PERIYAR MANIAMMAI INSTITUTE OF SCIENCE & TECHNOLOGY
PMIST

PERIYAR MANIAMMAI
INSTITUTE OF SCIENCE & TECHNOLOGY
(Deemed to be University)
Established Under Sec. 3 of UGC Act, 1956 • NAAC Accredited
think • innovate • transform

Criterion 1 – Curricular Aspects

Key Indicator	1.1	Curriculum Design and Development
Metric	1.1.3	Average percentage of courses having focus on employability/ entrepreneurship/ Skill development offered by Physics.

DEPARTMENT OF PHYSICS

SYLLABUS COPY OF THE COURSES HIGHLIGHTING THE FOCUS ON EMPLOYABILITY/ ENTREPRENEURSHIP/ SKILL DEVELOPMENT

1. List of courses for the programmes in order of

S. No.	Programme Name
i.	B.Sc. (Physics)
ii.	M.Sc (Physics)

2. Syllabus of the courses as per the list.

Legend : Words highlighted with **Blue Color** - Entrepreneurship
Words highlighted with **Red Color** - Employability
Words highlighted with **Purple Color** - Skill Development

1. **List of Courses**

Name of the Course	Course Code	Year of Introduction	Activities/Content with direct bearing on Employability/ Entrepreneurship / Skill development
B.Sc. (Physics)			
Communication Skills in English	XGL101	2018-19	Soft skill -Group discussion, Oral presentation, seminar
Ariviyal Tamil / Comprehensive English	XGL102A / XGL102B	2018-19	Soft skill -Group discussion, Oral presentation, seminar
Algebra, Trigonometry and Transform	XMG103	2018-19	Employability skill – Implementing skill- applying problem solving, reasoning skill
Properties of Matter and Sound	XPH104	2018-19	Employability skill
Mechanics and Special Theory of Relativity	XPH105	2018-19	Employability skill
Human Ethics, Values, Rights and Gender Equality	XUM106	2018-19	Soft skill -Group discussion, Oral presentation, seminar
Physics Practical I	XPH107	2018-19	Employability skill
English for Effective Communication	XGL201	2018-19	Soft skill -Group discussion, Oral presentation, seminar
Environmental Studies	XES202	2018-19	Soft skill -Group discussion, Oral presentation, seminar
Calculus and Differential Equations	XMG203	2018-19	Skill Development
Electricity and Magnetism	XPH204	2018-19	Employability skill
Atomic Physics	XPH205	2018-19	Employability skill
Physics Practical II	XPH206	2018-19	Employability skill
Physics Workshop Skills	XPH301	2018-19	Skill Development

Inorganic, Organic and Physical Chemistry I	XCG302	2018-19	Employability skill
Heat and Thermodynamics	XPH303	2018-19	Employability skill
Basic Electronics	XPH304	2018-19	Employability skill
*Open Elective		2018-19	**********
Volumetric and Qualitative Analysis	XCG305	2018-19	Employability skill
Disaster Management	XUM306	2018-19	Soft skill -Group discussion, Oral presentation, seminar
Physics Practical III	XPH307	2018-19	Employability skill
Office Automation (15 hours)		2018-19	**********
Electrical Circuit Network Skills	XPH401	2018-19	Skill Development
Inorganic, Organic and Physical Chemistry II	XCG402	2018-19	Employability skill
Waves and Optics	XPH403	2018-19	Employability skill
Analog & Digital electronics	XPH404	2018-19	Employability skill
*Open Elective		2018-19	**********
Volumetric and Qualitative Analysis	XCG405	2018-19	Skill Development
Physics Practical IV	XPH406	2018-19	Skill Development
Animation Software I (15 hours)		2018-19	**********
Basic Instrumentation Skills	XPH501	2018-19	Skill Development
Solid State Physics	XPH502A	2018-19	Employability skill
Atomic & Molecular Spectroscopy	XPH502B	2018-19	Employability skill
Nuclear and Particle Physics	XPH503A	2018-19	Employability skill
Principles of Modern Physics	XPH503B	2018-19	Employability skill
Microprocessor and C programming	XPH504A	2018-19	Skill Development, Employability skill
Micro Processor and Microcontroller	XPH504B	2018-19	Skill Development, Employability skill
*Open Elective		2018-19	**********

Physics Practical V A	XPH505	2018-19	Skill Development, Employability skill
Physics Practical V B	XPH506	2018-19	Skill Development, Employability skill
Animation Software II (15 hours)		2017-18	**********
IPT (21 days)	–	2017-18	**********
Renewable Energy	XPH601	2018-19	Soft skill -Group discussion, Oral presentation, seminar
Relativity & Quantum Mechanics	XPH602A	2018-19	Employability skill
Material Science	XPH602B	2018-19	Employability skill
Micro Electro Mechanical System	XPH603A	2018-19	Employability skill
Numerical methods in Physics	XPH603B	2018-19	Skill Development
Physics Practical VI A	XPH604	2018-19	Skill Development
Physics Practical VI B	XPH605	2018-19	Skill Development
Project	XPH606	2018-19	Skill Development
M.Sc. Physics			
Mathematical Physics I	YPH101	2010-11	Employability skill
Classical Dynamics and Relativity	YPH102	2010-11	Employability skill
Basic Electronics	YPH103	2010-11	Employability skill
Basic Practical (General & Electronics) Lab	YPH104	2010-11	Skill Development
Numerical Methods in Physics	YPH105A	2010-11	Employability skill
Geophysics	YPH105B	2010-11	Employability skill
Mathematical Physics II	YPH201	2010-11	Employability skill
Statistical Mechanics	YPH202	2010-11	Employability skill
Electromagnetic Theory	YPH203	2010-11	Employability skill
Advanced General Experiments Lab	YPH204	2010-11	Skill Development
Laser and its applications	YPH205A	2010-11	Employability skill
Nano Science	YPH205B	2010-11	Employability skill
Solid State Physics	YPH301	2010-11	Employability skill
Quantum Mechanics	YPH302	2010-11	Employability skill
Nuclear and Particle Physics	YPH303	2010-11	Employability skill
Advanced Electronics I - Lab	YPH304	2010-11	Skill Development
Crystal growth and Characterization Techniques	YPH305A	2010-11	Employability skill

Communication Electronics	YPH305B	2010-11	Employability skill
Spectroscopy	YPH401	2010-11	Employability skill
Special Electronics	YPH402	2010-11	Employability skill
Advanced Electronics II - Lab	YPH403	2010-11	Skill Development
Programming in C++	YPH404A	2010-11	Soft Skill
Non-Destructive Testing Technology	YPH404B	2010-11	Soft Skill
Project work and viva voce	YPH405	2010-11	Skill Development
Elective I - Thin film Science and Characterization Techniques	YPH105C	2015-16	Employability skill
Elective II - Non-Destructive Testing Technology	YPH205C	2015-16	Employability skill
Elective III – Automation Science & Techniques	YPH305B	2015-16	Employability skill
Research Methodology	YPH305C	2015-16	Employability skill

2. Syllabus of Courses B.Sc. Physics Programmes

XPH104 - PROPERTIES OF MATTER AND SOUND

COURSE OUTCOMES

CO1. Cog: R, U, App; ***Identify*** the principles of elasticity, ***derive*** expression for twisting couple and ***determine*** rigidity modulus of a wire.

CO2. Cog: U, App;***Develop Knowledge***on bending of beams, its properties and ***application.***

CO3. Cog: R, U; ***Define*** surface tension, ***recall*** the concepts of low pressure and ***explain*** the methods of production of low pressure.

CO4. Cog: U, Ana;***Understand***flow of liquid,viscosityand***identify***its ***applications.***

CO5.Cog: R, Ana; ***Describe*** the production, propagation, perception &***analysis*** of acoustical wave.

COURSE CODE	COURSE NAME	L	T	P	C
XPH104	PROPERTIES OF MATTER AND SOUND	3	1	0	4
		L	T	P	H
		3	1	0	4

UNIT I ELASTICITY **7+3**

Stress – Strain Diagram – Elastic Module, Work done per unit volume in shearing strain – relation between elastic constants – Poisson's Ratio- Expression for Poisson's ratio in terms of elastic constants – Twisting couple on a wire – Work done in twisting – Torsional pendulum – Determination of rigidity modulus of a wire.

