferromagnetism, Ferromagnetic domain, Curie temperature, Ferrimagnetism, Ferrites and its applications, Antiferromagnetism, Neel temperature.

Unit IV **7.5 hrs.**

Magnetostatics: Concept of magnetic field, Lorentz force equation, Magnetic dipole moment, angular momentum and gyromagnetic ratio, Biot- Savart's law, It's applications (B due to steady current in a long straight wire, B along the axis of circular coil), Ampere's law, It's applications(B for a solenoid, A Toroid), Magnetization current, Magnetic vectors, Gauss law of magnetization.

References and Text books:

7. Electricity and Magnetism, by D. C. Tayal
8. Electricity and Magnetism, by Rakshit, Chottopadhay
9. Electricity and Magnetism, by S. S. Atwood.
10. Electricity and Magnetism, by K. K. Tewari.
11. University physics, by J. C. Upadhyay, Himalaya publications.
12. Foundation of Electrodynamics, by Theory, Rietz and Millford.

SUBJECT: PHYSICS

B.SC. –II SEMESTER - III

Minor: BPH235T: PAPER- III (optics)

Marks- 40 **Time- 30 hours**

OBJECTIVES:

1.To disseminate the knowledge of optical phenomenon

2.To disseminate the fundamental knowledge of electromagnetic waves

3.Provide opportunities for scientific study and creativity

OUTCOMES:

1.Students gain knowledge of interference, diffraction and polarization

2.They gain knowledge of e.m. wave

3.Apply the knowledge to solve problems based on above properties to strengthen their concepts

Unit I: **7.5 hrs.**

Interference of light: Introduction, Interference in equal thickness thin film, Phase change on reflection, refraction and transmitted system. Newton's ring and its application to determine the wavelength and refractive index, Michelson Interferometer and its application to wavelength determination and wavelength difference, Fabry- Parrot Interferometer and its application.

Unit II: **7.5 hrs.**

Diffraction of light: Introduction, Fresnel's diffraction: Half period zones, Zone plates, Diffraction due to straight edge and due to narrow slit.

Fraunhoffer diffraction: Fraunhoffer diffraction at a single slit, at circular aperture, Plane diffraction grating and its application, Resolving power of grating, Rayleigh's criterion for resolution.

Unit III: **7.5 hrs.**

Polarization: Introduction, Brewster's law, Polarization by scattering (concept only), Blue color of the sky (only idea), Uniaxial and biaxial crystal, positive and negative crystal, ordinary and extraordinary rays, Nicol prism, its application as an analyzer and polarizer, Double refraction in uniaxial crystal, phase retardation plate (Half and Quarter wave), Double prism.

Unit IV: **7.5 hrs.**

EM Waves: Introduction to EM spectrum related to wavelength, origin and characteristics of EM waves, Physical significance of Maxwell's equations, EM wave equations (in conducting medium and in free space), It's transverse nature, Plane polarized EM wave ($E_0/H_0=\sqrt{\frac{\mu}{\epsilon}}$), Characteristics impedance of dielectric, Poynting vector, Poynting theorem.

References and Text books:

13. Physics for Degree students for B. Sc. Second year, by C. L. Arora, Dr. P. S. Hemne.
14. Optics and Spectroscopy, by R. Murugeshan , Kiruthign Sivaprakash.
15. Optics, by Brijlal and Subramayam.
16. Optics, by Ajay Ghatak.
17. A text book of optics, by Dr. Subrahmanyam, Brijlal and M. N. Avadhanulu.
18. Optics, by- J. K. Sharma, K. K. Sarkar.
19. Fundamentals of optics, by Jenkins and white.
20. Optics, by D. P. Khandelwal.
21. Electromagnetic field and waves, by Paul Lorrain and Dale R. Corson.
22. Foundation of Electromagnetic theory, by John R. Retitz, Fredrick, J. Milford.
23. Electromagnetic, by B. B. Laud.
24. Electrodynamics, by Jordon

