B. Sc.

Physics	
Program Out Come	The ability to think creatively in order to provide fresh ideas for explaining facts or solving issues. To have experience using scientific instruments, designing and conducting laboratory experiments, and drawing logical conclusions from them. To raise environmental awareness among faculty and students. To comprehend the essential concepts, principles, and scientific theories behind numerous scientific phenomena, as well as their application in everyday life.
Programe Specific Outcome	The student who completes the B. Sc. (Physics) programme will be able to: -Exhibit the ability to translate a physical description into a mathematical equation and explain the physical meaning of mathematics, portray fundamental parts of physics using graphs and diagrams, and solve problems using geometric arguments -Problem-solving in general, with a focus on qualitative and quantitative data, with applications to circumstances where evaluations must be made with little information. be able to do numerical, computational, and data-processing tasks. -Apply fundamental physics knowledge, such as basic concepts and principles in 1) Newtonian Mechanics, Classical Mechanics, Optics, Electronics, Electrodynamics, Thermodynamics, Quantum Mechanics, Solid State Physics, and 2) Mathematical (analytic and numerical) Methods and Experimental Methods for Physics, to pursue further study in various branches of physics.

Course Outcomes

In force from: June -2019

Veer Narmad South Gujarat University, Surat

Syllabus for F. Y. B. Sc. Sem I

Physics Paper I (PH – 101)

Unit 1	**Vector analysis (Vector analysis by Murray Spiegel Schaum's Outline 2nd Ed. McGraw-Hill, 2009)**
	Dot or scalar product, Cross or vector product, Triple product, reciprocal sets of vectors (Ch. 2), Ordinary derivatives of vectors, space curves, continuity and differentiability, differentiation formulae, Partial derivatives of vectors, differentials of vectors, differential geometry (Ch. 3), The vector differential operator del., the gradient, the divergence and the curl, formulae involving del, invariance(Ch. 4) Ordinary integrals of vectors, line integrals, surface integrals and volume integrals (Ch. 5), The divergence theorem of gauss, Stokes' theorem, Green's theorem in the plane, related integral theorems, integral operator form for del (Ch. 6) (Theorem statements only)
Unit 2	**Force and Newton's laws and Force and Newton's laws (Physics by Halliday, Resnick and Krane, Vol. 1, 5thEd. Wiley)**
	Classical Mechanics (3.1), Newton's first law (3.2), Force (3.3), Mass (3.4), Newton's second law (3.5), Newton's third law (3.6), Weight and mass (3.7), Applications of Newton's laws in one dimension (3.8), Motion in three dimensions with constant acceleration (4.1), Newton's laws in three dimensional vector form (4.2) Projectile motion (4.3), Drag forces and the motion of projectile (4.4), Uniform circular motion (4.5), Relative motion (4.6)
Unit 3	**Momentum and System of particles(Physics by Halliday, Resnick and Krane, Vol. 1, 5thEd.Wiley)**
	Collisions (6.1), Linear momentum (6.2), Impulse and momentum (6.3), conservation of momentum (6.4), two boy collisions (6.5), Two particle systems (7.2), many particle systems (7.3), centre of mass of solid objects (7.4), conservation of momentum in a system of particles (7.5), system of variable mass (7.6), rotational motion (8.1), The rotational variables (8.2), Rotational quantities as vectors (8.3), rotation with constant angular acceleration (8.4), relationships between linear and angular variables (8.6)
Unit 4	**Elasticity (Properties of Matter by D. S. Mathur, S Chand & Co., 2009)**
	Introduction (8.1), Load, stress and strain (8.2), Hooke's law (8.3), ductility, brittleness and plasticity (8.4), elastic behaviour of solids in general (8.5), factors affecting elasticity (8.7), three types of elasticity (8.8), equivalence of a shear to a compression and an extension at right angles to each other (8.9), deformation of a cube – bulk

	modulus (8.12), modulus of rigidity (8.13), Young's modulus (8.14), relations connecting the elastic constant (8.15), Poisson's ratio (8.16), relations for K and n in terms of Poisson's ratio (8.17), limiting values of σ (8.18)

Suggested Books:

1. Mathematical Methods for Physics and Engineering by Riley, Hobson and Bence, Cambridge University Press, 1998.
2. Mechanics (Berkley Physics Course 1 by C Kittle, W D Knight, M Alvine and A Ruderman, Tata McGraw-Hill, 1991.
3. University Physics by Young and R. Freedman, Pearson 13th Ed., 2013.

Syllabus for F. Y. B. Sc. Sem I

Physics Paper II (PH – 102)

Unit 1	**Electrostatics I (Physics by Halliday, Resnick and Krane, Vol. 2, 5th Ed. Wiley)**
	Coulomb's law (25.4), what is a field? (26.1), the electric field (26.2),), electric field of point charges (26.3),), electric field of continuous charge distributions (26.4), electric field lines (26.5), a point charge in an electric field (26.6) What is Gauss' law all about? (27.1), the flux of a vector field (27.2), the flux of the electric field (27.3), Gauss' law (27.4), applications of Gauss' law (27.5), Gauss' law and conductors (27.6), experimental tests of Gauss' law and Coulomb's law (27.7)
Unit 2	**Electrostatics II (Physics by Halliday, Resnick and Krane, Vol. 2, 5th Ed. Wiley)**
	Potential energy (28.1), electric potential energy (28.2), electric potential (28.3), calculating the potential from the field (28.4), potential due to point charges (28.5), electric potential of continuous charge distributions (28.6), calculating the field from the potential (28.7), equi-potential surfaces (28.8), Electric current (31.1), electromotive force (31.2), analysis of circuits (31.3), RC circuits (31.7)
Unit 3	**Diode circuits (Electronic principles by A. P. Malvino, 6th Ed. Tata McGraw-Hill)**
	The half-wave rectifier (4.1), the transformer (4.2), the full-wave rectifier (4.3), the bridge rectifier (4.4), the choke input filter (4.5), the capacitor input filter (4.6), peak inverse voltage and surge current (4.7), clippers and limiters (4.10), clampers (4.11)
Unit 4	**Optics (Optics by AjoyGhatak, 6th Ed. McGraw-Hill Education)**
	Introduction (3.1), laws of reflection and refraction from Fermat's principle (3.2), 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), The matrix method (5.2), Unit planes (5.3), Nodal planes (5.4), A system of two thin lenses (5.5)

Suggested Books:

1. Elements of Electromagnetics by M N O Sadiku, Oxford University Press, 2001
2. Electricity and Magnetism by A S Mahajan and A R Rangwala 7th Ed. Tata McGraw-Hill, 2003.
3. University Physics by H. D. Young, R. A. Freedman and A. Lewis Ford, 13th Ed. Pearson Education, 2013
4. Fundamentals of Optics by F. Jenkins and H. White, 4th Ed. McGraw Hill Education, 2017

Syllabus for F. Y. B. Sc. Sem I

Practical (PH – 103)

List of experiments

	Group A
1	Error analysis and least square fit
2	To verify the parallel axes theorem of moment of inertia
3	To verify the perpendicular axes theorem of moment of inertia
4	Modulus of rigidity of a wire using torsional pendulum
5	Modulus of rigidity of a rod by Searle's apparatus
6	Poisson's ratio of rubber

	Group B
1	Low resistance by Wheatstone's bridge method of projection
2	Study of decay of current in RC circuit
3	Study of rectifiers (Half wave and full wave rectifier)
4	Resistivity of the material of a conductor using Ohm's law
5	Cardinal points of a lens system placed in air
6	To determine angle of prism using spectrometer

Suggested Books

1. D.C.Tayal ,University Practical physics,Edited by Ila Agarwal ,Himalayan Publishing House
2. B. L. Worsnop and H. T. Flint, Advanced Practical Physics, Asia Publishing House, New Delhi.
3. P. Khandelwal, A Laboratory Manual of Physics for Undergraduate Classes, Vani Publication House, New Delhi.
4. Geeta Sanon, BSc Practical Physics, 1st Edn. (2007), R. Chand & Co.

Note:

1. The duration of each experiment is of 2 hours. Two such experiments are to be performed by each student per week.
2. In the external exam, a student will have to perform two experiments, one from each group. The experiment will be of 2 hours duration.
3. ~~It is recommended that~~ There should not be more than 20 students per batch in the external exam.

Structure for B.Sc. Syllabus

Inforce from June 2019

B. Sc. (PHYSICS)

Sr. No.	Course Code	Course Title	Credits
1	PH-201	Physics Paper I	2
2	PH-202	Physics Paper II	2
3	PH-203	Practical	2

Faculty Code: **Science** Subject Code: **PH**

Name of Program: **B.Sc.** Subject: **PHYSICS**

External Examination Time Duration: **02 Hours**

Name of Exam	Semester	PAPER No.	Course Group	Credit	Internal Marks	External Marks	Total Marks
B.Sc.	1	PH-101		02	20	50	70
		PH-102		02	20	50	70
		PH-103	Practical	02	20	40	60

Syllabus for F. Y. B. Sc. Sem II

Physics Paper I (PH – 201)

Unit 1	**Angular momentum and Gravitation (Physics by Halliday, Resnick and Krane, Vol. 1, 5thEd.)**
	Torques (9.1), rotational inertia and Newton's second law (9.2), rotational inertia of solid bodies (9.3), torque due to gravity (9.4), equilibrium applications of Newton's laws for rotation (9.5) Angular momentum of a particle (10.1), systems of particles (10.2), angular momentum and angular velocity (10.3), conservation of angular momentum (10.4), the spinning top (10.5), Origin of the law of gravitation (14.1), Newton's law of universal gravitation (14.2), the gravitational constant G (14.3), gravitation near the earth's surface (14.4), the two shell theorems (14.5), gravitational potential energy (14.6), the gravitational field (14.7), modern developments in gravitation (14.8)
Unit 2	**Oscillation and Waves (Oscillation and Waves by Suresh Garg, C. K. Ghosh and Sanjay Gupta)**
	Introduction (3.1), principle of superposition and linearity (3.2), superposition of two collinear SHOs of same frequency (3.3), superposition of two collinear SHOs of nearly equal frequencies (3.4), superposition of two mutually perpendicular harmonic oscillations (3.6), describing wave motion (7.3), phase of a wave (7.4), energy transported by a progressive wave (7.5), intensity of a wave (7.6)
Unit 3	**Particle properties of waves (Concepts of Modern Physics by A. Beiser)**
	Blackbody radiation (2.2), photoelectric effect (2.3), what is light (2.4), X- rays (2.5), X-ray diffraction (2.6), Compton effect (2.7), pair production (2.8), photons and gravity (2.9)
Unit 4	**Elasticity (Properties of Matter by D.S. Mathur, S Chand & Co., 2009)**
	Twisting couple on a cylinder (8.22), tensional pendulum (8.26), determination of coefficient of rigidity (n) for a wire (8.27), bending of a beam (8.39), the cantilever (8.30), transverse vibrations of a loaded cantilever (8.32), depression of a beam supported at the ends (8.33), determination of Y by bending of beams (8.34), determination of elastic constants by Searle's method (8.36)

Suggested Books:

1. Mechanics (Berkley Physics Course 1 by C Kittle, W D Knight, M Alvine and A Ruderman, Tata McGraw-Hill, 1991.
2. Modern Physics by Kenneth S Krane Wiley India Edition, 2016
3. Vibrations and Waves by A. P. French, CBS; 1st Ed., 2003

Syllabus for F. Y. B. Sc. Sem II

Physics Paper II (PH – 202)

Unit 1	**Magneto-statics and electromagnetic induction (Physics by Halliday, Resnick and Krane, Vol. 2, 5thEd.)**
	Magnetic interactions and magnetic poles (32.1), the magnetic force on a moving charge (32.2), circulating charges (32.3), the magnetic force on a current carrying wires (32.5), the torque on a current loop (32.6), Faraday's experiments (34.1), Faraday's law of induction (34.2), Lenz's law (34.3), motional emf (34.4), generator and motor (34.5)
Unit 2	**Thermodynamics (Physics by Halliday, Resnick and Krane, Vol. 2, 5thEd.)**
	Temperature and thermal equilibrium (21.1), thermal expansion (21.4), the ideal gas (21.5), a molecular view of pressure (22.2), the mean free path (22.3), the distribution of molecular speeds (22.4), equations of state for real gas (22.6), heat: energy and transit (23.1), the transfer of heat (23.2), the first law of thermodynamics (23.8), the application of the first law of thermodynamics (23.8), defining entropy change (24.2), entropy change for irreversible process (24.3), the second law of thermodynamics (24.4), entropy and the performance of engines (24.5), entropy and the performance of refrigerators (24.6), the efficiency of real engines (24.7)
Unit 3	**Special purpose diodes and Bipolar Junction Transistors (Electronic principles by A. P. Malvino, 6th Ed. Tata McGraw-Hill Ltd.)**
	The zener diode (5.1), the loaded zener regulator (5.2), optoelectronic devices (5.8), The unbiased transistor (6.1), the biased transistor (6.2), transistor currents (6.3), the CE connection (6.4), the base curve (6.5), collector curves (6.6)
Unit 4	**Optics (Optics by Ajoy Ghatak, 6thEd. McGraw-Hill Education)**
	Introduction (12.1), Huygens' theory (12.2), rectilinear propagation (12.3), introduction (13.1), superposition of two sinusoidal waves (13.5), introduction (14.1), coherence (14.3), interference of light waves (14.4), the interference pattern (14.5), the intensity distribution (14.6), introduction (18.1), single slit diffraction pattern (18.2)

Suggested Books:

1. Electricity and Magnetism by A S Mahajan and A R Rangwala 7thEd. Tata McGraw-Hill, 2003.
2. University Physics by H. D. Young, R. A. Freedman and A. Lewis Ford, 13th Ed. Pearson Education, 2013
3. Fundamentals of Optics by F. Jenkins and H. White, 4th Ed. McGraw Hill Education, 2017

Syllabus for F. Y. B. Sc. Sem II

Practical (PH – 203)

List of experiments

	Group A
1	Force constant (k) of a spring
2	Elastic constants (Y, η, K & σ) by Searle's method
3	Characteristics of photocell
4	"Y" by cantilever
5	"Y" by bending of a beam supported at two ends & loaded in the middle
6	Thermal conductivity of a bad conductor by Lee's method

	Group B
1	Study of magnetic field due to Solenoid
2	Characteristics of BJT (CE configuration)
3	Wattage of a lamp
4	Newton's rings experiment
5	To determine refractive index of the material of prism using spectrometer
6	Zener diode as a voltage regulator

Suggested Books

1. D.C.Tayal ,University Practical Physics, Edited by Ila Agarwal ,Himalayan Publishing House
2. B. L. Worsnop and H. T. Flint, Advanced Practical Physics, Asia Publishing House, New Delhi.
3. P. Khandelwal, A Laboratory Manual of Physics for Undergraduate Classes, Vani Publication House, New Delhi.
4. Geeta Sanon, BSc Practical Physics, 1st Edn. (2007), R. Chand & Co.

Note:

1. The duration of each experiment is of 2 hours. Two such experiments are to be performed by each student per week.
2. In the external exam, a student will have to perform two experiments, one from each group. The experiment will be of 2 hours duration.
3. It is recommended that there should not be more than 20 students per batch in the external exam.

Evaluation:

Pattern of end-semester examination

For Semesters I and III

1. The question paper will comprise of objective type questions totalling 50 marks.
2. There shall be negative marking of 25% marks per wrong questions attempted.
3. No marks will be deducted for not attempting a question.

For Semesters II, IV, V and VI

1. The question paper will be of 50 marks.
2. There shall be five questions carrying 10 marks each.
3. Question 1 will consist of 12 short answer questions of 1 mark each. A student can answer any 10 questions. Question 1 will cover the whole syllabus and 3 short answer questions will be asked from each unit.
4. Question 2 will be asked from unit 1, question 3 from unit 2, question 4 from unit 3 and question 5 from unit 4.
5. Question 2 onwards, each question will consist of option (a) or (b). Each question will include two sub-questions. Each sub-question will have theory based questions of 6 marks followed by one problem or application of 4 marks. A student should attempt any one of the two options (a) or (b).

Structure for B. Sc. Syllabus

B. Sc. (PHYSICS)

Sr. No.	Course Code	Course Title	Credits
1	PH – 303	Physics Paper III	02
2	PH – 304	Physics Paper IV	02
3	PH – 305	Physics Paper V	02
4	PH – 306	Practicals	02

Faculty code: Science **Subject code: PH**

Name of the Program: B. Sc. **Subject: PHYSICS**

External Examination Time Duration: 2 hrs.

Name of Exam	Semester	Paper No.	Course Group	Credit	Internal Marks	External Marks	Total Marks
B. Sc.	III	PH – 303	Theory	02	20	50	70
		PH – 304	Theory	02	20	50	70
		PH – 305	Theory	02	20	50	70
		PH – 306	Practical	02	20	40	60

S. Y. B. Sc. SemIII

Physics Paper III (PH – 303)

Unit 1	**Kinetic theory of gases (Thermal Physics by Garg, Bansal and Ghosh, 2nd Ed., McGraw Hill Education (India) Pvt Ltd. Chennai, 2012)**
	Classical theory of heat capacities of gases (1.4), Distribution of Molecular velocities in a perfect gas (1.5), Energy distribution of a Maxwellian gas (1.6), Experimental verification of Maxwell's distribution law (1.7)
Unit 2	**Damped Oscillations (Oscillations and Waves by Garg, Bansal and Ghosh, 2nd Ed., PHI Learning PVt Ltd. New Delhi, 2009)**
	Introduction (4.1), Types of Damping forces (4.2), Equation of motion of a 1-D Damped Oscillator (4.3), Solutions of the Equation of motion of a 1-D Damped Oscillator (4.4), Non-mechanical damped system (4.5), Energy of a weakly damped system (4.6), Characterising weak damping (4.7)
Unit 3	**Forced Oscillations(Oscillations and Waves by Garg, Bansal and Ghosh, 2nd Ed., PHI Learning PVt Ltd. New Delhi, 2009)**
	Introduction (5.1), Free and forced scillations: Resonance (5.2), Forced oscillations of a 1-D weakly damped oscillator (5.3), Steady state behaviour of a 1-D weakly damped forced oscillator (5.4), Amplitude and resonance (5.5), Power absorbed by a weakly damped forced oscillator (5.6), Quality factor: Sharpness of resonance (5.7), A resonant LCR circuit (5.8)
Unit 4	**Charged Particles in Electromagnetic Fields (Electricity and Magnetism by D C Tayal, 4th Revised Ed., Himalaya Publishing House, India, 2019)**
	Charged particles in crossed electric and magnetic fields(11.8)(i)velocity selector, (ii)Hall effect, (iii) e/m by Thomson method, (iv) Mass spectrograph, Aston mass spectrograph(11.9), Dempster's mass spectrograph(11.10), Bainbridge's mass spectrograph(11.11), Electron optics (Electron microscope)(11.12).

Suggested books

1. Heat & Thermodynamics by Zemansky and Dittman, 8th Ed., McGraw Hill Education Pvt. Ltd. New Delhi, 2011.
2. Fundamentals of Statistical and Thermal Physics by F.Reif, 1st Indian Ed., Levant Books, 2010.
3. Elements of Electromagnetics by M N O Sadiku, Oxford University Press, 2001
4. Electricity and Magnetism by A S Mahajan and A R Rangwala 7thEd. Tata McGraw-Hill, 2003.

S. Y. B. Sc. Sem III

Physics Paper IV (PH – 304)

Unit 1	**Wave Properties of Particles (Concepts of Modern Physics by Arthur Beiser, 6th Ed., TataMcBraw-Hill Publishing Co. Ltd. New Delhi, 2003)**
	De Broglie Waves (3.1), Waves of What? (3.2),Describing a Wave (3.3),Phase and Group Velocities (3.4),Particle Diffaraction(3.5),Particle in a Box (3.6),Uncertainty Principle-I (3.7),Uncertainty Principle-II (3.8),Applying the Uncertainty Principle(3.9).
Unit 2	**Atomic Structure (Concepts of Modern Physics by Arthur Beiser, 6th Ed., TataMcBraw-Hill Publishing Co. Ltd. New Delhi, 2003)**
	Atomic Structure (4.3),The Bohr Atom (4.4),Energy levels and Atomic Spectra (4.5),Correspondence Principle(4.6), Nuclear Motion (4.7), Atomic Excitation (4.8), The Laser(4.9).
Unit 3	**Fraunhofer Diffraction (Optics by AjoyGhatak 6th Ed., McGrawHill Education (India) Pvt. Ltd. New Delhi, 2017)**
	Diffraction by a Circular Aperture (18.3),Resolving Power of a Microscope(18.5.1),The Diffraction Grating (18.8),The Grating Spectrum (18.8.1),Resolving Power of a Grating(18.8.2),Resolving Power of a Prism(18.8.3),Oblique Incidence(18.9), X-ray Diffraction (18.10).
Unit 4	**Aberrations (Optics by AjoyGhatak 6th Ed., McGrawHill Education (India) Pvt. Ltd. New Delhi, 2017)**
	Introduction (6.1), Chromatic aberration (6.2), The achromatic doublet (6.2.1), Removal of chromatic aberration of a spherical doublet (6.2.2), Monochromatic aberrations (6.3), Spherical aberration (6.3.1), Coma (6.3.2), astigmatism and curvature of field (6.3.3), Distortion (6.4)

Suggestedbooks

1. Modern Physics by Kenneth Krane
2. Fundamentals of Optics by Jenkins and White
3. Optics by Eugene Hecht

S. Y. B. Sc. Sem III

Physics Paper V (PH – 305)