UNIT II BENDING OF BEAMS **8+3**

Expression for bending moment – Cantilever – Expression for depression – Experiment to find Young's Modulus – Cantilever oscillation – Expression for period – Uniform bending – Expression for elevation – Experiment to find Young's modulus using microscope – Non Uniform bending – Expression for depression – Experiment to determine Young's modulus using mirror and telescope.

UNIT III SURFACE TENSION **10+3**

Definition and dimensions of surface tension - Excess of pressure over curved surfaces - Application to spherical and cylindrical drops and bubbles - Variation of Surface tension with temperature - Jaegar's method. Physics of Low Pressure. Production and Measurement of low pressure - Grades' molecular pump - Rotary pump - Knudsen absolute gauge.

UNIT IV VISCOSITY **10+3**

Co-efficient of viscosity and its dimensions - Rate of flow of liquid in a capillary tube - Poiseuilles' formula - Experiment to determine co-efficient of viscosity of a liquid - Variation of viscosity of a liquid with temperature - Applications of viscosity.

UNIT V SOUND **10+3**

Laws of transverse vibrations in strings – verification by Sonometer - Music and noise- Characteristics of musical sound - Reverberation and Reverberation time – Sabine's formula – Optimum reverberation – Measurement of reverberation time – Absorption coefficient – Acoustics design – Ultrasonic Production: Piezo electric oscillator and magnetostriction oscillator method – Properties – Applications.

	LECTURE	TUTORIAL	TOTAL
	45	15	60

TEXT BOOKS

1. Brijlal and Subramanian, 'Properties of Matter', S. Chand and company Ltd, New Delhi, 2003.
2. N. Subrahmaniyam and Brijlal, 'A Text Book of Sound', Vikash Publishing House, Second Revised Edition, 1995.
3. R. Murugeshen, 'Properties of Matter and Acoustics', S. Chand and company Ltd, New Delhi, 2004.

REFERENCES

1. D.S. Mathur, ' Elements of Properties of Matter', S. Chand and company Ltd, New Delhi, 2000.
2. Subramanian Iyer and Jeyaraman, 'Properties of matter'
3. L.P. Sharma, H.C. Saxena, 'Oscillations, Waves and Sound'
4. R. L. Saigal, 'A Text Book of Sound'

Mapping with Programme Outcomes

Cos	PO_1	PO_2	PO_3	PO_4	PO_5	PO_6	PO_7	PO_8
CO_1	**3**	**3**	**2**	**0**	**0**	**3**	**0**	**1**
CO_2	**3**	1	**0**	**2**	**3**	**3**	**0**	**1**
CO_3	**3**	3	**3**	**0**	**0**	**3**	**3**	**2**
CO_4	**3**	3	**0**	**0**	**3**	**3**	**0**	**2**
CO_5	**1**	3	**3**	**1**	**2**	**3**	**0**	**2**
	13	13	**8**	**3**	**8**	**15**	**2**	**8**
Scaled to 1, 2, 3	**3**	3	**2**	**4**	**2**	**3**	**1**	**2**

3 – Strong: 2 – Medium: 1 – Low

XPH105 - MECHANICS AND SPECIAL THEORY OF RELATIVITY

COURSE OUTCOMES

CO1. Cog: R, U, App; ***Recall, associate and solve*** the fundamentals of vector, differential equations and laws of motion.

CO2. Cog: R, U;Acquire ***knowledge*** and ***describe*** momentum, work, energy, rotationalmotion, oscillatory motion and its ***relation***

CO3. Cog: R, U;Aff: Rec.;***Explain*** various laws of gravitation and ***how*** it is used in the latest science of satellite launching.

CO4. Cog: R, U, App;***Describe***the concepts of statics, hydrostatics and hydrodynamics, ***recall*** the laws of floatation ad ***construct*** models for pressure variations**.**

CO5.Cog: R, U; ***Understand*** the theory of relativity, Lorentz transformations and ***derive*** mass-energy equivalence

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COURSE CODE	SUBJECT NAME	L	T	P	C
XPH105	MECHANICS AND SPECIAL THEORY OF RELATIVITY	3	1	0	4
		L	T	P	H
		3	1	0	4

UNIT I PROJECTILE, IMPULSE & IMPACT **5+2**

Projectile- Path of a projectile is a parabola – Range on a inclined plane – Impulse – Impact – Impulsive force – Laws of impact – Impact of a smooth sphere on a horizontal plane – Direct & oblique impact – Loss of kinetic energy – Motion of two interacting bodies

UNIT II DYNAMICS OF RIGID BODIES **12+4**

Kinetic energy of rotation – Angular momentum of a rotating body – Compound pendulum – equivalent simple pendulum – reversibility of centres of oscillation and suspension – centre of percussion – minimum period – Determination of g and radius of gyration of a bar pendulum. Law of conservation of momentum – Center of mass - Velocity and Acceleration of centre of mass – System of variable mass- Equation of a Rocket motion – conservation of linear and angular momentum.

UNIT III GRAVITATION, CENTER OF GRAVITY AND CENTRE OF PRESSURE **8+3**

Newton's law of gravitation - Boy's method of determination of G - Kepler's laws - orbital velocity and escape velocity - Geo-stationary and Communication- Satellites Centre of gravity of solid and hollow tetrahedron, solid and hollow hemisphere. Centre of pressure - vertical rectangular lamina - vertical triangular lamina.

UNIT IV HYDRODYNAMICS **10+3**

Equation of continuity of flow - venturimeter - Pitot's tube for liquids - Euler's equation for unidirectional flow - Torricelli's theorem - Bernoulli's theorem and applications. Laws of floatation - meta centre - meta centric height of a ship. Atmospheric pressure its variations with altitude - reasons for such variations.

UNIT V THEORY OF RELATIVITY **10+3**

Galilean-Newtonian relativity, Galilean frames formations- Michelson Morley Experiment and its importance – Einstein's postuletes – Lorentz transformation – Relativity of space and time – Addition of velocities – Variation of Mass with velocity – Mass- Energy equivalence- Physical significance.

	LECTURE	TUTORIAL	TOTAL
	45	15	60

TEXT BOOKS

1. M. Narayanamoorthy and N. Nagarethnam, 'Dynamics', National publishing Company, Chennai, 8th Edition, 2002.
2. R. Mugrugesan, KiruthigaSivaprakash, 'Modern Physics', S. Chand & Co. Ltd. New Delhi, First Edition, 1992.
3. M.Narayanamoorthy and N.Nagarethinam, 'Hydrostatics', National Publishing company, Chennai.

REFERENCES

1. P. R. Subramaniam, T. Jayaraman and C. Rangarajan S.V., 'Mechanics for B.Sc., Classes', Publishers Chennai.
2. D.S. Mathur, ' Elements of Properties of Matter', S. Chand and company Ltd, New Delhi, 2000.
3. Gupta Kumar,'Elementary Statistical Mechanics'

Mapping with Programme Outcomes

Cos	PO_1	PO_2	PO_3	PO_4	PO_5	PO_6	PO_7	PO_8
CO_1	3	3	1	2	3	2	0	1
CO_2	3	2	1	2	3	3	0	1
CO_3	3	3	2	2	3	3	3	2
CO_4	3	3	0	2	3	2	0	2
CO_5	3	2	2	2	3	3	0	2
	15	13	6	10	15	13	2	8
Scaled to 1, 2, 3	3	3	2	2	3	3	1	2

3 – Strong: 2 – Medium: 1 – Low

COURSE CODE	SUBJECT NAME	L	T	P	C
XPH107	PHYSICS PRACTICAL –I	0	0	3	2
		L	T	P	H
		0	0	3	3

COURSE OUTCOMES:

CO1: Cog: Ana; Aff: Rec.; Psy: Mech; ***Use*** laboratory techniques such as accuracy of **measurements** and data **analysis**.

CO2: Cog: U; Aff: Rec.; Psy: Set, GR; ***Explain theconcepts*** that are learnt in the lecture sessions and ***follow*** hands-on learning experience in the laboratory sessions.