SUBJECT: PHYSICS

B.SC. –II SEMESTER - III

Minor : BPH236P : Practical

1. To determine the horizontal component of Earth's magnetic field and magnetic moment of the magnet.
2. To study the variation of magnetic field along the axis of a current carrying circular coil.
3. Study of magnetic field by vibration magnetometer.
4. To determine the dipole moment of a given liquid.
5. To determine magnetic susceptibility of $FeCl_3$.
6. To determine the radius of curvature of the lower surface of a plano-convex lens by using Newton's ring apparatus.
7. Study of wavelength of light using Newton's ring.
8. To study the variation of the fine width with color of light.
9. To study the characteristics of micro phone.
10. Study of loudspeaker (woofer, squawker, tweeter) as a transducer.
11. Study of Piezoelectric effect.
12. To produce interference pattern using Lloyd's mirror and to determine the wavelength of sodium light.
13. To determine the dispersive power of a prism.
14. Study of polarization of light by reflection (Brewster's law).
15. To find R.I. of glass by using Brewster's law.
16. To determine the resolving power of a grating.
17. To study diffraction at straight edge and to determine the wavelength of monochromatic light.
18. To determine the resolving power of a telescope.
19. Study of wavelength of light using plane diffraction grating.
20. To determine the wavelength of prominent lines of mercury by plane transmission grating.

SUBJECT: PHYSICS

B.SC. –II SEMESTER - III

GE: BPH237T: PAPER- V (Physics of Planet earth)

Marks- 40 **Time- 30 hours**

Credit:02 **Duration: 30Hrs**

Course objectives:

- To inculcate the learner about the scientific knowledge of planet Earth
- To introduce the learner to the concept of origin and evolution of Earth
- To introduce the learner about the interior and the atmosphere of Earth
- To introduce the learner about the magnetic as well as thermal properties of planet Earth

Course outcomes:

After completing the course, the learner will be able to

- explain the origin, evolution and dynamics of planet Earth
- explain the interior and the atmosphere of Earth
- explain the magnetic as well as thermal properties of planet Earth

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Unit I: Origin And Evolution Of Earth **7.5 Hrs**

Origin of Solar system, nebular hypothesis, condensation theory, terrestrial planets and jovian planets, the melting of solid Earth, Keplers laws of planetary motion, dynamic evolution of Solar system, speed and momentum of Earth, Gravitational potential of a nearly spherical body, Rotation, ellipticity and gravity

Unit II: Interior And Atmosphere of Earth **7.5 Hrs**

Formation of Earth's atmosphere, formation of the oscens, formation of Ozon layer, continental drift, sea floor spreading. Internal constitution of the earth, characteristics of lithosphere, and asthenosphere, causes of geodynamical process, geodynamic models, continental drift, Ocean floor spreading, plate tectonics and its geological implications, oceanic ridges, trenches and island arcs.

Unit III: Magnetic Properties Of Earth **7.5 Hrs**

Origin of geomagnetic field, theory of Earth's magnetism, Components of Earth's magnetic field, angle of dip, reversals of geomagnetic field, secular variations and westward drift, geomagnetic storms, polar wandering, geologic time, Palaeomagnetic studies of rock samples and their applications.

Unit IV: Thermal Proeprties of Earth **7.5 Hrs**

Importance of heat flow, thermal history of the earth, sources of heat generation and temperature distribution inside the earth, Jacob's hypothesis for liquid nature of the outer core, Radiogenic heat, Thermal contraction, gravitational energy and the heat capacity, Energy balance of the core, Thermodynamic efficiency, buoyancy forces and convective power.

References:

- An Introduction to astrophysics by Baidyanath Basu, PHI Learning Pvt. Ltd.
- The Physical Universe by Frank H. Shu, University of California, Berkeley
- Seven Wonders of the Sky by Jayant Vishnu Narlikar,Cambridge University Press
- Astrophysics for Physicists by Arnab Rai Chaudhari, Cambridge University Press
- Howell: Introduction to Geophysics
- Stacey: Physics of the Earth
- Lowrie: Fundamentals of Geophysics
- Chapman: Earth's Magnetism

Activities

- Experience the Zero shadow day. What will be the physics behind it?
- Think about the thermal properties of three phases of water found on earth.
- Observe the orientation of freely suspended magnetic niddle. Is there any relation with Earth’s magnetic field?