Unit 1	**Fourier Series (Mathematical Physics by B. S. Rajput, PragatiPrakashan, India, 2013)**
	Definition (7.1), Dirichlet's condition (7.2), Graphical representation of a function (7.3), Extension of the interval (7.4), Complex form of Fourier series (7.5), Advantages of Fourier series (7.6), Properties of Fourier series (7.7)
Unit 2	**Thermoelectricity (Electricity and Magnetism by D C Tayal, 4th Revised Ed., Himalaya Publishing House, India, 2019)**
	Seeback Effect(9.1), Peltier Effect(9.2), Thomson Effect(9.3),Measurement of thermos emf(9.8),Applications of thermos emf (9.9) (i)Thermopyle (ii) Bolometer (iii)Boy's radio micrometer (iv) Duddle thermos galvanometer (v) Thermoelectric pyrometer (vi) Thermomilliameter.
Unit 3	**Transistor BiasingandAC Models (Electronics Principles by Malvino, 6th Ed., Tata McGraw-Hill Publishing Co. Ltd., New Delhi, 1999)**
	Voltage Sources(1.3), Current Sources (1.4) ,Thevinin's Theorem(1.5),Norton's Theorem(1.6), Voltage Divider Bias(8.1),Accurate VDB analysis(8.2),VDB load line & Q point(8.3),Two-Supply Emitter Bias(8-4),Other types of Biases(8.5),Troubleshooting (8.6), PNP transistors (8.7), Base-Baised Amplifier(9.1), Emitter-Baised Amplifier (9.2), Small-Signal operation(9.3), AC Beta(9.4), AC Resistance of the Emitter Diode(9.5), Two Transistor Models(9.6), Analyzing an Amplifier (9.7), AC quantities on the Data Sheet (9.8).
Unit 4	**Voltage and Power Amplifiers (Electronics Principles by Malvino, 6th Ed., Tata McGraw-Hill Publishing Co. Ltd., New Delhi, 1999)**
	Voltage gain (10.1), The loading effect of input inpedance (10.2), Multistatgeamplifier (10.3), Swamped amplifier (10.4), Two stage feedback (10.5) Amplifier terms (11.1), Two load lines (11.2), Class A operation (11.3), Class B operation (11.4), Class C operation (11.5), Class C formulas (11.6), Transistor power rating (11.7)

Suggested books

1. Elements of Electromagnetics by M N O Sadiku, Oxford University Press, 2001
2. Electricity and Magnetism by A S Mahajan and A R Rangwala 7thEd. Tata McGraw-Hill, 2003.
3. Electronic Devices and Circuit Theory by Boylestad
4. Mathematical Methods in the Physical sciences: Mary L. Boas Wiley India, 3rd ed.

S. Y. B. Sc. Sem III

PH-306

LIST OF EXPERIMENTS

	GROUP A
1	To Study Simple and Damped Harmonic Motion
2	To study the oscillations of a bar pendulum
3	To determine the Boltzmann's constant using V-I characteristics of PN diode
4	To verify Stefan's fourth power law
5	To study the variation of thermo-emf with temperature
	GROUP B
1	To determine wavelength of spectral lines by plane transmission grating.(Minimum Deviation Method)
2	To determine the resolving power of a Prism
3	To study spherical aberration of a Plano-convex lens
4	To study diffraction by cylindrical obstacle.
5.	To find Cauchy's Constant.
	GROUP C
1	To find band gap of a semiconding material
2	To determine temperature coefficient of resistance of the given thermistor
3	To Verify Thevenin's theorem and to find equivalent Voltage of source circuit
4	To Verify Norton's theorem and to find equivalent Norton's components
5	To study series resonance in LCR circuit

Suggested books:

1. D.C.Tayal ,University Practical physics,Edited by Ila Agarwal ,Himalaya Publishing House
2. B. L. Worsnop and H. T. Flint, Advanced Practical Physics, Asia Publishing House, New Delhi.
3. P. Khandelwal, A Laboratory Manual of Physics for Undergraduate Classes, Vani Publication House, New Delhi.
4. GeetaSanon, BSc Practical Physics, 1st Edn. (2007), R. Chand & Co.

Note:

1. The duration of each experiment is of 2 hours. Three such experiments are to beperformed by each student per week.
2. In the external exam, a student will have to perform three experiments, one fromeach group. Each experiment will be of 2 hours duration.
3. There shall not be more than 20 students per batch in the external exam.

Structure for B. Sc. Syllabus

B. Sc. (PHYSICS)

Sr. No.	Course Code	Course Title	Credits
1	PH – 403	Physics Paper III	02
2	PH – 404	Physics Paper IV	02
3	PH – 405	Physics Paper V	02
4	PH – 406	Practicals	02

Faculty code: Science **Subject code: PH**

Name of the Program: B. Sc. **Subject: PHYSICS**

External Examination Time Duration: 2 hrs.

Name of Exam	Semester	Paper No.	Course Group	Credit	Internal Marks	External Marks	Total Marks
B. Sc.	IV	PH – 403	Theory	02	20	50	70
		PH – 404	Theory	02	20	50	70
		PH – 405	Theory	02	20	50	70
		PH – 406	Practical	02	20	40	60

S. Y. B. Sc. Sem IV

Physics Paper III (PH – 403)

Unit 1	**Thermodynamic relations, free energies and Thermodynamic equilibrium (Thermal Physics by Garg, Bansal and Ghosh, 2nd Ed., McGraw Hill Education (India) Pvt Ltd. Chennai, 2012)**
	The Maxwell relations (8.2), Thermodynamic relations involving heat capacities (8.3), The TdS equations (8.4), The energy equations (8.5), Heat of reaction: Gibbs-Helmholtz equation (8.6) General condition for a natural change (9.2), An adiabatic process (9.2.1), An isothermal process (9.2.2), Free energies and Maxwell relations (9.3), Thermodynamic mnemonic diagrams (9.4), General conditions for thermodynamic equilibrium (9.5), An adiabatic process (9.5.1), An isothermal process (9.5.2), equilibrium between phases (9.6), One component system (9.6.1), Multi-component systems: Gibbs phase rule (9.6.2)
Unit 2	**Production of low temperatures (Thermal Physics by Garg, Bansal and Ghosh, 2nd Ed., McGraw Hill Education (India) Pvt Ltd. Chennai, 2012)**
	Ordinary methods of cooling (10.2), Adiabatic cooling (10.3), Joule-Thomson effect (10.4), Joule-Kelvin effect: An isenthalpic process (10.4.1), Adiabatic demagnetisation (10.5), The third law of thermodynamics (10.9), consequences of the third law (10.9.1)
Unit 3	**Crystal Structure (Introduction to Solid State Physics by Charles Kittel, 8th Ed., John Wiley and Sons, 2005)**
	Chapter 1 (includes subtopics) Periodic array of atoms, Fundamental types of lattices, index systems for crystal planes, simple crystal structures, direct imagining of atomic structure, Non ideal crystal structures Chapter 2 (includes sbtopics) Diffraction of waves by crystals, Brillouin zones
Unit 4	**Crystal Vibrations (Introduction to Solid State Physics by Charles Kittel, 8th Ed., John Wiley and Sons, 2005)**
	Chapter 4 (includes subtopics) Vibrations of crystals with monoatomic bases, two atoms per primitive bases

Suggested books

1. Heat and Thermodynamics by Zemansky and Dittman, Wiley India
2. Solid State Physics by A Dekker

S. Y. B. Sc. Sem IV

Physics Paper IV (PH – 404)

Unit 1	**Quantum Mechanics ((Concepts of Modern Physics by Arthur Beiser, 6th Ed., TataMcBraw-Hill Publishing Co. Ltd. New Delhi, 2003)**
	Quantum Mechanics(5.1),Wave Equation(5.2),Schrodinger's Equation:Time Dependent Form(5.3),Linearity and Superposition(5.4),Expectation Values(5.5),Operators(5.6).
Unit 2	**Quantum Mechanics ((Concepts of Modern Physics by Arthur Beiser, 6th Ed., TataMcBraw-Hill Publishing Co. Ltd. New Delhi, 2003)**
	Schrodinger's Equation: Steady- State Form (5.7),Particle in Box(5.8),Finite Potential(5.9), Tunnel Effect(5.10), Harmonic Oscillator (5.11)
Unit 3	**Polarization and Double Refraction (Optics by AjoyGhatak 6th Ed., McGrawHill Education (India) Pvt. Ltd. New Delhi, 2017)**
	Introduction (22.1), Malus' Law (22.2), The Wire Grid Polarizer and the Polaroid (22.3.1),Polarization by Reflection(22.3.2),Polarization by Double Refraction(22.3.3),Polarization by Reflection(22.3.4),Analysis of Polarized Light(22.7), Optical Activity(22.8), Theory of Optical Activity (22.16)
Unit 4	**Lasers: An Introduction and Optical Fiber Basics (Optics by AjoyGhatak 6th Ed., McGrawHill Education (India) Pvt. Ltd. New Delhi, 2017)**
	Introduction(27.1),Spontaneous and Stimulated Emission(27.1.1), Main Components of the Lasers(27.1.2), Understanding Optical Amplification: The EDFA(27.1.3), The Resonator(27.1.4), The Lasing Action(27.1.5), The Fiber Laser(27.2), The Ruby Laser(27.3), The He-Ne Laser(27.4), Introduction(28.1), Total Internal Reflection(28.3), The Optical Fiber(28.4).

Suggestedbooks

1. Modern Physics by Kenneth S. Krane
2. Optics by Eugene Hecht
3. Fundamentals of Optics by Jenkins & White
4. An Introduction to Laser Theory and Applications by M. N. Avadhanulu

S. Y. B. Sc. Sem IV

Physics Paper V (PH – 405)

Unit 1	**Complex variable (Mathematical Physics by B. S. Rajput, PragatiPrakashan, India, 2013)**
	Function of complex variable (4.7), Analytical Function (4.8), Complex integration (4.11), Some special integrals (without proof) (4.12), Cauchy's theorem (without proof) (4.13), Cauchy's integral formula (without proof) (4.14), zeroes and singularities of complex functions (4.19), Residue (4.20), Cauchy's residue theorem (without proof) (4.21)
Unit 2	**Thermoelectricity (Electricity and Magnetism by D C Tayal, 4th Revised Ed., Himalaya Publishing House, India, 2019)**
	Impedance Bridge(17.18), Measurement of Inductance(17.19) (a) Maxwell's Impedance Bridge (b) Maxwell's LC bridge (c) Owen's Bridge: (d) Anderson's Bridge,Measurement of Capacitance(17.21) (a) De Sauty's Bridge (b) Wien's Bridge (c) Schering Bridge, Measurement of frequency (low)(17.22).
Unit 3	**Emiter Follower (Electronics Principles by Malvino, 6th Ed., Tata McGraw-Hill Publishing Co. Ltd., New Delhi, 1999)**
	CC amplifier (12.1) Output impedance (12.2), Maximum peak to peak output (12.3), Darlington connections (12.4), Class B push-pull emitter follower (12.5), Biasing Class B amplifiers (12.6), Class B driver (12.7), Voltage regulation (12.8)
Unit 4	**JFETs (Electronics Principles by Malvino, 6th Ed., Tata McGraw-Hill Publishing Co. Ltd., New Delhi, 1999)**
	Basic Ideas(13.1), Drain curves(13.2), The Transcoductance curve(13.3), Biasing intheOhmic region(13.4), Biasing in the active region (13.5), Transconductance (13.6), JFET amplifiers (13.7), The JFET analog switch (13.8), other JFET applications (13.9)

Suggestedbooks

1. Elements of Electromagnetics by M N O Sadiku, Oxford University Press, 2001
2. Electricity and Magnetism by A S Mahajan and A R Rangwala 7thEd. Tata McGraw-Hill, 2003.
3. Electronic Devices and Circuit Theory by Boylestad

S. Y. B. Sc. Sem IV

PH - 406

LIST OF EXPERIMENTS

	GROUP A
1	To study characteristics of Solar cell
2	To study divergence of LASER beam
3	To determine lattice parameters of a cubic single crystals structure.(From XRD pattern)
4	To find stopping potential using photocell
5	Y by bending
	GROUP B
1	Verification of Malus's Law
2	Verification of Brewster's Law
3	To determine wavelength of LASER beam using plane transmission grating.
4	To determine wavelength of spectral lines by plane transmission grating (Normal Incident Method)
5	To determine the specific rotation of a cane sugar by Laurent's half shade polarimeter
	GROUP C
1	To determine k_B/e using Transistor
2	To studyFET characteristics
3	To determine figure of merit of Ballistic galvanometer
4	To determine the self-inductance of a coil by Owen's bridge.
5	To determine the dielectric constant of a given liquid by Schering bridge.