CO3: Cog: R; Aff: Rec.; Psy: Mech; Gain ***knowledge*** in the scientific methods and ***identify*** the process of **measuring** different Physical variables

CO4: Cog: Ap; Aff: Rec, Org;Psy: Mech; ***Manipulate***and ***complete*** all the experiments with excellent ***application*** knowledge.

LIST OF EXPERIMENTS

1. Young's modulus - Non uniform bending – Scale and telescope
2. Young's modulus – Non uniform bending –Pin and microscope.
3. Koenigs – Uniform Bending Method – Young's Modulus.
4. Screw Gauge and Vernier Caliper (Measurements)
5. Surface tension and interfacial surface tension by drop weight method.
6. Coefficient of viscosity – burette method.
7. Compound Pendulum – Determination of g and K.
8. Surface tension by capillary rise method.
9. Torsional pendulum- determination of the rigidity modulus of thin wire.
10. Stokes method – determine the viscosity of the given liquid.

TEXT BOOKS

1. BSc Practical Physics, C. L. Arora, (S. Chand)
2. An Advanced Course in Practical Physics, D. Chattopadhyay and P. C. Rakshit, (New Central Book Agency)
3. A Text Book of Advanced Practical Physics, S. Ghosh, (New Central Book Agency) 7 Semester 1 - Physics (Honours) Theory Paper.
4. Shukla R. K. and Anchal Srivastava, Practical Physics, New Age International (P) Ltd, Publishers, 2006.

5. Arora C. L., B.Sc Practical Physics, S. Chand and Company Ltd, 2007.

REFERENCES

1. Squires G. L., Practical Physics, 4 th Edition, Cambridge University Press, 2001.
2. Halliday D., Resnick R. and Walker J., Fundamentals of Physics, 6th Edition, John Wiley and Sons, 2001.
3. Jenkins F.A. and White H.E., Fundamentals of Optics, 4th Edition, Mc Graw Hill Book Company, 2007.
4. Geeta Sanon, B. Sc., Practical Physics, 1st Edition, S. Chand and Company, 2007.
5. Benenson, Walter, and Horst Stocker, Handbook of Physics, Springer, 2002.

Mapping with Programme Outcomes

COs	**PO_1**	**PO_2**	**PO_3**	**PO_4**	**PO_5**	**PO_6**	**PO_7**	**PO_8**
CO_1	3	1		2	1	2	3	3
CO_2	3	1		2	1	2	3	2
CO_3	3	1		1	1	2	2	1
CO_4	3	1		2	1	2	3	2
	12	4		7	4	6	11	8
Scaled to 1, 2, 3	**3**	**1**		**2**	**1**	**2**	**3**	**2**

3 – Strong: 2 – Medium: 1 – Low

XPH204 ELECTRICITY AND MAGNETISM

COURSE OUTCOMES

CO1. Cog: R, U, App; ***Recall, understand and use*** the basic theorems of scalars and vectors

CO2. Cog: R, U, App;***Identify*** and ***explain*** Gauss theorem and its applications and ***apply*** knowledge of the concepts of electrostatics

CO3. Cog: R, U, Ana.;***Recall***Biot-Savart's law, ***explain*** current passing through straight conductor, coil, solenoid and ***distinguish*** various properties of magnetic materials.

CO4. Cog: R, U;***Define***Faraday's law and Lenz's law and ***demonstrate*** mutual and self inductance of the coil.

CO5.Cog: R, App, E;***Select***the principle of magneto-statics, ***develop*** Maxwell's equation and ***explain*** EM wave propagation.

COURSE CODE	**SUBJECT NAME**	**L**	**T**	**P**	**C**
XPH204	**ELECTRICITY AND MAGNETISM**	**3**	**1**	**0**	**4**
		L	**T**	**P**	**H**
		3	**1**	**0**	**4**

UNIT IELECTROSTATICS **12+4**

Electrostatic field - electric flux - Gauss's theorem of electrostatics - Application of Gauss theorem - electric field due to a point charge - infinite line of charge, uniformly charged spherical shell and solid sphere - plane charged sheet - charged conductor - Electric potential as line integral of electric field - potential due to a point charge - electric dipole - uniformly charged spherical shell and solid sphere. Capacitance of an isolated spherical conductor - Parallel plate, spherical and cylindrical condenser - Energy per unit volume in electrostatic field - dielectric

medium - Parallel plate capacitor completely filled with dielectric.	
UNIT II CURRENT ELECTRICITY	**8+3**
Kirchoff's Laws of Electricity(Statement), Wheatstone's bridge – Carrey Foster's Bridge – Heating effect: Joule's law, Seebeck effect, Peltier effect, Thomson effect – Thermodynamics of thermocouple – Thermo electric diagrams – Determination of Thomson, Peltier coefficient – Measurement of thermo emf using potemtiometer.	
UNIT IIIMAGNETISM	**10+3**
Magneto statistics: Biot-Savart's law & its applications - straight conductor, circular coil and solenoid carrying current - Ampere's circuital law - Magnetic properties of materials: magnetic intensity, magnetic induction, permeability, magnetic susceptibility - brief introduction of dia, para and ferro magnetic materials.	
UNIT IV ELECTROMAGNETIC INDUCTION	**5+2**
Faraday's laws of electromagnetic induction - Lenz's law - self and mutual inductance, L of a single coil, M of two coils - Energy stored in magnetic field.	
UNIT V MAXWELL'S EQUATION AND ELECTROMAGNETIC WAVE PROPAGATION	**10+3**
Equation of continuity of current - displacement vector - Maxwell's equations - Poynting vector - energy density in electromagnetic field - electromagnetic wave propagation through vacuum and isotropic dielectric medium - transverse nature of EM waves - polarization.	

	LECTURE	**TUTORIAL**	**TOTAL**
	45	**15**	**60**

TEXT BOOKS

1. R. Murugeshan, 'Electricity and Magnetism', S. Chand & Company Ltd. New Delhi, 2008.
2. Brijlal and N. Subrahmanyam,'Electricity and Magnetism', Ratan PrakashanMandir, Agra, 2000.
3. K.K.Tiwari, 'A Text Book of Electricity and Magnetism', S. Chand & Company Ltd. New Delhi, 2002.
4. Edward M. Purcell, 'Electricity and Magnetism', McGraw Hill Education.
5. D C Tayal, 'Electricity and Magnetism', Himalaya Publishing House.

REFERENCES

1. D.L. Sehgal, K.L. Chopra and N.K. Sehgal,'Electricity and Magnetism', 5th Edition, Sultan chand& Sons, New Delhi, 1996.
2. William Hayt,'Engineering Electromagnetism', TMH ed.
3. D. Kraus,'Introduction to Electromagnetic Theory', Wiley Eastern.
4. Benjamin Cummings, 'Introduction to Electrodynamics', 3rd Edition
5. J H Fewkes& JYarwood,'Electricity and Magnetism', Oxford University Press, Vol.I.

Mapping with Programme Outcomes

COs	**PO_1**	**PO_2**	**PO_3**	**PO_4**	**PO_5**	**PO_6**	**PO_7**	**PO_8**
CO_1	**3**	**3**	**0**	**3**	**3**	**3**	**0**	**1**
CO_2	**3**	3	**1**	**3**	**2**	**3**	**0**	**1**
CO_3	**3**	3	**1**	**3**	**2**	**3**	**3**	**2**
CO_4	**3**	3	**1**	**3**	**2**	**3**	**0**	**2**
CO_5	**3**	3	**1**	**3**	**2**	**3**	**0**	**2**
	15	15	**4**	**15**	**11**	**15**	**2**	**8**
Scaled to 1, 2, 3	**3**	3	**1**	**3**	**3**	**3**	**1**	**2**

3 – Strong: 2 – Medium: 1 – Low

XPH205 ATOMIC PHYSICS

COURSE OUTCOMES:

CO1. Cog., A: R,U, An, E; ***Recall*** Atomic structure, ***Compare*** various atom models, ***Distinguish*** various potentials and ***Explain*** special quantization and spectra of atom.
CO2. Cog: U, An; ***Demonstrat***e alkali spectra of atom, ***Compare*** LS &JJ couplings, ***Distinguish*** X-rays and A***nalyze*** various applications of X-ray.
CO3. Cog., A: U, E; ***Explain*** the dual nature of particles and uncertainty principle.
CO4. Cog: R, E; ***Define*** matter waves and wave amplitude and ***Explain*** Schrodinger equation for non-relativistic particles.
CO5. Cog: U, E; ***Explain*** physical interpretation of wave function, probabilities, normalization and tunneling across a rectangular potential barrier.