SUBJECT: PHYSICS

B.SC. –II SEMESTER - III

VSEC C ProgrammingB-PH238P

2 Credits

1. C program to display “Hello World”
2. C program to sum 2 integers from user
3. C program to calculate simple interest
4. C program to multiply float numbers
5. C program to sort numbers (ascending or descending)
6. C program to calculate area of circle
7. C program to detect a Leap Year
8. C program to calculate volume of Sphere
9. C program to Calculate HCF and LCM
10. C program to sum Array Elements

References

1. **Let Us C: Authentic guide to C programming language - 19th Edition, by Yashavant Kanetkar**
2. **Learn C Programming from Scratch: A step-by-step methodology with problem solving approach, by Mohammad Saleem Mir**
3. **The C Programming Language 2e by Brian W. Kernighan / Dennis Ritchie**

END of SEM III

SUBJECT: PHYSICS

B.SC. –II SEMESTER - IV

DSC: BPH241T: PAPER- I (Introduction to Quantum Mechanics)

Marks- 40 **Time- 30 hours**

OBJECTIVES: 1. To disseminate the knowledge of quantum mechanics

2. Provide opportunities for scientific study and creativity

OUTCOMES: 1. Students gain knowledge of quantum mechanics

2. Apply the knowledge to solve problems based on above properties to strengthen their concepts

UNIT-I Unit I: 7.5 hrs.

Failure of classical physics to explain: black body radiations, wiens theory, Rayleigh-Jeans law, Planck's radiation law, photoelectric effect, characteristic of photoelectric effect, Einstein's explanation of photoelectric effect, Compton Effect, Rutherford's model of atom, Bohr's postulates, Wave particle duality, de Broglie's hypothesis.

Unit II: 7.5 hrs.

Superposition principle, construction of wave packet, Concept of wave velocity and group velocity,

Davisson and Germer experiment, Heisenberg's uncertainty principle and Heisenberg's gamma ray microscope,

Schrodinger's equation (Time dependent and time independent equations), Physical significance of wave function Ψ, normalization of wave function, Probability current density, Operators, Expectation values of a dynamical quantities, Ehrenfest's theorem.

UNIT III : 7.5 hrs.

Linear operators, Eigen value and Eigen functions. One-dimensional applications of Schrodinger equations: free particle, step potential, Particle in a one dimensional potential box, Particle in a one dimensional well, rectangular potential barrier.

UNIT IV: 7.5 hrs.

One dimensional linear harmonic oscillator, Three- dimensional linear harmonic oscillator, zero-point energy, spherically symmetric system and potential, separation of variables, solution of ø, solution of Θ, solution of R, wave equation of hydrogen atom, reduction of equivalent one-body problem, Schrodinger solution of hydrogen atom , selection rule, forbidden and allowed transition.

References:

1. Quantum Mechanics, Statistical Mechanics and SSP, by D. Chattopadhay, P. C. Rakshit.
2. Fundamentals of Quantum Mechanics, by P. R. Waghmare
3. Quantum Mechanics, by John L. Powel, Bernd Crasemann.
4. Quantum Mechanics, by Mathews and Venketesan.
5. Quantum Mechanics, by A. K. Ghatak, S. lokanathan.

6. Quantum Mechanics, by S. P. Singh, M. K. Bagde and Kamal Singh.
7. Quantum Mechanics, by Chatwal, Anand, Himalaya publications.
8. Advanced Quantum Mechanics, by- Satya Prakash, Pragati Publications.

SUBJECT: PHYSICS

B.SC. –II SEMESTER - IV

DSC: BPH242T: PAPER- II (Basic Electronics)

Marks- 40 **Time- 30 hours**

OBJECTIVES:

1. To disseminate the concepts of basic electronics
2. To disseminate the fundamental knowledge of different electronic components
3. Provide opportunities for scientific study and creativity within a global context that will stimulate and challenge the students.