Suggested books:

1. D C Tayal,University Practical Physics,Edited by Ila Agarwal ,Himalaya Publishing House
2. B. L. Worsnop and H. T. Flint, Advanced Practical Physics, Asia Publishing House, New Delhi.
3. P. Khandelwal, A Laboratory Manual of Physics for Undergraduate Classes, Vani Publication House, New Delhi.
4. GeetaSanon, BSc Practical Physics, 1st Edn. (2007), S. Chand & Co.

Note:

1. The duration of each experiment is of 2 hours. Three such experiments are to be performed by each student per week.
2. In the external exam, a student will have to perform three experiments, one from each group. Each experiment will be of 2 hours duration.
3. There shall not be more than 20 students per batch in the external exam.

B. Sc.

B. Sc. (PHYSICS)

Semester V

Sr. No.	Course Code	Course Title	Credits
1	PH – 506	Physics Paper VI	02
2	PH – 507	Physics Paper VII	02
3	PH – 508	Physics Paper VIII	02
4	PH – 509	Physics Paper IX	02
5	PH – 510	Physics Paper X	02
6	PH – 511	Physics Paper XI	02
7	PH – 512	Practical	06
8	Elective Course	Elective Paper 1 or 2 or 3	02

Faculty code: Science **Subject code: PH**

Name of the Program: B. Sc. (Physics) **Subject: PHYSICS**

External Examination	Time Duration
Theory Examination	2 Hrs. per paper
Practical Examination	2 Hrs. per practical

Name of Exam	Semester	Paper No.	Course Group	Credit	Internal Marks	External Marks	Total Marks
B. Sc.	V	PH – 506	Theory	02	20	50	70
		PH – 507	Theory	02	20	50	70
		PH – 508	Theory	02	20	50	70
		PH – 509	Theory	02	20	50	70
		PH – 510	Theory	02	20	50	70
		PH – 511	Theory	02	20	50	70
		PH – 512	Practical	06	60	120	180
		Elective Course	Theory	02	20	50	70

Note:

1. Student must opt one Elective Paper in each semester (V & VI) out of different Elective Papers offered by the College. (Choice of the Elective Paper number exercised by student shall remain same in both the semesters)
2. College can offer more than one Elective Paper as a choice to the students depending on the available staff and infrastructure.

T. Y. B. Sc. Sem V

Physics Paper VI (PH – 506)

Classical Mechanics and Solid State Physics

Unit 1	**Motion in Central Force Field (Introduction to Classical Mechanics by R G Takwale and P S Puranik, McGraw Hill Edu. (India) Pvt. Ltd., 2017)**
	Equivalent one-body problem (5.1), Motion in a central force field (5.2), General features of the motion (5.3), Motion in an inverse-square law force field (5.4), Equation of the orbit (5.5), Kepler's laws of planetary motion (5.6)
Unit 2	**Lagrangian Formulation (Introduction to Classical Mechanics by R G Takwale and P S Puranik, McGraw Hill Edu. (India) Pvt. Ltd., 2017)**
	Constraints (8.1), Generalised coordinates (8.2), D'Alembert's principle (8.3), lagrange's equations (8.4), General expression for kinetic energy (8.5), Symmetries and laws of conservation (8.6), Cyclic or ignorable coordinates (8.7), Velocity-dependent potential of electromagnetic field (8.8), Reyleigh's dissipation function (8.9)
Unit 3	**Free Electron Fermi Gas (Solid State Physics Charles Kittel , John Wiley & Sons, 8th ed., 2005)**
	Ch:6 Energy levels in one dimension, Effect of temperature on the fermi dirac distribution, Free electron gas in 3 dimensions, Heat capacity of the electron gas, Electrical conductivity and Ohm's law, Motion in magnetic field, Thermal conductivity of metals (Including subtopics)
Unit 4	**Energy Bands (Solid State Physics Charles Kittel , John Wiley & Sons, 8th ed., 2005)**
	Ch:7 Nearly free electron model, Bloch functions, Kronig – Penny model, Wave equation of electron in periodic potential, Number of orbitals in a band (Including subtopics)

Additional References:

1. An Introduction to Mechanics by Daniel Kleppner and Robert Kolenkow, McGraw Hill Edu. 2017
2. Classical Mechanics by G. Aruldhas, PHI, 2015
3. Solid State Physics by S O Pillai, New Age International Publishers, 2018.

T. Y. B. Sc. Sem V

Physics Paper VII (PH – 507)

Electrodynamics and Optics

Unit 1	**Electric Fields in Matter (Introduction to Electrodynamics by David J. Griffiths, Pearson India Education, 4th ed., 2015)**
	Ch – 4 Electric Fields in Matter **1 Polarization:** Dielectrics (1.1), Induced dipoles (1.2), Alignments of polar molecules (1.3), Polarization (1.4) **2 The field of a polarized object:** Bound Charges (2.1), Physical interpretation of bound charges, The field inside a dielectric (2.3) **3 The electric displacement:** Gauss's law in presence of dielectrics (3.1), A deceptive parallel (3.2), Boundary conditions (3.3) **4 Linear dielectrics:** Susceptibility, permittivity, Dielectric constant (4.1), Boundary value problems with linear dielectrics(4.2), Energy in dielectric systems(4.3), Forces on dielectrics (4.4)
Unit 2	**Magnetic Fields in Matter (Introduction to Electrodynamics by David J. Griffiths, Pearson India Education, 4th ed., 2015)**
	Ch – 6 Electric Fields in Matter **1 Magnetization:** Diamagnets, paramagnets, ferromagnets (1.1), Torques and forces on magnetic dipoles (1.2), Effect of magnetic field on atomic orbits (1.3), Magnetization (1.4) **2 The field of a magnetized object:** Bound currents (2.1), Physical interpretation of bound currents (2.2), The Magnetic field inside matter (2.3) **3 The Auxiliary Field H:** Ampere's law in magnetized materials (3.1), A deceptive parallel (3.2) **4 Linear and Non-linear media:** Magnetic susceptibility and permeability (4.1), Ferromagnetism (4.2)
Unit 3	**Multiple Beam Interferometry (Optics by Ajoy Ghatak, McGraw Hill Edu. (India) Pvt. Ltd., 6th ed. 2017)**
	Introduction (16.1), Multiple reflections from a plane parallel film (16.2), The Fabry-Perot etalon (16.3), The Fabry-Perot interferometer (16.4), Resolving power (16.5), The Lummer-Gehrcke plate (16.6), Interference filters (16.7) (Including subtopics)
Unit 4	**Holography (Optics by Ajoy Ghatak, McGraw Hill Edu. (India) Pvt. Ltd., 6th ed. 2017)**
	Introduction (21.1), Basic theory (21.2), Requirements (21.3), Some applications of Holography (21.4) (Including subtopics)

Additional References:

1. Electricity and Magnetism by D C Tayal, Himalaya Publishing House, 2014
2. Fundamentals of Optics by F A Jenkins and H E White, McGraw Hill, 2017
3. Optics by Eugene Hecht and A. R. Ganeshan, Pearson Education, 2019

T. Y. B. Sc. Sem V

Physics Paper VIII (PH – 508)

Atomic and Nuclear Physics

Unit 1	**Quantum Theory of Hydrogen Atom (Concepts of Modern Physics by Arthur Beiser, McGraw Hill Publishing Co. Ltd. New Delhi, 6th ed., 2006)**
	Schrodinger's equation for the hydrogen atom (6.1), Separation variables (6.2), Quantum numbers (6.3), Principal quantum number (6.4), Orbital quantum number (6.5), Magnetic quantum number (6.6)
Unit 2	**Quantum Theory of Hydrogen Atom (Concepts of Modern Physics by Arthur Beiser, McGraw Hill Publishing Co. Ltd. New Delhi, 6th ed., 2006)**
	Electron probability density (6.7), Radiative transitions (6.8), Selection rules (6.9), Zeeman effect (6.10), Electron spin (7.1), Exclusion principle (7.2), Symmetric and antisymmetric wave functions (7.3)
Unit 3	**Nuclear Models (Introduction to Nuclear and Particle Physics by V.K. Mittal, R.C. Verma, S.C. Gupta, PHI, 3rd ed., 2014)**
	Introduction (2.1), Liquid drop model (2.2), Shell model (2.3), Fermi gas model (2.4), Collective model (2.5) (Including subtopics)
Unit 4	**Radioactivity (Introduction to Nuclear and Particle Physics by V.K.Mittal, R.C. Verma, S.C. Gupta, PHI, 3rd ed., 2014)**
	Alpha emission (3.5), Beta decay (3.6) Gamma decay (3.7), Artificial or induced radioactivity (3.8), Applications of radioactivity (3.9) (Including subtopics)

Additional References:

1. Quantum Physics by Robert Eisberg & Robert Resnick, Wiley, 2006
2. Nuclear Physics by D C Tayal, Himalaya Publications, 2017.
3. Nuclear and Particle Physics by Satadal Bhattacharyya, University Press (India) Private Ltd., 2019

T. Y. B. Sc. Sem V

Physics Paper IX (PH – 509)

Statistical Mechanics and Special Relativity

Unit 1	**Blackbody radiation (Thermal Physics by Garg, Bansal and Ghosh, McGraw Hill Education (India) Pvt Ltd. Chennai, 2nd ed., 2012)**
	Blackbody radiation as a thermodynamics system (11.4), The Stefan-Boltzmann law (11.4.1), Isothermal and adiabatic expansion of blackbody radiation (11.4.2), Spectral distribution of radiant energy (11.5), Wien's law (11.5.1), Rayleigh-Jeans law (11.5.2), Planck's law (11.5.3)
Unit 2	**Basic concepts of Statistical Mechanics (Thermal Physics by Garg, Bansal and Ghosh, McGraw Hill Education (India) Pvt Ltd. Chennai, 2nd ed., 2012)**
	Introduction (12.1), Bridging microscopic and macroscopic behaviours (12.2), Phase space and quantum states (12.3), Specification of the state of the system (12.4), Macrostate and microstates (12.5), Probability calculations (12.6), Types of Ensembles (12.7), Entropy and probability (12.8) (Including subtopics)
Unit 3	**The Experimental Background of the Theory of Special Relativity (Introduction to Special Relativity by Robert Resnick, Wiley India Pvt. Ltd., 2007)**
	Introduction (1.1), Galilean transformations (1.2), Newtonian relativity (1.3), Electromagnetism and newtonian Relativity (1.4), Attempts to locate the absolute frame; the Michelson-Morley experiment (1.5), Attempts to preserve the concept of a preferred ether frame; the lorentz-fitzgerald contraction hypothesis (1.6), Attempts to preserve the concept of a preferred ether frame; the ether-drag hypothesis (1.7), Attempts to modify electrodynamics (1.8), The postulates of special relativity theory (1.9)
Unit 4	**Relativistic Kinematics (Introduction to Special Relativity by Robert Resnick, Wiley India Pvt. Ltd., 2007)**
	The relativity of simultaneity (2.1), Derivation of the Lorentz transformation equations (2.2), Some consequences of the Lorentz transformation equations (2.3), The relativistic addition of velocities (2.6), Aberration and Doppler effect of relativity (2.7)