COURSE CODE	COURSE NAME	L	T	P	C
XPH205	ATOMIC PHYSICS	3	1	0	4
		L	T	P	H
		3	1	0	4

UNIT I Atomic Structure **11+3**

Atom models – spectral series of hydrogen atom – Excitation of atoms – Critical, Excitation and Ionisation Potential – Experimental determination of critical potential - Frank and Hertz`s method – Sommerfield atom model – Qualitative treatment – Derivation of condition for the allowed elliptical orbits – Quantum numbers associated with Vector atom model – Paul's exclusion principle – The periodic classification of elements (Periodic table) – Bohr magnetron – spatial quantization – Stern and Gerlach experiment. Problems with Rutherford model- instability of atoms and observation of discrete atomic spectra– Bohr's quantization rule and atomic stability– calculation of energy levels for hydrogen like atoms and their spectra.

UNIT II Atomic spectra **11+3**

Atomic Spectra of hydrogen – deuteron and alkali atoms – spectral terms – doublet fine structure – screening constants for alkali spectra for s, p. d, and f states – selection rules. Singlet and triplet fine structure in alkaline earth spectra – L-S and J-J couplings – Weak spectra – continuous X-ray spectrum and its dependence on voltage – Duane and Haunt's law – Characteristics X-rays – Moseley's law – doublet structure and screening parameters in X-ray spectra – X-ray absorption spectra.

UNIT III Matter Waves **7+3**

Position measurement- gamma ray microscope thought experiment– Wave-particle duality, Heisenberg uncertainty principle- impossibility of a particle following a trajectory– Estimating minimum energy of a confined particle using uncertainty principle– Energy-time uncertainty principle.

UNIT IV Schrodinger Equation and its Applications **7+3**

Two slit interference experiment with photons, atoms and particles – linear superposition principle as a consequence – Matter waves and wave amplitude – Schrodinger equation for non-relativistic particles – Momentum and Energy operators– stationary states.

Unit V Physical interpretation and Energy spectra **9+3**

Physical interpretation of wave function, probabilities and normalization– Probability and probability current densities in one dimension – One dimensional infinitely rigid box- energy eigen values and eigen functions, normalization– Quantum dot as an example– Quantum mechanical scattering and tunnelling in one dimension - across a step potential and across a rectangular potential barrier.

	LECTURE	TUTORIAL	TOTAL
	45	15	60

TEXT BOOKS

1. Arthur Beiser, Concepts of Modern Physics, 2002, McGraw-Hill.
2. Rich Meyer, Kennard, Coop, Introduction to Modern Physics, 2002, Tata McGraw Hill
3. David J. Griffith,Introduction to Quantum Mechanics, 2005, Pearson Education
4. Jewett &Serway, Physics for scientists & Engineers with Modern Phys., 2010, Cengage Learning.
5. A.K. Ghatak and S. Lokanathan, Quantum Mechanics: Theory & Applications, 2004, Macmillan.
6. C.H. Holbrow, J.N. Lloyd, J.C. Amato, E. Galvez et.al.Modern Introductory Physics, 2010, Springer.

REFERENCES

1. John R. Taylor, Chris D. Zafiratos, Michael A. Dubson,Modern Physics, 2004, PHI Learning.
2. H.S. Mani and G.K. Mehta, Introduction of Modern Physics, 1988, Affiliated East-West Press.
3. Thomas A. Six Ideas that Shaped Physics: Particle Behave like Waves, Moore, 2003, McGraw Hill

Mapping with Programme Outcomes

Cos	PO_1	PO_2	PO_3	PO_4	PO_5	PO_6	PO_7	PO_8
CO_1	3	2	0	3	3	3	0	1
CO_2	3	2	1	2	3	2	0	1
CO_3	3	2	1	2	3	2	3	2
CO_4	3	2	1	2	3	2	0	2
CO_5	3	2	1	2	3	2	0	2
	15	10	4	11	15	11	2	8
Scaled to 1, 2, 3	3	2	1	3	3	3	1	2

3 – Strong: 2 – Medium: 1 – Low

COURSE CODE	SUBJECT NAME	L	T	P	C
XPH206	PHYSICS PRACTICAL –II	0	0	3	2
		L	T	P	H
		0	0	3	3

COURSE OUTCOMES:

CO1: Cog: Ana; Aff: Rec.; Psy: Mech; ***Use*** laboratory techniques such as accuracy of **measurements** and data **analysis**.

CO2: Cog: U; Aff: Rec.; Psy: Set, GR; ***Explain theconcepts*** that are learnt in the lecture sessions and ***follow*** hands-on learning experience in the laboratory sessions.

CO3: Cog: R; Aff: Rec.; Psy: Mech; Gain ***knowledge*** in the scientific methods and ***identify*** the process of **measuring** different Physical variables

CO4: Cog: Ap; Aff: Rec, Org;Psy: Mech; ***Manipulate***and ***complete*** all the experiments with excellent ***application*** knowledge

LIST OF EXPERIMENTS

1 Young's modulus – Uniform bending – Scale and telescope.
2 Young's modulus – Uniform bending – Pin and microscope.
3 Static torsion – determine the rigidity modulus.
4 Potentiometer –Voltmeter calibration(low range)
5 Meter bridge – determination of specific resistance.
6 Potentiometer – Thermister – Temperature Coefficient.
7 Meter bridge – verification of laws of resistance.
8 Potentiometer – Internal resistance of cells.
9 Sonometer – Verification of laws.
10 Comparison of surface tension by capillary rise method.

TEXT BOOKS

1. BSc Practical Physics, C. L. Arora, (S. Chand)
2. An Advanced Course in Practical Physics, D. Chattopadhyay and P. C. Rakshit, (New Central Book Agency)
3. A Text Book of Advanced Practical Physics, S. Ghosh, (New Central Book Agency) 7 Semester 1 - Physics (Honours) Theory Paper.
4. Shukla R. K. and Anchal Srivastava, Practical Physics, New Age International (P) Ltd, Publishers, 2006.
5. Arora C. L., B.Sc Practical Physics, S. Chand and Company Ltd, 2007.

REFERENCES

1. Squires G. L., Practical Physics, 4 th Edition, Cambridge University Press, 2001.
2. Halliday D., Resnick R. and Walker J., Fundamentals of Physics, 6th Edition, John Wiley and Sons, 2001.
3. Jenkins F.A. and White H.E., Fundamentals of Optics, 4th Edition, Mc Graw Hill Book Company, 2007.
4. Geeta Sanon, B. Sc., Practical Physics, 1st Edition, S. Chand and Company, 2007.
5. Benenson, Walter, and Horst Stocker, Handbook of Physics, Springer, 2002.

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Mapping with Programme Outcomes

COs	**PO_1**	**PO_2**	**PO_3**	**PO_4**	**PO_5**	**PO_6**	**PO_7**	**PO_8**
CO_1	3	1		2	1	2	3	3
CO_2	3	1		2	1	2	3	2
CO_3	3	1		1	1	2	2	1
CO_4	3	1		2	1	2	3	2
	12	4		7	4	6	11	8
Scaled to 1, 2, 3	**3**	**1**		**2**	**1**	**2**	**3**	**2**

3 – Strong: 2 – Medium: 1 – Low

XPH301 PHYSICS WORKSHOP SKILLS

COURSE OUTCOMES:

CO1. Cog: U, Ap; ***Relate***SI and CGS units and ***Apply*** their knowledge in various measuring instruments.

CO2. Cog:Ap, An; ***Recall andDevelop*** their knowledge to find welding defect & handling of various tools and ***Distinguish*** like metal, composites and alloy materials.

CO3. Cog:Ap; ***Apply*** their knowledge to handle multimeter and soldering to construct circuit.

CO4. Cog: U, Ap; ***Identify*** the diode, transistor and FET - ICs on PCB and ***Construct*** the regulated power supply and timer circuits.

CO5. Cog:U, C; ***Infer*** small mechanism of lever, break and gear and ***Adapt***working principle of power generation system.