OUTCOMES:

1. Students gain knowledge of concepts of electronics
2. They the fundamental knowledge of different electronic components and their applications
3. Apply the knowledge to solve problems based on above properties to strengthen their basics

UNIT 1: PN junction; Formation, depletion region, barrier potential, symbol, biasing modes, V-I characteristics, diode current equation, effect of temperature on diode current, ideal diode, basic diode ratings, Zener diode: Construction, working, V-I characteristics & application of Zener diode as voltage regulator

UNIT 2: Transistor Basics: Formation of transistor: PNP and NPN, symbols, working principle, transistor current equation. Modes of operation; CB, CE and CC, input output and transfer characteristics in CB and CE configuration, definition of α, ß and relation between them, Regions of operation (active, cut off and saturation), load line and Q point, Transistor as an amplifier and switch in CE configuration, Leakage currents, Thermal Runaway, Stabilization, Stability factor, Bias stabilizing circuits.

UNIT 3: Field Effect Transistors: Construction, working and characteristics of JFET, Parameters: drain resistance, transconductance, amplification factor and their relation. MOS Field Effect Transistors: Types of MOSFETs, their Construction, Working and Characteristic curves.

UNIT 4: Switching Devices:
i) UJT: Construction, Working principle, characteristic curves, symbol and Application as relaxation oscillator and sawtooth generator, SCR
Optoelectronic devices: Solar cells (Photovoltaic cell), Photodiodes, LED: Construction and working and their I-V characteristics

References:

1. Electronics by V. K. Mehata
2. Basic electronics by Malvino
3. Basic electronics by B.L. Theraja
4. Electronic devices and circuit theory by Boylestad, Pearson publication,

SUBJECT: PHYSICS

B.SC. –II SEMESTER - IV

DSC: BPH243P: PRACTICAL

1. To study the characteristics of PN junction diode.
2. To study the characteristics of zener diode.
3. To study the zener diode voltage regulating characteristics.
4. Study of characteristics of LED.
5. To study the characteristics of FET
6. To study the characteristics of photo diode and use as light sensor (LDR).
7. Study of Solar cell as a Photo voltaic cell.
8. Study of characteristics of transistor in common base mode.
9. Study of characteristics of transistor in common emitter mode.
10. To study the variation of gain with frequency of single stage common emitter amplifier.
11. To study the frequency response of a single stage transformer coupled transistor amplifier.
12. To study variation of gain of CE amplifier with load at fixed frequency.
13. Study of characteristics of field effect transistor.
14. Study of FET as an amplifier.
15. To determine the Rydberg constant for Hydrogen.
16. To determine the plank's constant 'h' by vacuum type photocell using DPMS.
17. To determine Planck's constant by photo cell.
18. To determine Planck's constant by solar cell.

SUBJECT: PHYSICS

B.SC. –II SEMESTER - IV

Minor: BPH244T: PAPER- III (Concepts in Quantum Mechanics**)**

Marks- 40 **Time- 30 hours**

OBJECTIVES: 1. To disseminate the knowledge of quantum mechanics

2. Provide opportunities for scientific study and creativity

OUTCOMES: 1. Students gain knowledge of quantum mechanics

2. Apply the knowledge to solve problems based on above properties to strengthen their concepts

UNIT-I Unit I: 7.5 hrs.

Failure of classical physics to explain: black body radiations, wiens theory, Rayleigh-Jeans law, Planck's radiation law, photoelectric effect, characteristic of photoelectric effect, Einstein's explanation of photoelectric effect, Compton Effect, Rutherford's model of atom, Bohr's postulates, Wave particle duality, de Broglie's hypothesis.

Unit II: 7.5 hrs.

Superposition principle, construction of wave packet, Concept of wave velocity and group velocity,

Davisson and Germer experiment, Heisenberg's uncertainty principle and Heisenberg's gamma ray microscope,

Schrodinger's equation (Time dependent and time independent equations), Physical significance of wave function Ψ, normalization of wave function, Probability current density, Operators, Expectation values of a dynamical quantities, Ehrenfest's theorem.

UNIT III : 7.5 hrs.

Linear operators, Eigen value and Eigen functions. One-dimensional applications of Schrodinger equations: free particle, step potential, Particle in a one dimensional potential box, Particle in a one dimensional well, rectangular potential barrier.

UNIT IV: 7.5 hrs.