Additional References:

1. Fundamentals of Thermal and Statistical Physics by Fredrick Reif, Sarat Book Distributors, 2010
2. The Special Theory of Relativity by S Banerji and Asit Banerjee, PHI Learning Pvt. Ltd. New Delhi, 2012

T. Y. B. Sc. Sem V

Physics Paper X (PH – 510)

Analog and Digital Electronics

Unit 1	**MOSFET, Thyristor & UJT (Electronic Principles by A Malvino and D. Bates, McGraw Hill Edu. (India) Pvt. Ltd, New Delhi, 7th ed., 2017)**
	MOSFETS: The Depletion-mode MOSFET (14.1), D-MOSFET curves (14.2), Depletion-Mode MOSFET amplifiers (14.3), The Enhancement-mode MOSFET (14.4), The Ohmic region (14.5), Digital switching (14.6), CMOS (14.7), Power FETs (14.8), E-MOSFET amplifiers (14.9) **Thyristors:** The Four – Layer diode (15.1),The Silicon controlled rectifier (15.2), The SCR crowbar (15.3), SCR phase control (15.4), Bidirectional thyristors (15.5), Other thyristors (15.7)
Unit 2	**Differential Amplifier (Electronic Principles by A Malvino and D. Bates, McGraw Hill Edu. (India) Pvt. Ltd, New Delhi, 7th ed., 2017)**
	Differential amplifier (17.1), DC analysis of a differential amplifier (17.2), AC analysis of differential amplifier (17.3), Input characteristic of an Op Amp (17.4), Common mode gain (17.5), Integrated circuits (17.6), The current mirror (17.7), The loaded diff amp (17.8)
Unit 3	**Digital logic and combinational logic circuit** **(Digital Principles and Applications by D. Leach, A Malvino and G. Saha, McGraw Hill Edu. (India) Pvt. Ltd. 7th ed., 2010)**
	Digital Logic: The Basic gates-NOT, OR, AND (2.1), Universal logic gates (2.2), AND –OR invert gates (2.3) **Combinational Logic Circuit:** Boolean law and theorems (3.1), Sum of product method (3.2), Truth table to karnaugh map (3.3), Pairs, quads And octets (3.4) Karnaugh simplifications (3.5), Don't care conditions (3.6), Product of sum method (3.7), Product of sum simplification (3.8)
Unit 4	**Digital logic and combinational logic circuit (Digital Principles and Applications by D. Leach, A Malvino and G. Saha, McGraw Hill Edu. (India) Pvt. Ltd 7th ed., 2010)**
	Multiplexer (4.1), Demultiplexer (4.2), 1 of 16 Decoder, BCD to decimal decoders (4.4), Encoders (4.6), Exclusive OR gate (4.7), Parity generators and checkers (4.8), Magnitude comparator (4.9), Binary number system (5.1), Binary to decimal conversion (5.2), Decimal To binary conversion (5.3), Octal number (5.4), Hexadecimal numbers (5.5)

Additional References:

1. Functional Electronics by K.V. Ramanan – McGraw Hill Edu. (India) Pvt. Ltd Publication
2. Electronics Devices and Circuits by Allen Mottershed – PHI Publication.
3. Modern Digital Electronics by R P Jain, McGraw Hill Education, New Delhi, 2009.

T. Y. B. Sc. Sem V

Physics Paper XI (PH – 511)

Mathematical Methods of Physics and C-Programming

Unit 1	**Vector Analysis : (Mathematical Method for Physicists by Arfken and Weber, Academic Press, 6th ed., 2010)**
	Orthogonal coordinates in R^3 (2.1), Differential vector operators (2.2), Spatial coordinate system; Introduction (2.3), Circular cylindrical coordinates (2.4), Spherical polar coordinates (2.5)
Unit 2	**Numerical Methods (Introductory Methods of Numerical Analysis by S.S.Sastry, PHI publication, 4th ed., 2006)**
	Solutions of algebraic equations: Introduction (2.1), The bisection method (2.2), The method of false position (2.3), The iteration method (2.4), Newton-Raphson method (2.5) **Interpolation:** Introduction (3.1), Errors in polynomial interpolation (3.2), Finite differences (3.3), Forward differences (3.3.1), Backward differences (3.3.2), Central differences (3.3.3), Symbolic relations and separation of symbols (3.3.4), Detection of errors by use of difference tables (3.4), Differences of a polynomial (3.5), Newton's formula for interpolation (3.6) Divided differences and their properties (3.10), Newton's general interpolation formula (3.10.1)
Unit 3	**C Programing (Computer Programing in C by V Rajaraman by PHI Learning Private Ltd, Delhi (24th Printing))**
	Numerical Constant and Variables: Constants (5.1), Scalar variable (5.2), Declaring variable names (5.3), Defining constants (5.4) **Arithmetic Expressions:** Arithmetic operators and modes of expressions (6.1), Integer expressions (6.2), Floating point expressions (6.3), Operator precedence in expressions (6.4), Examples of arithmetic expressions (6.5), Assignment statements (6.6), Defining variables (6.7), Arithmetic conversion (6.8), Assignment expressions (6.9), Increment and decrement operators (6.10), Multiple assignments (6.11)
Unit 4	**C Programing (Computer Programing in C by V Rajaraman by PHI Learning Private Ltd, Delhi (24th Printing))**
	Input and Output in C Programs Output function (7.1), Input function (7.2) **Conditional Statements** Relation Operators (8.1), Compound statement (8.2), Conditional statements (8.3), Example programs using conditional statements (8.4) **Implementing Loops in Programs** The *while* loop (9.1), The *for* Loop (9.2), The *do while* loop (9.3)

Additional References:

1. Mathematical Physics by H K Dass and Dr. Rama Verma, S.Chand Co.7th ed., 2019
2. Let us C by Y. Kanetkar, BPB Publications, 17th ed., 2017
3. Numerical Method for Scientists and Engineers by K. S. Rao, PHI, 2001.
4. Numerical Mathematical analysis by J. B. Scarborough, John Hopkin Press, 1930.

Practicals for T. Y. B. Sc. Sem V

PH-512

LIST OF EXPERIMENTS

	GROUP A
1	To determine Young's modulus of a wire using optical lever.
2	To determine Gravitational acceleration by Keter's pendulum
3	To study Measurement of susceptibility of paramagnetic material
4	To determine Elastic constants for the material of flat spiral spring
5	To determine angle of contact and surface tension of mercury by Quinck's method.
6	To determine Moment of Inertia by Bifilar suspension.
	GROUP B
1	To determine wave length of light by constant deviation spectrometer
2	To determine the cardinal points of a lens system using turn table.
3	To determine separation between plates of a Fabry Perot Etalon.
4	To determine the resolving power of a telescope.
5	To determine Hartman formula using prism.
6	To determine refractive index of a liquid by total internal reflection.
	GROUP C
1	To determine activation energy of semiconductor
2	To determine electronic charge 'e' using photo – emissive cell.
3	To determine absorption coefficient of liquid using photo cell.
4	To determine dielectric constant of a dielectric material with frequency.
5	To determine value of Planck's constant using LEDs of at least 4 different colors.
6	To determine thermal conductivity of Rubber Tubing
	GROUP D
1	Study of Parallel resonance using LCR circuit.
2	To determine Temperature Coefficient of Resistance for Platinum using Carey-Foster's bridge
3	To determine self-inductance by Anderson's bridge
4	To determine absolute value of capacitance using ballistic galvanometer.
5	Comparison of capacitance by the method of mixture.
6	To determine figure of merits of ballistic galvanometer.
	GROUP E
1	Design built and test adder/ subtractor using IC 741
2	Design built and test astable multivibrator using IC-555/Op-Amp
3	Design built and study Wien bridge oscillator
4	Design built and test Integrator and differentiator using IC 741.
5	Design built and test AND, OR, NOT gates using NAND/NOR gates.
6	Design built and test two stage RC coupled amplifier.
	GROUP F
1	C-program for calculation of days between two dates of a year
2	C-program to solve the sum of the sine and cosine series and print out the curve.
3	C-program to convert a given integer into binary and octal systems and vice versa.
4	C-program to find Inverse of a matrix
5	Find roots of $f(x) = 0$ by using Newton-Raphson method

6	Find roots of f(x) = 0 by using iteration method
7	Use of Newton's forward, backward and general interpolation formula
8	Use of Newton's interpolation formula to estimate the first order and the second order differentials numerically.

Additional References:

1. D.C.Tayal ,University Practical physics, Edited by Ila Agarwal, Himalaya Publishing House
2. B. L. Worsnop and H. T. Flint, Advanced Practical Physics, Asia Publishing House, New Delhi.
3. P. Khandelwal, A Laboratory Manual of Physics for Undergraduate Classes, Vani Publication House, New Delhi.
4. Geeta Sanon, BSc Practical Physics, 1st Edn. (2007), R. Chand & Co.

Note (for Sem-V Practical) :

1. The duration of each experiment is of 2 hours.
2. In the external exam, a student shall perform six experiments, one from each group. Each experiment will be of 2 hours duration.
3. There shall not be more than 20 students per batch in the external exam.
4. The external exam of each batch should be completed in two days by arranging three sessions of 2 hours each in a day.

T. Y. B. Sc. Sem V

Elective Paper - I

Modern Digital and Analog Communication System-I

Unit 1	**Introduction : Communication System (Modern Digital And Analog Communication System by B P Lathi & Zhi Ding, Oxford University Press, 4th ed., South Asia Edition, 2017)**
	Communication systems (1.1), Analog and digital messages (1.2), Channel effect, Signal-to-Noise ratio and capacity (1.3), Modulation and detection (1.4) (Including subtopics)
Unit 2	**Amplitude Modulations and Demodulations (Modern Digital And Analog Communication System by B P Lathi & Zhi Ding, Oxford University Press, 4th ed., South Asia Edition, 2017)**
	Baseband versus carrier communications (3.1), Double-Sideband amplitude modulation (3.2), Amplitude modulation (AM) (3.3), Bandwidth-Efficient amplitude modulations (3.4), Amplitude modulations: vestigial sideband(VSB) (3.5), Local carrier synchronization (3.6), Frequency division multiplexing (FDM) (3.7), Phase-Locked loop and some applications (3.8) (Including subtopics)
Unit 3	**Angle Modulation and Demodulation (Modern Digital And Analog Communication System by B P Lathi & Zhi Ding, Oxford University Press, 4th ed., South Asia Edition, 2017)**
	Nonlinear modulation (4.1), Bandwidth of Angle-Modulated waves (4.2), Generating FM waves (4.3), Demodulation of FM signals (4.4), Effects of nonlinear distortion and interference (4.5), Superheterodyne analog AM/FM receivers (4.6), FM broadcasting system (4.7)
Unit 4	**Sampling and analog-to-Digital Conversion (Modern Digital And Analog Communication System by B P Lathi & Zhi Ding, Oxford University Press, 4th ed., South Asia Edition, 2017)**
	Sampling theorem (5.1), Pulse code modulation (PCM) (5.2), Digital telephony: PCM in T1 carrier systems (5.3), Digital multiplexing (5.4), Differential pulse code modulation (DPCM) (5.5), Adaptive differential PCM (ADPCM) (5.6), Delta modulation (5.7) Vocoders and video compression (5.8) (Including subtopics)

Additional References:

1. Electronic Communications by Ruddy and coolen, Pearson Education, 4th ed., 2008
2. Introduction to Analog & Digital Communications : Simon Haykin & Michael Moher, 2014
3. Electronic Communication system by G. Kennedy & B. Devis, McGraw Hills Education, 6th ed., 2017.