COURSE CODE	COURSE NAME	L	T	P	C
XPH301	PHYSICS WORKSHOP SKILLS	0	0	2	2
		L	T	P	H
		0	0	2	2

UNIT - I Measuring Instruments and Units — **7**

Measuring units, conversion to SI and CGS., Familiarization with meter scale, Vernier caliper, Screw gauge and their utility. Measure the dimension of a solid block, volume of cylindrical beaker/glass, diameter of a thin wire, thickness of metal sheet, etc. Use of Sextant to measure height of buildings, mountains, etc..

UNIT - II Mechanical Skill — **11**

Concept of workshop practice, Overview of manufacturing methods: casting, foundry, machining, forming and welding - Types of welding joints and welding defects. Common materials used for manufacturing like steel, copper, iron, metal sheets, composites and alloy, wood. Concept of machine processing - introduction to common machine tools like lathe, shaper, drilling, milling and surface machines. Cutting tools - lubricating oils - Cutting of a metal sheet using blade - Smoothening of cutting edge of sheet using file – Drilling of holes of different diameter in metal sheet and wooden block – Use of bench voice and tools for fitting – Make funnel using metal sheet.

UNIT - III Electrical skill — **9**

Use of Multimeter – Soldering of electrical circuits having discrete components (R, L and C)

Unit - IV Electronic Skill — **9**

Basic principle of diode, transistor and FET - ICs on PCB - Operation of oscilloscope – Making regulated power supply, timer circuit, electronic switch using transistor and relay

UNIT - V Introduction to prime movers — **9**

Mechanism, gear system, wheel, fixing of gears with motor axel – Lever mechanism - lifting of heavy weight using lever, breaking systems, pulleys, working principle of power generation systems – demonstration of pulley experiment.

	TUTORIAL	PRACTICAL	TOTAL
	15	30	45

TEXT BOOKS

1. B.L. Theraja, A text book in Electrical Technology, S. Chand and company.
2. M.G. Say,Performance and design of AC machines, ELBS Edn.
3. K.C. John, Mechanical workshop practice, 2010,PHI learning Pvt, Ltd.

REFERENCES
1. Bruce J. Black, Workshop processes, practices and materials, 2005, 3rdEdn., Editor Newnes [ISBN: 0750660732].
2. Lawrence Smyth/Liam Hennessy,New engineering technology, The Educational company ofIreland [ISBN: 0861674480]

Mapping with Programme Outcomes

COs	PO_1	PO_2	PO_3	PO_4	PO_5	PO_6	PO_7	PO_8
CO_1	3	2	0	3	2	3	0	1
CO_2	3	2	1	3	2	3	0	1
CO_3	3	2	1	3	2	3	3	2
CO_4	3	2	1	3	2	3	0	2
CO_5	3	2	1	3	2	3	0	2
	15	10	4	15	10	15	2	8
Scaled to 1, 2, 3	3	2	1	3	3	3	1	2

3 – Strong: 2 – Medium: 1 – Low

XPH303 HEAT AND THERMODYNAMICS

COURSE OUTCOMES:

CO1. Cog., A: R,U; ***Recall*** Cp and Cv and basic concepts of specific heat and ***Explain*** various theories.

CO2. Cog: An, E; ***Explain*** the nature of heat and heat transmission and ***Distinguish*** mono-dia- triatomic gases.

CO3. Cog., A: R, U, E; ***List*** the laws of thermodynamics and ***Explain*** latent heat and entropy

CO4.Cog: R,E,C; ***Define*** Coefficient of Thermal Conductivity, ***Determine*** thermal conductivity of bad conductor and ***Discuss*** the various laws for heat flow.

CO5. Cog: U, An, E, C; ***Analyze*** statistical equilibrium, explain various distribution laws and ***Compare*** the three statistics

COURSE CODE	COURSE NAME	L	T	P	C
XPH303	HEAT AND THERMODYNAMICS	3	1	0	4
		L	T	P	H
		3	1	0	4

UNIT ISPECIFIC HEAT	10+3
Specific Heat – Specific Heat of a Liquid by Joule's Electrical Method, SpecificHeat of a Gas – Mayer's Relation - Specific Heat of a gas at Cv – Joly's SteamCalorimeter – Cp Regnault's Method - Dulong and Petit's Law – Variation of Specific Heat and Atomic Heat with Temperature – Debye's theory – Einstein's Quantum Theory.	
UNIT IINATURE OF HEAT	**7+3**
Degrees of freedom and Maxwell's Law of Equipartition of Energy – Atomicity ofGases – Monatomic – Diatomic – Triatomic Gases – Molecular velocity distributionMaxwell's Derivation – Mean Free Path – Transport Phenomena – Viscosity of Gases – Thermal Conductivity of Gases.	
UNIT IIITHERMODYNAMICS	**8+3**
Carnot's Theorem – Thermodynamic Scale of Temperature –Clapeyron Latent Heat Equation – Entropy – Change of Entropy in a Reversible and Irreversible Process – 3rd Law of	

Thermodynamics – T-S Diagram – Entropy of a Perfect Gas – Zero Point Energy And Negative Temperature – Maxwell's Thermodynamical Relations Derivation.	
UNIT IV TRANSMISSION OF HEAT	**10+3**
Coefficient of Thermal Conductivity – Lee's Disc method for bad conductors.Radial and cylindrical flow of heat – Wiedmann – Franz law – Stefan's law –Mathematical derivation – Newton's law of cooling from Stefan's law –Experimental verification – Stefan's constant – Experimental determination.	
UNIT VSTATISTICAL THERMODYNAMICS	**10+3**
Statistical equilibrium –M.B. distribution law –M.B. distribution law in terms of temperature – application to ideal gas – Quantum Statistics – Phase space – Fermi-Dirac Distribution Law – Electron gas – Fermi energy – Bose – Einstein Distribution Law – Photon gas – Comparison of three statistics.	

	LECTURE	**TUTORIAL**	**TOTAL**
	45	**15**	**60**

TEXT BOOKS

1. Brijlal and Subramanium,Heat and Thermodynamics,S.Chand Publishers & Co, New Delhi 2004.
2. J.B.Rajam,Heat and Thermodynamics,S.Chand Publishers
3. S. D. S. Mathur,Heat and Thermodynamics, Chand & Co, New Delhi 2004.

REFERENCES

1. Brijlal, N.Subrahmanyum and P.S.Hemne, Thermodynamics and Statistical physics(multi colour edn.7) .
2. Mark W Zemansk,Richard H Dittman, Heat and Thermodynamics (seventh Edn.)
3. Francis W.Sears& Gerhard L Salinger, Thermodynamics, Kinetic Theory, Statistical – Thermodynamics.
4. Arthur Beiser, Concepts of Modern physics (fifth Edn.)

Mapping with Programme Outcomes

COs	**PO_1**	**PO_2**	**PO_3**	**PO_4**	**PO_5**	**PO_6**	**PO_7**	**PO_8**
CO_1	**3**	**2**	**0**	**3**	**3**	**3**	**0**	**1**
CO_2	**3**	2	**0**	**2**	**3**	**2**	**0**	**1**
CO_3	**3**	2	**0**	**2**	**3**	**2**	**3**	**2**
CO_4	**3**	2	**0**	**2**	**3**	**2**	**0**	**2**
CO_5	**3**	2	**0**	**2**	**3**	**2**	**0**	**2**
	15	10	**0**	**11**	**15**	**11**	**2**	**8**
Scaled to 1, 2, 3	**3**	2	**0**	**3**	**3**	**3**	**1**	**2**

3 – Strong: 2 – Medium: 1 – Low

XPH304 BASIC ELECTRONICS
COURSE OUTCOMES: CO1. Cog., A: R, Ap; ***Recall*** the function of PN junction diode, zener diode LED and ***Construct*** the full wave rectifier filters, regulated power supply- zener regulator, photo diode. CO2.Cog: U, E; ***Demonstrate*** the transistor construction and working characteristics,***Determine*** the h- parameters. CO3. Cog: U, E; ***Compare*** the FET and Transistorand ***Explain*** the characteristics & applications of special semiconductor devices. CO4. Cog: U, C, E; ***Classify***Amplifiers, ***Discuss*** the feedback principle for amplifier, Oscillators and ***Explain*** the Hartley and Collpitt's oscillators. CO5. Cog: An., E; ***Distinguish***the modulations and ***Appraise*** the function of detectors.