One dimensional linear harmonic oscillator, Three- dimensional linear harmonic oscillator, zero-point energy, spherically symmetric system and potential, separation of variables, solution of ø, solution of Θ, solution of R, wave equation of hydrogen atom, reduction of equivalent one-body problem, Schrodinger solution of hydrogen atom , selection rule, forbidden and allowed transition.

References:

9. Quantum Mechanics, Statistical Mechanics and SSP, by D. Chattopadhay, P. C. Rakshit.
10. Fundamentals of Quantum Mechanics, by P. R. Waghmare
11. Quantum Mechanics, by John L. Powel, Bernd Crasemann.
12. Quantum Mechanics, by Mathews and Venketesan.
13. Quantum Mechanics, by A. K. Ghatak, S. lokanathan.
14. Quantum Mechanics, by S. P. Singh, M. K. Bagde and Kamal Singh.

15. Quantum Mechanics, by Chatwal, Anand, Himalaya publications.
16. Advanced Quantum Mechanics, by- Satya Prakash, Pragati Publications.

SUBJECT: PHYSICS

B.SC. –II SEMESTER - IV

Minor: BPH245T: PAPER- II (Fundamental of electronics)

Marks- 40 **Time- 30 hours**

OBJECTIVES:

11. To disseminate the concepts of basic electronics

12. To disseminate the fundamental knowledge of different electronic components

13. Provide opportunities for scientific study and creativity within a global context that will stimulate and challenge the students.

OUTCOMES:

4. Students gain knowledge of concepts of electronics
5. They the fundamental knowledge of different electronic components and their applications
6. Apply the knowledge to solve problems based on above properties to strengthen their basics

UNIT 1: PN junction; Formation, depletion region, barrier potential, symbol, biasing modes, V-I characteristics, diode current equation, effect of temperature on diode current, ideal diode, basic diode ratings, Zener diode: Construction, working, V-I characteristics & application of Zener diode as voltage regulator

UNIT 2: Transistor Basics: Formation of transistor: PNP and NPN, symbols, working principle, transistor current equation. Modes of operation; CB, CE and CC, input output and transfer characteristics in CB and CE configuration, definition of α, ß and relation between them, Regions of operation (active, cut off and saturation), load line and Q point, Transistor as an amplifier and switch in CE configuration, Leakage currents, Thermal Runaway, Stabilization, Stability factor, Bias stabilizing circuits.

UNIT 3: Field Effect Transistors: Construction, working and characteristics of JFET, Parameters: drain resistance, transconductance, amplification factor and their relation. MOS Field Effect Transistors: Types of MOSFETs, their Construction, Working and Characteristic curves.

UNIT 4: Switching Devices:
i) UJT: Construction, Working principle, characteristic curves, symbol and Application as relaxation oscillator and sawtooth generator, SCR
Optoelectronic devices: Solar cells (Photovoltaic cell), Photodiodes, LED: Construction and working and their I-V characteristics

References:

5. Electronics by V. K. Mehata
6. Basic electronics by Malvino
7. Basic electronics by B.L. Theraja
8. Electronic devices and circuit theory by Boylestad, Pearson publication,

SUBJECT: PHYSICS

B.SC. –II SEMESTER - IV

MINOR : BPH246P : Practical

1. To study the characteristics of PN junction diode.
2. To study the characteristics of zener diode.
3. To study the zener diode voltage regulating characteristics.
4. Study of characteristics of LED.
5. To study the characteristics of FET
6. To study the characteristics of photo diode and use as light sensor (LDR).
7. Study of Solar cell as a Photo voltaic cell.
8. Study of characteristics of transistor in common base mode.
9. Study of characteristics of transistor in common emitter mode.
10. To study the variation of gain with frequency of single stage common emitter amplifier.
11. To study the frequency response of a single stage transformer coupled transistor amplifier.
12. To study variation of gain of CE amplifier with load at fixed frequency.
13. Study of characteristics of field effect transistor.
14. Study of FET as an amplifier.
15. To determine the Rydberg constant for Hydrogen.
16. To determine the plank's constant 'h' by vacuum type photocell using DPMS.
17. To determine Planck's constant by photo cell.
18. To determine Planck's constant by solar cell.