T. Y. B. Sc. (Physics) Sem V
Elective Paper 12

Astrophysics-I

Unit 1	**Astronomical Instruments (An Introduction to Astrophysics by Baidyanath Basu, Tanuka Chattopadhyay and Sudhindra Nath Biswas PHI Learning Private Ltd, 2nd ed., 2017)**
	Optical telescopes (1.3), Radio telescopes (1.4), The hubble space telescope (HST) (1.5), Astronomical spectrograph (1.6), Spectrophotometry (1.9)
Unit 2	**Star (An Introduction to Astrophysics by Baidyanath Basu, Tanuka Chattopadhyay and Sudhindra Nath Biswas PHI Learning Private Ltd, 2nd ed., 2017)**
	Magnitudes, Motions, and Distances of Stars Stellar magnitude sequence (3.1), Absolute magnitude and the distance module (3.2), Radiometric magnitudes (3.5), The colour index of a star (3.6), Luminosities of star (3.7) **Spectral Classification of Stars** Introduction (4.1), Boltsmann's formula (4.2), Saha's equation of thermal ionization (4.3), Importance of ionization theory in astrophysics (4.6)
Unit 3	**The Sun (An Introduction to Astrophysics by Baidyanath Basu, Tanuka Chattopadhyay and Sudhindra Nath Biswas PHI Learning Private Ltd, 2nd ed., 2017)**
	Sun- A typical star (5.1), The photosphere: limb- darkening (5.2), Solar granulation (5.3), The chromosphere (5.5), Solar corona (5.6), Prominences (5.7), The 11 Year solar cycle and sunspots (5.8), The solar magnetic fields (5.9), Theory of sunspots (5.10), Solar flares (5.11), Radio emission from the sun (5.12), Solar wind (5.13), The solar neutrino puzzle (5.14)
Unit 4	**Binary and Multiple Stars (An Introduction to Astrophysics by Baidyanath Basu, Tanuka Chattopadhyay and Sudhindra Nath Biswas PHI Learning Private Ltd, 2nd ed., 2017)**
	Introduction (7.1), Visual binary (7.2), Spectroscopic binary (7.3), Eclipsing binary (7.4), Multiple stars (7.5), Origin of binary stars (7.6), Steller masses and mass luminosity relation (7.7), Mass transfer in close binary systems (7.8)

Additional References:

1. Astrophysics: Stars and Galaxies by K D Abhyankar, Unievrsity Press, 2001
2. Introduction to Cosmology by Jayant Narlikar, Cambridge University Press, 2002.

T. Y. B. Sc. (Physics) Sem V
Elective Paper 13

Measurements and Instrumentation-I

Unit 1	**Optoelectronic measurement (Electrical and Electronic Measurements and Instrumentation By A.K. Sawhney, Dhanpat Rai & Co., 19th ed., 2021)**
	Introduction (19.1), Monochromatic light (19.2), Polarized wave shape (19.3), Refraction and refractive index (19.4), Reflection, Absorption and transmission (19.5), Radiometry and photometry (19.6), Terms relating to photometry (19.7), Laws of illumination (19.11), Terms relating to radiometry (19.12), Photometry/radiometry measurement systems (19.13), Optical sources (19.14), Optical detectors (19.15).
Unit 2	**Electronic Instruments (Electrical and Electronic Measurements and Instrumentation By A.K. Sawhney, Dhanpat Rai & Co., 19th ed., 2021)**
	Introduction (20.1), Electronic voltmeter and their advantages (20.2), Vacuum tube voltmeter (20.3), Differential amplifier (20.4), Difference amplifier type of electronic voltmeter (20.5), Source follower types of electronic voltmeter (20.6), DC voltmeter with direct-coupled amplifier (20.7), Chopper stabilized amplifier (20.8), Electronic voltmeter using rectifier (20.9)
Unit 3	**Cathode Ray Oscilloscope (Electrical and Electronic Measurements and Instrumentation By A.K. Sawhney, Dhanpat Rai & Co., 19th ed., 2021)**
	Introduction (21.1), Cathode ray tube (21.2), Electron gun (21.3), Electrostatic focusing(21.4), Electrostatic deflection (21.5), Post deflection acceleration of electron beam (21.6), Effect of beam transit time and frequency limitations (21.7), Deflection plates (21.8), Graticule (21.10), Time base generator (21.13), Oscilloscope amplifiers (21.14), Vertical input and sweep generator signal synchronization (21.15), Attenuators (21.16), Basic CRO circuits (21.17), Observation of waveform on CRO (21.18), Measurements of voltage and currents (21.19), measurements of phase and frequency (21.20)
Unit 4	**Transducers (Electrical and Electronic Measurements and Instrumentation By A.K. Sawhney, Dhanpat Rai & Co., 19th ed., 2021)**
	Transducers (25.6), Electric-transducers (25.7), Classification transducers (25.8), Characteristics and choice of transducers (25.9), Summary of factors influencing the choice of transducers (25.10), Resistive transducers (25.11), Potentiometers (25.12), Materials used for potentiometer (25.14), Advantages and disadvantages of resistance potentiometer (25.15)

Additional References:

1. Electrical and electronic measurements and instrumentation By R.K.Rajput, S.Chand Publication
2. Electronic instrumentation by H.S.Kalsi, Mc Graw Hill (third Edition), 2017
3. Electrical and electronic measurements and instrumentation by Syed Imam and Vibhav Kumar Published by Wiley, 2020

Structure for B. Sc. Syllabus

Inforce from June 2021

B. Sc. (PHYSICS)

Semester VI

Sr. No.	Course Code	Course Title	Credits
1	PH – 606	Physics Paper VI	02
2	PH – 607	Physics Paper VII	02
3	PH – 608	Physics Paper VIII	02
4	PH – 609	Physics Paper IX	02
5	PH – 610	Physics Paper X	02
6	PH – 611	Physics Paper XI	02
7	PH – 612	Practicals	06
8	Elective Course	Elective Paper 1 or 2or 3	02

Faculty code: Science **Subject code: PH**

Name of the Program: B. Sc. (Physics) **Subject: PHYSICS**

External Examination	Time Duration
Theory Examination	2 Hrs. per paper
Practical Examination	2 Hrs. per practical

Name of Exam	Semester	Paper No.	Course Group	Credit	Internal Marks	External Marks	Total Marks
B. Sc.	VI	PH – 606	Theory	02	20	50	70
		PH – 607	Theory	02	20	50	70
		PH – 608	Theory	02	20	50	70
		PH – 609	Theory	02	20	50	70
		PH – 610	Theory	02	20	50	70
		PH – 611	Theory	02	20	50	70
		PH – 612	Practical	06	60	120	180
		Elctive Course	Theory	02	20	50	70

T. Y. B. Sc. Sem VI

Physics Paper VI (PH – 606)

Classical Mechanics and Solid State Physics

Unit 1	**Moving Coordinate Systems (Introduction to Classical Mechanics by R G Takwale and P S Puranik, McGraw Hills Edu. Pvt. Ltd., 2017)**
	Coordinate system with relative translational motion (9.1), Rotating coordinate system (9.2), The Coriolis force (9.3), Motion on the Earth (9.4), Effect of Coriolis force on a freely falling particles (9.5)
Unit 2	**Motion of a Rigid Body (Introduction to Classical Mechanics by R G Takwale and P S Puranik, McGraw Hills Edu. Pvt. Ltd., 2017)**
	Euler's theorem (10.1), Angular Momentum and Kinetic Energy (10.2), the inertia tensor (10.3), Euler's equations of motion (10.4), Torque-free motion (10.5), Euler's angles (10.6), Motion of a symmetric top (10.7)
Unit 3	**Fermi Surfaces and Metals (Solid State Physics Charles Kittel , John Wiley & Sons, 8th ed., 2005)**
	Ch: 9 Reduced zone scheme, Periodic zone scheme, Construction of fermi surfaces, Electron orbits, Hall orbits and open orbits, Calculation of energy bands, Experimental methods in fermi surface studies (including of subtopics)
Unit 4	**Superconductivity (Solid State Physics Charles Kittel , John Wiley & Sons, 8th ed., 2005)**
	Ch:10 Experimental Survey, Theoretical Survey, High Temperature Superconductors (including subtopics)

Additional References:

1. An Introduction to Mechanics by Daniel Kleppner and Robert Kolenkow, McGraw Hill Edu. 2017
2. Classical Mechanics by G. Aruldhas, PHI, 2015
3. Solid State Physics by S O Pillai, New Age International Publishers, 2018.

T. Y. B. Sc. Sem VI

Physics Paper VII (PH – 607)

Electrodynamics and Optics

Unit 1	**Electrodynamics (Introduction to Electrodynamics by David J. Griffiths, Pearson India Education, 4th ed., 2015)**
	Ch-7 Electrodynamics **1 Electromotive Force:** Ohm's law (1.1), Electromotive force (1.2), Motional emf (1.3) **2 Electromagnetic Induction** Faraday's law (2.1), The induced electric field (2.2), Inductance (2.3), Energy in magnetic field (2.4)
Unit 2	**Electrodynamics (Introduction to Electrodynamics by David J. Griffiths, Pearson India Education, 4th ed., 2015)**
	Ch-7 Electrodynamics **3 Maxwell's Equations :** Electrodynamics before maxwell (3.1), How maxwell fix Ampere's law (3.2), Maxwell's equation (3.3), Magnetic charge (3.4), Maxwell's equations in matter (3.5), Boundary conditions (3.6) **Conservation laws:** The continuity equation (1.1), Poynting's theorem (1.2)
Unit 3	**Reflection and Refraction of Electromagnetics Waves (Optics by Ajoy Ghatak, McGraw Hill Edu. (India) Pvt. Ltd., 6th ed., 2017)**
	Introduction (24.1), Reflection and refractions at an interface of two media (24.2), Normal incidence on a medium (24.3), Oblique incidence: E Parallel to the plane of incidence (24.4), Polarization by reflection: Brewster's law (24.5), Total internal reflection and the evanescent wave (24.6), Oblique incidence: E perpendicular to the plane of incidence (24.7), Expressions for reflectivity and transmittivity (24.8)
Unit 4	**Optical Fiber Basics using Ray Optics (Optics by Ajoy Ghatak, McGraw Hill Edu. (India) Pvt. Ltd., 6th ed., 2017)**
	Why glass fibers? (28.5), The coherent bundle (28.6), The numerical aperture (28.7), Attenuation in optical fibers (28.8), Multimode fibers (28.9)

Additional References:

1. Electricity and Magnetism by D C Tayal, Himalaya Publishing House, 2014.
2. Fundamentals of Optics by F A Jenkins and H E White, McGraw Hill, 2017.
3. Optics by Eugene Hecht and A. R. Ganeshan, Pearson Education., 2019.