COURSE CODE	COURSE NAME	L	T	P	C
XPH304	BASIC ELECTRONICS	3	1	0	4
		L	T	P	H
		3	1	0	4

UNIT 1: DIODES AND RECTIFIERS	**7+3**
PN Junction diode – characteristics- Zener diode – Characteristics- LED- Full wave rectifier - ripple factor - filters - L-section, Π-section filters - zener voltage regulated power supply, Photo Diode and Uses.	
UNIT 2: TRANSISTORS	**10+3**
Junction Transistors –construction – Mechanism of amplification – Modes of operation – Alpha & Beta of a Transistor – Current expression – Transistor static characteristics in CB and CE modes – Transistor biasing (voltage divider biasing) – Two port representation of a Transistor – Parameters- Determination of h-parameters.	
UNIT 3: SPECIAL DEVICES	**9+3**
Special semiconductor devices – FET, JFET, MOSFET (Construction And Working) - FET parameters – Comparison between FET and Transistor - Phototransistor – SCR, UJT characteristics- Applications of SCR as relay and UJT as relaxation oscillator.	
UNIT 4: AMPLIFIERS AND OSCILLATORS	**9+3**
Power amplifier – Class A power amplifier –Class B power amplifier - Push pull – Gain of amplifier with feedback – Effects of negative feedback – Oscillators – Types – Concepts of feedback oscillators – Hartley and Collpitt's oscillators.	
UNIT 5: MODULATORS AND DETECTORS	**10+3**
Modulation – Amplitude modulation-Modulation factor – Power in AM waves – Limitations of amplitude modulation-Frequency modulation – Phase modulation –Demodulation-Essentials in demodulation- Linear Diode Detector.	

LECTURE	TUTORIAL	TOTAL
45	15	60

TEXT BOOKS

1. V.K. Mehta, Principles of electronics, S.Chand& Co.- 7th Rev. Edition (2005).
2. N.Bhargava, D.Kulshreshtha and S.Gupta,Basic Electronics and Linear Circuits, Tata McGraw-Hill Publishing Co (1983).

REFERENCES

1. Sarjeer Gupta, Electronic Devices and circuits, Dhaanpat rai Publications – New Delhi – Reprint – 2008.
2. A. Ambrose and T.Vincent Devaraj, Elements of solid state electronics, Mera publications - 1993.
3. R.Muthusubramanian, S. Salivahanan, K.A. Muraleedharan, Basic electrical, Electronics and computer Engineering, Tata McGraw Hill publishing Co. Ltd., New Delhi – Reprint (2004)
4. Jacob Millman, Christos C. Halkias, Electronic Devices and circuits, Tata McGraw Hill publishing Co., Ltd., New Delhi – Reprint (2002).

Mapping with Programme Outcomes

Cos	PO_1	PO_2	PO_3	PO_4	PO_5	PO_6	PO_7	PO_8

CO_1	**3**	**2**	**0**	**2**	**3**	**3**	**0**	**1**
CO_2	**3**	2	**0**	**2**	**3**	**2**	**0**	**1**
CO_3	**3**	2	**1**	**2**	**3**	**2**	**3**	**2**
CO_4	**3**	2	**1**	**2**	**3**	**2**	**0**	**2**
CO_5	**3**	2	**1**	**2**	**3**	**2**	**0**	**2**
	15	10	**3**	**10**	**15**	**11**	**2**	**8**
Scaled to 1, 2, 3	**3**	2	**1**	**2**	**3**	**3**	**1**	**2**

3 – Strong: 2 – Medium: 1 – Low

COURSE CODE	SUBJECT NAME	L	T	P	C
XPH307	**PHYSICS PRACTICAL –III**	**0**	**0**	**3**	**2**
		L	**T**	**P**	**H**
		0	**0**	**3**	**3**

COURSE OUTCOMES:

CO1: Cog: Ana; Aff: Rec.; Psy: Mech; ***Use*** laboratory techniques such as accuracy of **measurements** and data **analysis**.

CO2: Cog: U; Aff: Rec.; Psy: Set, GR; ***Explain theconcepts*** that are learnt in the lecture sessions and ***follow*** hands-on learning experience in the laboratory sessions.

CO3: Cog: R; Aff: Rec.; Psy: Mech; Gain ***knowledge*** in the scientific methods and ***identify*** the process of **measuring** different Physical variables

CO4: Cog: Ap; Aff: Rec, Org;Psy: Mech; ***Manipulate***and ***complete*** all the experiments with excellent ***application*** knowledge.

LIST OF EXPERIMENTS

1. Sonometer- Determination of unknown frequency and unknown weight.
2. Melde's string Determination of frequency.
3. Transistor characteristics – common Emitter.
4. Newton's law of cooling – Specific heat capacity of the liquid.
5. Junction diode and Zener diode – Characteristics.
6. Carey Foster Bridge - Temperature Coefficient.
7. Lee's disc –specific heat capacity of the bad conductor.
8. Specific heat by Joules calorimeter.
9. Potentiometer- high range voltmeter
10. Zener Regulated Power Supply.

TEXT BOOKS

1. BSc Practical Physics, C. L. Arora, (S. Chand)
2. An Advanced Course in Practical Physics, D. Chattopadhyay and P. C. Rakshit, (New Central Book Agency)
3. A Text Book of Advanced Practical Physics, S. Ghosh, (New Central Book Agency) 7 Semester 1 - Physics (Honours) Theory Paper.
4. Shukla R. K. and Anchal Srivastava, Practical Physics, New Age International (P) Ltd, Publishers, 2006.
5. Arora C. L., B.Sc Practical Physics, S. Chand and Company Ltd, 2007.

REFERENCES

1. Squires G. L., Practical Physics, 4 th Edition, Cambridge University Press, 2001.
2. Halliday D., Resnick R. and Walker J., Fundamentals of Physics, 6th Edition, John Wiley and Sons, 2001.
3. Jenkins F.A. and White H.E., Fundamentals of Optics, 4th Edition, Mc Graw Hill Book Company, 2007.
4. Geeta Sanon, B. Sc., Practical Physics, 1st Edition, S. Chand and Company, 2007.
5. Benenson, Walter, and Horst Stocker, Handbook of Physics, Springer, 2002.

Mapping with Programme Outcomes

COs	**PO_1**	**PO_2**	**PO_3**	**PO_4**	**PO_5**	**PO_6**	**PO_7**	**PO_8**
CO_1	3	1		2	1	2	3	3
CO_2	3	1		2	1	2	3	2
CO_3	3	1		1	1	2	2	1
CO_4	3	1		2	1	2	3	2
	12	4		7	4	6	11	8
Scaled to 1, 2, 3	**3**	**1**		**2**	**1**	**2**	**3**	**2**

3 – Strong: 2 – Medium: 1 – Low

XPH401 ELECTRICAL CIRCUIT NETWORK SKILLS

COURSE OUTCOME:

CO1. Cog., A: R,U,An; ***Recall*** Basic Electricity Principles, ***Analyze*** electrical circuits and ***Distinguish*** single phase and three phase

CO2. Cog., A: R,U,E,An; ***Recall*** symbols, ***Explain*** circuits and diagram, ***Distinguish*** capacitance, inductance and impedance

CO3. Cog: R, An; ***Describe*** DC&AC power sources, ***Distinguish*** DC/AC Generator and motor.

CO4. Cog., A: U, E; ***Classify*** all Solid-State Devices, ***Explain*** response of inductors and capacitors with sources. ***Describe*** how the electrical components are protected.

CO5. Cog., A: An, C; ***Discuss*** about electrical wiring and***Distinguish*** the types of wiring.