SUBJECT: PHYSICS

B.SC. –II SEMESTER - IV

GE: BPH247T: PAPER- II (Introduction to astronomy)

Marks- 40 **Time- 30 hours**

Course objectives:

- To inculcate a scientific awareness about the vastness of the space
- To introduce the learners to the exciting world of astronomy
- To explore and compare properties of the planets in solar system
- To understand the structure of the Universe and our position in it

Course outcomes:

After completing the course, the students are enable to

- identify the objects visible to the unaided eye in the night sky
- explain the phenomenon like seasons on the Earth, solar and lunar eclipses
- explain the dynamics of planets in solar system, use the orbital properties to estimate mass of the Sun
- compare and contrast the terrestrial planets and the Jovian planets
- derive the scientific understanding and explain the observed properties of stars and estimate
- their temperature, mass, size, etc.
- describe the scale of the Universe and the relative sizes of the different objects within the Universe
- describe the Earth's place in the Solar System, Galaxy, and Universe

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Unit 1: Observational Astronomy 7.5 Hrs

Contribution of Ptolemy, Copernicus, Tycho Brahe, Johannes Kepler, Galileo Galilei

Concepts of Positional Astronomy: the Celestial Sphere, the cardinal points and circles on the celestial sphere, the alt-azimuth, equatorial coordinate systems, Sidereal, Apparent and Mean solar time and their relations , Constellations and nomenclature of stars: Aries, Pisces, Orion, Canis major, Taurus, Leo, Summer Triangle and Big Dipper (Saptarsi)

Unit 2: The Solar System 7.5 Hrs

The Sun and its atmosphere, planetary system, elliptical orbits of planets and Kepler’s laws

Terrestrial planets, Jovian Planets, characteristics of terrestrial and Jovian planets, asteroids, meteors and meteorites, comets, Phases and motion of the Moon, solar and lunar eclipses, Seasons, origin of the solar system – the nebular model

Unit 3: Astronomical Measurements 7.5 Hrs

Concept of Astronomical Unit, light year, Parcsec, Distance measurement techniques: Radar ranging, parallax method, Luminosity, flux, surface brightness of a star, apparent and absolute magnitude, Distance-modulus relationship and it's application

Unit 4: Physics of Stars 7.5 Hrs

classification of stars, H-R Diagram and its salient features, Color index and temperatures of stars, Population I and Population II stars, Life cycle of a star, White dwarf, Neutron Stars, Black hole.

Reference:

- An Introduction to astrophysics by Baidyanath Basu, PHI Learning Pvt. Ltd.
- The Physical Universe by Frank H. Shu, University of California, Berkeley
- Seven Wonders of the Sky by Jayant Vishnu Narlikar,Cambridge University Press
- Astrophysics for Physicists by Arnab Rai Chaudhari, Cambridge University Press
- V. B. Bhatia , Textbook of Astronomy and Astrophysics with Elements of
- Cosmology, Narosa Publishing House, New Delhi.
- Astrophysics: Stars and Galaxies, K. D. Abhyankar, Tata McGraw Hill
- Publication
- An Introduction to astrophysics , Baidyanath Basu, PHI Learning Pvt. Ltd.

SUBJECT: PHYSICS

B.SC. –II SEMESTER - IV

VSEC: BPH248P: (Computer hardware and maintenance)

Marks- 40 **Time- 30 hours**

1. Introduction of Hardware and software/ and understating of components of computer
2. Information regarding mother board, chipset and microprocessor
3. Different type of floppy drive and other components viz. HDD, DVD, RAM, SMPS and BIOS
4. Handling and holding sensitive equipment, installing motherboard, choosing cabinet and cooling considerations, installing CPU.
5. Assembling different part of computers
6. Knowing ports, wires attached in the PC, knowing SATA slot, IDE slots.
7. CMOS and Setting BIOS configurations.
8. Installation of OS and application software, handling viruses.
9. Networking basics: different wires, hubs, connectors, punching tools.
10. Creation of cross wires and direct cables.
11. IP and/ setting of a computer on LAN.

END of SEM IV