T. Y. B. Sc. Sem VI

Physics Paper VIII (PH – 608)

Atomic and Nuclear Physics

Unit 1	**Many Electron Atoms (Concepts of Modern Physics by Arthur Beiser, McGraw Hill Publishing Co. Ltd. New Delhi, 6 ed., 2006)**
	Periodic table (7.4), Atomic structures (7.5), Explaining the Periodic table (7.6), Spin-Orbit Coupling (7.7), Total Angular Momentum (7.8), X-Ray spectra (7.9)
Unit 2	**Molecular Physics (Concepts of Modern Physics by Arthur Beiser, McGraw Hill Publishing Co. Ltd. New Delhi, 6 ed., 2006)**
	The Molecular bond (8.1), Electron sharing (8.2), The H2+ Molecular ion (8.3), The Hydrogen molecule (8.4), Complex molecules (8.5), Rotational energy levels (8.6), Vibrational energy levels (8.7), Electronic spectra of molecules (8.8)
Unit 3	**Particle Accelerators and Radiation Detectors (Introduction to Nuclear and Particle Physics by V. K. Mittal, R. C. Verma, S. C. Gupta, PHI, 3rd ed., 2014)**
	Introduction (6.1) Cockcroft and Walton accelerator (6.2), Tandem accelerator (6.4), Linear Accelerator (LINAC) or Drift Tube accelerator (6.5), Introduction (7.1), Gas-Filled detectors (7.2), Ionizations chamber (7.3), Proportional counters (7.4), Geiger-Muller (GM) counters (7.5), Scintillations detectors (7.6), Semiconductors radiations detectors (7.7), Cloud chamber (7.8), Cerenkov counters (7.12) (Including subtopics)
Unit 4	**Particle Physics (Introduction to Nuclear and Particle Physics by V. K. Mittal, R. C. Verma, S. C. Gupta, PHI, 3rd ed., 2014)**
	Introduction (8.1), Productions of elementary particles (8.2), Types of interaction (8.3), Classification of elementary particles (8.4), Mass spectra and decays of elementary particles (8.5), Quantum numbers (8.6), Conservation laws (8.7) (Including subtopics)

Additional References:

1. Quantum Physics by Robert Eisberg & Robert Resnick, Wiley, 2006
2. Nuclear Physics by D C Tayal, Himalaya Publications, 2017
3. Nuclear and Particle Physics by Satadal Bhattacharyya, University Press (India) Private Ltd, 2019

T. Y. B. Sc. Sem VI

Physics Paper IX (PH – 609)

Statistical Mechanics and Special Relativity

Unit 1	**Classical and Quantum Statistics (Thermal Physics by Garg, Bansal and Ghosh, McGraw Hill Education (India) Pvt Ltd. Chennai, 2nd ed., 2012)**
	Classical and quantum statistics (12.9), Distribution functions (12.9.1), Partition function and thermodynamics properties of a system (13.2), The partition function for an ideal monatomic gas(13.3), Single partition function (13.3.1), N-particle partition function and thermodynamic variables (13.3.2), Some deductions from MB statistics (13.4), Distribution law for molecular speeds (13.4.1), specific heat capacity of gases (13.4.2), partition function of a diatomic molecule (13.4.3), specific heat capacity of hydrogen (13.4.5)
Unit 2	**Specific Heat Capacity of Solids (Thermal Physics by Garg, Bansal and Ghosh, McGraw Hill Education (India) Pvt Ltd. Chennai, 2nd ed., 2012)**
	Specific heat capacity of solids (13.5), Einstein's theory (13.5.1), Debye theory (13.5.2), Thermodynamic functions of systems with finite number of energy levels (13.6), negative temperatures (13.6.1), transition between states: Einstein's formulation of spontaneous and stimulated emission of radiation (13.6.2), Laser action (13.6.3)
Unit 3	**Relativistic Dynamics (Introduction to Special Relativity by Robert Resnick, Wiley India Pvt. Ltd.)**
	The need to redefine momentum (3.2), Relativistic momentum (3.3), Alternative views of mass in relativity (3.4), The relativistic force law and the dynamics of a single Particle (3.5), The equivalence of mass and energy (3.6)
Unit 4	**Relativity and Electromagnetism (Introduction to Special Relativity by Robert Resnick, Wiley India Pvt. Ltd.)**
	Introductions (4.1) The interdependence of electric and magnetic fields (4.2), The transformation for **E** and **B** (4.3), The field of a uniformly moving point charge (4.4), Forces and fields near a current carrying wire (4.5), Forces between moving charges (4.6), The invariance of Maxwell's equations (4.7), The possible limitations of Special Relativity (4.8)

Additional References:

1. Fundamentals of Thermal and Statistical Physics by Fredrick Reif, Sarat Book Distributors, 2010
2. The Special Theory of Relativity by S Banerji and Asit Banerjee, PHI Learning Pvt. Ltd. New Delhi, 2012

T. Y. B. Sc. Sem VI

Physics Paper X (PH – 610)

Analog and Digital Electronics

Unit 1	**Operational Amplifiers and Linear Op-Amp circuits (Electronic Principles by A Malvino and D. Bates, McGraw Hill Edu. (India) Pvt. Ltd, New Delhi, 7th ed.)**
	Introduction : Introduction to OP Amps (18.1), The 741 Op Amp (18.2), The inverting amplifiers (18.3), The Non-inverting amplifiers (18.4), Two Op-Amp applications (18.5) Inverting-amplifier circuits (20.1), Noninverting-amplifier circuits (20.2), Inverter/Noninverter circuits (20.3), Differential amplifiers (20.4), Instrumentation amplifiers (20.5), Summing amplifier circuits (20.6)
Unit 2	**Feedback & Oscillators (Electronic Principles by A Malvino and D. Bates, McGraw Hill Edu. (India) Pvt. Ltd, New Delhi, 7th ed.)**
	Feedback: Four types of negative feedback (19.1), VCVS Voltage gain (19.2) **Oscillators:** Theory of sinusoidal oscillators (23.1), The Wein Bridge oscillator (23.2), Other RC oscillators (23.3), The Colpitt oscillator (23.4), Other LC oscillators (23.5), The 555 timer (23.7), Astable operation of 555 timer (23.8), 555 circuits (23.9)
Unit 3	**Arithmetic Circuits (Digital Principles And Applications by D. Leach, A Malvino and G. Saha, McGraw Hill Edu. (India) Pvt. Ltd, 7th ed., 2010)**
	Clock waveforms (7.1), TTL clock (7.2), Schmitt trigger (7.3), 555 timer – Astable (7.4), 555 timer – monostable (7.5), Monostables with input logic (7.6), Pulse-forming circuits (7.7)
Unit-4	**Flip-Flop (Digital Principles And Applications by D. Leach, A Malvino and G. Saha, McGraw Hill Edu. (India) Pvt. Ltd, 7th ed., 2010)**
	RS Flip-Flop (8.1), Gated Flip-Flops (8.2),Edged-Triggered RS Flip-Flops (8.3), Edged-Triggered D Flip-Flops (8.4), Edged-Triggered, Jk Flip-Flops (8.5), Flip-Flops Timing (8.6),Edge Triggering through input lock out (8.7), JK Master-Slave Flip-Flops (8.8).

Additional References:

1. Functional Electronics by K.V. Ramanan – McGraw Hill Edu. Pvt. Ltd, New Delhi Publication
2. Electronics Devices and Circuits by Allen Mottershed – PHI Publication.
3. Modern Digital Electronics by R P Jain, McGraw Hill Education, New Delhi, 2009.

T. Y. B. Sc. Sem VI

Physics Paper XI (PH – 611)

Mathematical Method of Physics and C-Programming

Unit 1	**Differential equations (Mathematical Method for Physicists by Arfken and Weber, Academic Press 6th ed., 2010)**
	Partial Differential Equations (9.1), First order Differential Equations (9.2), Separation of variables (9.3), Singular Points (9.4) Series solutions-Frobenius method (9.5)
Unit 2	**Matrices (Mathematical Method for Physicists by Arfken and Weber, Academic Press 6th ed., 2010)**
	Matrices Basic Definitions, Rank, Equality, Addition, Subtraction, Multiplication by Scalar, Matrix Multiplication- inner product, Direct product, Diagonal matrices, Matrix inversion, **Orthogonal Matrices** Direction cosines, Applications to vectors, Orthogonality conditions: Two Dimensional case, Transpose matrix 3.5 **Diagonalization of Matrices:** Moment of inertia matrix, Eigen vector, Eigen values, Hermitian matrices, Anti-Hermitian matrices, Functions of matrices, Diagonal matrices
Unit 3	**C Programing (Computer Programing in C by V Rajaraman by PHI Learning Private Ltd, Delhi (24th Printing))**
	Defining and Manipulating Arrays: Array Variable (10.1), Syntax rules for arrays (10.2), Use of multiple subscripts in array (10.3), Reading and writing multidimensional arrays (10.4), Examples of for Loops with arrays (10.5) **Logical Expressions and More Control Statements:** Introduction (11.1), Logical operators and expressions (11.2), Precedence rules for logical operators (11.3), Some example of use of logical expressions (11.4), The switch statement (11.5), The break statement (11.6), The continue statement (11.7)
Unit 4	**C Programing (Computer Programing in C by V Rajaraman by PHI Learning Private Ltd, Delhi (24th Printing))**
	Functions: Introduction (13.1), Defining and using functions (13.2), Syntax rules for function declaration (13.3), Array in functions (13.4), Global local and static variables (13.5)

Additional References:

1. Mathematical Physics by H K Das and Dr. Rama Verma, S. Chand Co., 7th ed., 2019
2. Mathematical Physics by P K Chattopadhaya, New Age International publishers, 2006
3. Let us C by Y. Kanetkar, BPB Publications, 17th ed., 2017

Practicals for T. Y. B. Sc. Sem VI

PH-612

LIST OF EXPERIMENTS

	GROUP A
1	To determine Young's modulus by Koeing's method.
2	To study Resonance Pendulum
3	To study coupled oscillator
4	To determine the oscillation of mass in the case of combination of two spring.
5	To determine Young's modulus by the method of vibration
6	To determine the moment of inertia of a flywheel
	GROUP B
1	To determine refractive index of liquid using hollow prism
2	To determine the wavelength of light using Fresnel's biprism
3	To determine the resolving power of diffraction grating
4	To determine cardinal points of a lens system using Searle's goniometer
5	To determine the wavelength of light using Lloyd's mirror
6	To determine wavelength of light using Edser butler plate
	GROUP C
1	To determine the constants of thermocouple
2	To determine e/m by Thomson's method
3	To determine the constants of BG using solenoid
4	To study LDR
5	To study Colpitt's oscillator
6	To study Hartley's oscillator
	GROUP D
1	To determine high resistance using method of leakage
2	To determine mutual inductance by Carey-Foster's method
3	To determine self-inductance of a given coil by Rayleigh's method
4	To determine self-inductance of a given coil using Maxwell's Induction bridge
5	To determine the ratio of capacities using Desauty's method
6	To determine mutual inductance using ballistic galvanometer

References:

1. University Practical Physics by D C Tayal, Edited by Ila Agarwal, Himalaya Publishing House
2. Advanced Practical Physics by B. L. Worsnop and H. T. Flint, Asia Publishing House, New Delhi.
3. A Laboratory Manual of Physics for Undergraduate Classes by P. Khandelwal, Vani Publication House, New Delhi.
4. BSc Practical Physics by Geeta Sanon, S. Chand & Co., 1st ed. 2007

Note (for Sem-VI Practical):

1. The duration of each experiment is of 2 hours.
2. In the external exam, a student shall perform four experiments, one from each group. Each experiment will be of 2 hours duration.
3. The experiments in Sem-VI divided in four groups (A,B,C and D) carrying 4 credits (8hrs/week) as per list attached above.
4. In addition to experiments, students have to perform project work (4 hr/week, 2 credits) under the guidance of a faculty as per the guidelines mentioned below:
5. There shall not be more than 20 students per batch in the external exam.
6. The external exam of each batch of 20 students should be completed in two days by arranging three sessions of 2 hours each in a day. Last two sessions per batch shall be allotted for evaluation of project work.