COURSE CODE	**COURSE NAME**	**L**	**T**	**P**	**C**
XPH401	**ELECTRICAL CIRCUIT NETWORK SKILLS**	**0**	**0**	**3**	**2**
		L	**T**	**P**	**H**

		0	**0**	**3**	**3**

UNIT I Electrical Principles and Circuits	**7+3**
Basic Electricity Principles: Voltage, current, resistance and power – Ohm's law - Series, parallel and series-parallel combinations – AC Electricity and DC electricity – Familiarization with multimeter, voltmeter and ammeter. **Understanding Electrical Circuits**: Main electric circuit elements and their combination – Rules to analyze DC sourced electrical circuits – Current and voltage drop across the DC circuit elements – Single-phase and three-phase alternating current sources – Rules to analyze AC sourced electrical circuits – Relay, imaginary and complex power components of AC source – Power factor – Saving energy and money.	
UNIT II Electrical Drawing and Components	**6+3**
Drawing symbols – Blueprints – reading schematics – ladder diagrams – electrical schematics – Power circuits – control circuits – Reading of circuit schematics – Tracking the connections of elements and identify current flow and voltage drop. Inductance – capacitance – impedance – Operation of transformers.	
UNIT III Electric Generators and Motors	**6+3**
DC power sources – AC/DC generators – Single-phase and three-phase DC motors – Basic design – Interfacing DC or AC sources to control heater &motors – Speed & power of AC motor.	
UNIT IV Electrical devices and protection	**7+3**
Solid-State Devices: Resistors – inductors – capacitors – diode and rectifiers – components in series or in shunt – response of inductors and capacitors with DC or AC sources. **Electrical Protection**: Relays – Fuses and disconnect switches – circuit breakers – overload devices – Ground-fault protection – Grounding and isolating – phase reversal – surge protection – interfacing DC or AC sources to control elements (relay protection device).	
UNIT V Electrical Wiring	**5+3**
Different types of conductors and cables – Basics of wiring – Star and delta connection – Voltage drop and losses across cables and conductors – Instruments to measure current – voltage – power in DC and AC circuits – Insulation – solid and standard cable – Conduit Cable trays – Splices : wire nuts – crimps –terminal blocks – split bolts and solder – Preparation of extension board.	

	LECTURE	**TUTORIAL**	**TOTAL**
	45	**15**	**60**

TEXT BOOKS
1.B.L. Theraja,A text book in Electrical Technology, S Chand & Co. New Delhi. 2. A. K. Theraja,A text book of Electrical Technology.
REFERENCES
1. MG Say, Performance and design of AC machines, ELBS Edn.

Mapping with Programme Outcomes

COs	**PO_1**	**PO_2**	**PO_3**	**PO_4**	**PO_5**	**PO_6**	**PO_7**	**PO_8**
CO_1	**3**	**2**	**0**	**3**	**3**	**3**	**0**	**1**
CO_2	**3**	2	**0**	**2**	**3**	**2**	**0**	**1**
CO_3	**3**	2	**0**	**2**	**3**	**2**	**3**	**2**
CO_4	**3**	2	**0**	**2**	**3**	**2**	**0**	**2**
CO_5	**3**	2	**0**	**2**	**3**	**2**	**0**	**2**
	15	10	**0**	**11**	**15**	**11**	**2**	**8**

Scaled to 1, 2, 3	**3**	2	**0**	**2**	**3**	**3**	**1**	**2**

3 – Strong: 2 – Medium: 1 – Low

XPH403 WAVES AND OPTICS
COURSE OUTCOMES: CO1. Cog.:R,U;***Define*** super position principle and ***Relate*** the collinear and perpendicular harmonic oscillators. CO2. Cog.: R,E;***Recall*** transverse wave***, List*** the types of waves and ***Explain*** Group velocity, phase velocity CO3. Cog.: R, Ap;***What*** is interference and ***Identity*** various method to produce interference. CO4. Cog.: R, An;***Define*** diffraction and ***Analyze*** diffraction effect. CO5. Cog.: U, An;***Explain*** polarization and ***Distinguish*** the polarizer and analyser

COURSE CODE	**COURSE NAME**	**L**	**T**	**P**	**C**
XPH403	**WAVES AND OPTICS**	**3**	**1**	**0**	**4**
		L	**T**	**P**	**H**
		3	**1**	**0**	**4**

UNIT - I Superposition of Harmonic Oscillations	**6+3**
Superposition of Two Collinear Harmonic Oscillations: Linearity and Super position Principle (1) Oscillations having equal frequencies and (2) Oscillations having different frequencies (Beats) **Superposition of Two Perpendicular Harmonic Oscillations** : Graphical and analytical methods, Lissajous figures (1:1 and 1:2) and their uses.	
UNIT - II Wave Motion	**10+3**
General : Transverse waves on a string. Travelling and standing waves on a string. Normal Modes of a string. Group velocity, Phase velocity. Plane waves, Spherical waves, Wave intensity. **Wave optics:** Electromagnetic nature of light. Definition and properties of wave front Huygens Principle.	
UNIT – IIIInterference	**13+3**
Division of amplitude and division of wave front. Young's Double stilt experiment. Lloyd's Mirror and Fresnel's Biprism, Phase change on reflection: Stokes' treatment. Interference in Thin films: parallel and wedge shaped films. Fringes of equal inclination (Haidinger Fringes); Fringes of equal thickness (Fizeau Fringes). Newton's Rings: measurement of wavelength and refractive index.	
UNIT - IV Diffraction	**14+3**
Fraunhofer diffraction: Single slit; Double slit, Multiple slits & Diffraction grating. Fresnel Diffraction: Half period Zones. Zone plate, Fresnel Diffraction pattern of a straight edge, a slit and a wire using half period zone analysis.	
UNIT - V Polarization	**5+3**
Transverse nature of light waves. Plane polarized light – production and analysis. Circular and elliptical polarization.	

	LECTURE	**TUTORIAL**	**TOTAL**
	45	**15**	**60**

TEXT BOOKS
1. F.A. Jenkins and H. E. White, Fundamentals of Optics, 1976, McGraw Hill.

2. B.K. Mathur, Principles of Optics, 1995, Gopal Printing. 3. H.R. Gulati and D.R. Khanna, Fundamentals of Optics, 1991, R. Fhand Publication.
REFERENCES
1. F.W. Sears, M.w. Zemansky and H.D.Young, University Physics, 13 / e, 1986 Addison - Wesley.

Mapping with Programme Outcomes

COs	**PO_1**	**PO_2**	**PO_3**	**PO_4**	**PO_5**	**PO_6**	**PO_7**	**PO_8**
CO_1	**3**	**2**	**0**	**3**	**3**	**1**	**0**	**1**
CO_2	**3**	3	**0**	**1**	**2**	**1**	**0**	**1**
CO_3	**3**	3	**0**	**1**	**2**	**1**	**3**	**2**
CO_4	**3**	3	**0**	**1**	**2**	**1**	**0**	**2**
CO_5	**3**	3	**0**	**1**	**2**	**1**	**0**	**2**
	15	14	**0**	**7**	**11**	**5**	**2**	**8**
Scaled to 1, 2, 3	**3**	3	**0**	**2**	**3**	**1**	**1**	**2**

3 – Strong: 2 – Medium: 1 – Low

XPH404 DIGITAL ELECTRONICS
COURSE OUTCOMES: CO1. Cog.: Ap., An., C;***Analyze*** various number systems and codes, ***Develop*** their knowledge to do arithmetic calculations and ***Discuss*** operation of all the gates. CO2. Cog.: U;***Show*** the simplification of Boolean expression using the methods of Boolean algebra and Karnaugh map. CO3. Cog.:Ap;***Solve*** the arithmetic calculations by a fixed function of combinational logical circuits and their implementation CO4. Cog.:Ap.,C;***Develop***the fundamentals flip flops, registers and counters, and ***Design*** the sequential logic circuits. CO5. Cog.: U;***Demonstrate*** the Characteristics and Parameters of the operational amplifier and its parameter and ***Classify*** inverting- non inverting, Adder-subtractor, differentiator-integrator and comparators.