Guidelines for Project Work:

It is expected that,

1. As project work the student does work equivalent to twelve hours laboratory experiments through sixth semester under the guidance of faculty.
2. A project shall be carried out either individually or in a group of not more than four students. The Head of the Department shall assign one teacher per project. The equivalent workload should be credited to the teacher who has been assigned the project guideship and must be added in the time schedule of practical.
3. The project work is a practical course and it is intended to develop a set of skills pertaining to the laboratory work apart from the cognition of students. Therefore, the guides should not permit projects that involve no contribution on part of student.
4. The project must have a clear and strong link with the principles of basic physics and/or their applications.
5. The theme chosen should be such that it promotes better understanding of physics concepts and brings out the creativity in the students.
6. The evaluation of the project work must give due credit to the amount of the project work actually done by a student, skills shown by the student, understanding of the physics concepts involved and the presentation of the final report at the time of viva voce.
7. Any ready-made material used in the report (such as downloaded pages from the web) must be clearly referred to and acknowledged.
8. Time schedule for project work shall be decided by the guide in such a way that the final report submission is completed along with submission of journal of laboratory work.
9. Any non-adherence to this norm should attract a penalty by way of deduction in the marks awarded to a student.

Minimum 4 hours per student/group should be spent by the faculty member for the guidance of project work to the students which shall be considered as work load of practical.

Evaluation of the project work:

The following points shall be considered during evaluation of project work:

1. Working model (Experimental or Concept based simulation)
2. Understanding of the project
3. Data collection
4. Data Analysis
5. Innovation/difficulty
6. Report.

Scheme of external examination: (Total 120 marks)

1. The University (external) examination for Practical shall be conducted at the end of each Semester and the evaluation of Project work at the end of the sixth semester along with practical examination.
2. The candidates shall appear for external examination of Practical course carrying
   (i) 120 marks at the end of fifth semester (Six practical of two hours each)
   (ii) 80 marks (Four sessions of two hours each) + 40 marks project work.
3. The evaluation of project work should be conducted based on presentation and report. Extra care must be taken in the evaluation of projects done in a pair or group. Delegation of the work done by individuals must be sought from the students in such cases.
4. The candidate shall prepare and submit a certified Journal for practical examination based on the practical course with at least 80% of total experiments from each group.
5. At the time of practical examination, the candidate must also submit the certified Project Report prepared as per the guidelines given in the Syllabus.
6. A candidate will be allowed to appear for the practical examination in each semester only if the candidate submits a certified journal of that semester or a certificate from the Head of the Department to the effect that the candidate has completed the practical course of that semester as per the minimum requirements and a project completion report duly certified by the project in-charge and Head of the Department.
7. The scheme for internal marks (total 60 marks) shall also be followed to include project work evaluation.
8. During the external practical examination the number of students per batch should be twenty (20).

T. Y. B. Sc. Sem VI

Elective Course – I

Modern Digital and Analog Communication System-II

Note: The prerequisite for this course is that a student should have taken the Elective paper: Modern Digital and Analog Communication System-I in Semester V.

Unit 1	**Principles of Digital Data Transmission (Modern Digital And Analog Communication System by B P Lathi & Zhi Ding, Oxford University Press, 4th ed., South Asia Edition (2017)**
	Digital communication systems(8.1), Line coding (8.2), Pulse shaping (8.3) (Including subtopics)
Unit 2	**Principles of Digital Data Transmission (Modern Digital And Analog Communication System by B P Lathi & Zhi Ding, Oxford University Press, 4th ed., South Asia Edition (2017)**
	Scrambling (8.4), Digital receivers and regenerative repeaters (8.5), Eye diagrams: An important tool (8.6), PAM: Mary baseband signalling for higher data rate (8.7), Digital carrier systems (8.8), Mary digital carrier modulation (8.9)
Unit 3	**Performance Analysis of Digital Communication Systems (Modern Digital And Analog Communication System by B P Lathi & Zhi Ding, Oxford University Press, 4th ed., South Asia Edition (2017)**
	Optimum linear detector for binary polar signaling (9.1), General binary signaling (9.2), Coherent receivers for digital carrier modulations (9.3), Signal space analysis of optimum detection (9.4), Vector decomposition of white noise random processes (9.5) (Including subtopics)
Unit 4	**Performance Analysis of Digital Communication Systems (Modern Digital And Analog Communication System by B P Lathi & Zhi Ding, Oxford University Press, 4th ed., South Asia Edition (2017)**
	Optimum receiver for while gaussian noise channels (9.6), General expression for error probability of optimum receivers (9.7), Equivalent signal sets (9.8), Nonwhite (Colored) Channel noise (9.9), Other useful performance criteria (9.10), Noncoherent detection (9.11) (Including subtopics)

Additional References:

1. Electronic Communications by Ruddy and coolen, Pearson Education, 4th ed., 2008
2. Introduction to Analog & Digital Communications : Simon Haykin & Michael Moher, 2014
3. Electronic Communication system by G. Kennedy & B. Devis, McGraw Hills Education, 6th ed., 2017.

T. Y. B. Sc. Sem VI

Elective Paper 25

Astrophysics-II

Note: The prerequisite for this course is that a student should have taken the Elective paper: Astrophysics-I in Semester V.

Unit 1	**Structure and Evolution of Stars (An Introduction to Astrophysics by Baidyanath Basu, Tanuka Chattopadhyay and Sudhindra Nath Biswas PHI Learning Private Ltd 2nd ed.)**
	Introduction (14.1), The equation of state for stellar interior (14.3), Mechanical and thermal equilibrium in stars (14.4), Energy generation in stars (14.6), Steller evolution (14.7) White dwarfs (14.8)
Unit 2	**Pulsars, Neutron Stars and Black Holes (An Introduction to Astrophysics by Baidyanath Basu, Tanuka Chattopadhyay and Sudhindra Nath Biswas PHI Learning Private Ltd 2nd ed.)**
	Discovery of pulsars (15.1), Rotating neutron stars model of pulsars (15.2), Period distribution and loss of rotational energy (15.3), Binary pulsars (15.7), Black holes (15.8)
Unit 3	**Quasars (An Introduction to Astrophysics by Baidyanath Basu, Tanuka Chattopadhyay and Sudhindra Nath Biswas PHI Learning Private Ltd 2nd ed.)**
	The discovery (20.1), Radio properties (20.2), Optical properties (20.3), The redshift of quasars (20.4), Active galactic nuclei (20.5)
Unit 4	**Cosmology (An Introduction to Astrophysics by Baidyanath Basu, Tanuka Chattopadhyay and Sudhindra Nath Biswas PHI Learning Private Ltd 2nd ed,)**
	Introduction (21.1), Redshift and the Exapansion of the Universe (21.2), Matter Density in the universe and the deceleration parameter (21.3), The Cosmological Principle: The perfect Cosmological principle (21.4), Fundamental equations of cosmology (21.5), The Cosmic Microwave Background Radiation (21.8)

Additional References:

1. Astrophysics: Stars and Galaxies by K D Abhyankar, University Press, 2001
2. Introduction to Cosmology by Jayant Narlikar, Cambridge University Press, 2002.

T. Y. B. Sc. Sem VI

Elective Paper 26

Measurements and Instrumentation-II

Note: The prerequisite for this course is that a student should have taken the Elective paper: Measurements and Instrumentation-I in Semester V.

Unit 1	**Primary Sensing Elements and Trasducers 1 (Electrical and Electronic Measurements and Instrumentation By A.K. Sawhney, Dhanpat Rai & Co., 19th ed., 2021)**
	Resistance Thermometer (25.19), Thermistors (25.20), Integrated circuits temperature transducers (25.22), Variable inductance transducers (25.23), Linear Variable Differential Transformer (LVDT) (25.24), Rotary Variable Differential Transformer (RVDT)(25.25), Synchros (25.26), Resolvers (25.27)
Unit 2	**Primary Sensing Elements and Trasducers 2 (Electrical and Electronic Measurements and Instrumentation By A.K. Sawhney, Dhanpat Rai & Co., 19th ed., 2021)**
	Capacitive transducers (25.28), Piezo-electric transducers (25.29), Hall effect transducers (25.30), Magneto-Resistors (25.31), Magneto-elastic and magneto-strictive trasducers (25.32), Optoelectronic transducers (25.33)
Unit 3	**Display Devices (Electrical and Electronic Measurements and Instrumentation By A.K. Sawhney, Dhanpat Rai & Co., 19th ed., 2021)**
	Introduction (28.1), Electrical indicating instruments (28.2), Digital instruments (28.3), Electronic counters (28.4), Digital display methods (28.5), Digital display units (28.6), Segmental displays (28.7), DOT matrices (28.8), Rear projection display (28.9), Light emitting diode (28.11), Liquid crystal diodes (28.12), Nixie tubes (28.13), Segmental gas discharge displays (28.14), Decade counting assemblies (DCAs) (28.15), Display systems (28.16)
Unit 4	**Modern Sensors and Chemical Sensors (Electrical and Electronic Measurements and Instrumentation By A.K. Sawhney, Dhanpat Rai & Co., 19th ed., 2021)**
	Types of modern sensors (32.2), Neno-sensors (32.3), Biosensors (32.4), Introduction (34.1), Probe analysers (34.2), Differential refractometers (34.3), Spectrophotometers (34.4), Detectors (34.5), Filters (34.6), Chromatography (34.7), Electrochemical sensors (34.8),

Additional References:

1. Electrical and electronic measurements and instrumentation By R.K.Rajput, S.Chand Publication
2. Electronic instrumentation by H.S.Kalsi, Mc Graw Hill (third Edition), 2017
3. Electrical and electronic measurements and instrumentation by Syed Imam and Vibhav Kumar Published by Wiley, 2020