COURSE CODE	COURSE NAME	L	T	P	C
XPH404	ANALOG &DIGITAL ELECTRONICS	3	1	0	4
		L	T	P	H
		3	1	0	4

UNIT 1 Semiconductor Devices	**9+3**
semiconductors - intrinsic an extrinsic semiconductors - Fermi level (No Derivation) - Mechanism of Current Conduction - PN Junction Diode - Zener diode - LED - Solar Cell. Transistor: Construction - Mechanism of Amplification - Current components - Modes of operation - Transistor amplifier.	
UNIT2 Operational Amplifier	**9+3**
Ideal op-amp - Inverting and non-inverting amplifiers - summing amplifier - differential amplifier -integrator - differentiator - CMRR. A/D & D/A converters Introduction - weighted resistor D/A converter - ladder network D/A converter - BCD D/A converter. A/D converters: flash A/D converter - successive approximation converter - dual Slope A/D converter.	
UNIT 3 Boolean Algebra & Combinational Logic Circuit Design	**9+3**
Basic logic gates - NAND, NOR, XOR and XNOR gates and their truth tables - Boolean postulates - Boolean laws - Simplification of Boolean algebraic expressions - Universal Building Blocks – NAND / NOR logic: Minterms and Maxterms - 2,3,4 variable Karnaugh map design - SOP and POS reduction - don't care states.; Design of decoder, encoder, multiplexer, demultiplexer circuits using gates - half adder, full adder, half subtractor and full subtractor using gates.	
UNIT 4 Flip Flops, Registers & Counters: Flip-flops	**9+3**
RS,D,JK & T flip flops - clocked flip-flops - race around condition - JK Master-Slave Flip-flop - Converting JK flip-flop to RS, D & T flip-flops. Registers: Types - shift right and shift left registers using D & JK flip-flops. Counters: types - binary ripple counter - mod 3 counter - ring counter - Johnson counter - wave forms for counters.	
UNIT 5 Design of a Digital Computer	**9+3**
Instruction Code - Computer registers - Computer Instructions - Timing and Control - Memory hierarchy - main memory - RAM, ROM, EPROM, EEPROM, UVEPROM - Cache memory - virtual memory.	

	LECTURE	TUTORIAL	TOTAL

	45	**15**	**60**

TEXT BOOKS

1. R.S.Sedha, Textbook of Applied Electronics - 3rd ed., S.Chand & Co. (For Unit I)
2. John D.Ryder, Electronic Fundamentals & Applications - (5th ed., PHI) (For Units – II to IV)
3. M.Morris Mano Computer System Architecture (3rd ed.,PHI) (For Unit- V).

REFERENCES

1. Virendni Kumar, Digital Technology — Principles & Practice (1 st ed. New Age International Pvt. Ltd.)

Mapping with Programme Outcomes

COs	**PO_1**	**PO_2**	**PO_3**	**PO_4**	**PO_5**	**PO_6**	**PO_7**	**PO_8**
CO_1	**3**	**2**	**0**	**3**	**3**	**3**	**0**	**1**
CO_2	**3**	1	**0**	**1**	**3**	**2**	**0**	**1**
CO_3	**3**	1	**0**	**1**	**3**	**2**	**3**	**2**
CO_4	**3**	1	**0**	**1**	**3**	**2**	**0**	**2**
CO_5	**3**	1	**0**	**1**	**3**	**2**	**0**	**2**
	15	6	**0**	**7**	**15**	**11**	**2**	**8**
Scaled to 1, 2, 3	**3**	2	**0**	**2**	**3**	**3**	**1**	**2**

3 – Strong: 2 – Medium: 1 – Low

COURSE CODE	SUBJECT NAME	L	T	P	C
XPH406	PHYSICS PRACTICAL –IV	0	0	3	2
		L	T	P	H
		0	0	3	3

COURSE OUTCOMES:

CO1: Cog: Ana; Aff: Rec.; Psy: Mech; ***Use*** laboratory techniques such as accuracy of **measurements** and data **analysis**.

CO2: Cog: U; Aff: Rec.; Psy: Set, GR; ***Explain theconcepts*** that are learnt in the lecture sessions and ***follow*** hands-on learning experience in the laboratory sessions.

CO3: Cog: R; Aff: Rec.; Psy: Mech; Gain ***knowledge*** in the scientific methods and ***identify*** the process of **measuring** different Physical variables

CO4: Cog: Ap; Aff: Rec, Org;Psy: Mech; ***Manipulate***and ***complete*** all the experiments with excellent ***application*** knowledge.

LIST OF EXPERIMENTS

1. P.O. Box – resistance of the coil.
2. Spectrometer –grating- minimum deviation.
3. Bridge Rectifier.
4. Convex lens –Focal length – Combination method(two types)
5. Transistor characteristics – Common base.
6. Logic gates IC's verification.
7. Logic gates – Discrete components (AND, OR & NOT).
8. Potentiometer – Calibration of ammeter.
9. Potentiometer – Resistance of a coil
10. Spectrometer – Dispersive Power.

TEXT BOOKS

1. BSc Practical Physics, C. L. Arora, (S. Chand)
2. An Advanced Course in Practical Physics, D. Chattopadhyay and P. C. Rakshit, (New Central Book Agency)
3. A Text Book of Advanced Practical Physics, S. Ghosh, (New Central Book Agency) 7 Semester 1 - Physics (Honours) Theory Paper.
4. Shukla R. K. and Anchal Srivastava, Practical Physics, New Age International (P) Ltd, Publishers, 2006.
5. Arora C. L., B.Sc Practical Physics, S. Chand and Company Ltd, 2007.

REFERENCES

1. Squires G. L., Practical Physics, 4 th Edition, Cambridge University Press, 2001.
2. Halliday D., Resnick R. and Walker J., Fundamentals of Physics, 6th Edition, John Wiley and Sons, 2001.
3. Jenkins F.A. and White H.E., Fundamentals of Optics, 4th Edition, Mc Graw Hill Book Company, 2007.
4. Geeta Sanon, B. Sc., Practical Physics, 1st Edition, S. Chand and Company, 2007.
5. Benenson, Walter, and Horst Stocker, Handbook of Physics, Springer, 2002.

Mapping with Programme Outcomes

COs	PO_1	PO_2	PO_3	PO_4	PO_5	PO_6	PO_7	PO_8
CO_1	3	1		2	1	2	3	3
CO_2	3	1		2	1	2	3	2
CO_3	3	1		1	1	2	2	1
CO_4	3	1		2	1	2	3	2
	12	4		7	4	6	11	8
Scaled to 1, 2, 3	**3**	**1**		**2**	**1**	**2**	**3**	**2**

3 – Strong: 2 – Medium: 1 – Low

XPH501 BASIC INSTRUMENTATION SKILLS

COURSE OUTCOMES:

CO1:Cog: R, U;***Classify***accuracy, precision, sensitivity, resolution range and Errorsand ***Relate*** DC &AC voltage and current.

CO2:Cog: An;***Distinguish*** conventional voltmeter & multimeter and electronically voltmeter & multimeter

CO3:Cog :U, C;***Compare*** CRO & CRT and ***Explain*** operations and specification of CRO.

CO4:Cog: An; ***Analyze***various type of generators and rectifiers.

CO5:Cog: U; ***Explain*** the principle and working of digital meter and ***Compare*** analog & digital meters.

COURSE CODE	COURSE NAME	L	T	P	C
XPH501	BASIC INSTRUMENTATION SKILLS	0	0	3	2
		L	T	P	H
		0	0	3	3

UNIT - I Basic of Measurement **7+3**

Instruments accuracy, precision, sensitivity, resolution range etc. Errors in measurements and loading effects – Multimeter: Principles of measurement of dc voltage and dc current, ac current and resistance – Specifications of a multimeter and their significance.

UNIT - II Electronic Voltmeter **8+3**

Advantage over conventional multimeter for voltage measurement with respect to input impedance and sensitivity – Principles of voltage, measurement (block diagram only) – Specifications of an electronic Voltmeter / Multimeter and their significance – AC millivoltmeter : Type of AC millivoltmeters Amplifier – rectifier and rectifier – amplifier – Block diagram ac millivoltmeter – specifications of a CRO and their significance.

UNIT - III Cathode Ray Oscilloscope **10+3**

Block diagram of basic CRO – construction of CRT – Electron gun – electrostatic focusing and acceleration (Explanation only no mathematical treatment) brief discussion on screen phosphor – visual persistence & chemical composition – Time base operation – synchronization – Front

panel controls – Specifications of a CRO and their significance. Use of CRO for the measurement of voltage (dc and ac) frequency, time period – Special features of dual trace – introduction to digital oscilloscope – probes – digital storage oscilloscope: Block diagram and principle of working.
UNIT - IV Generators and Bridges **10+3**
Signal Generators and Analysis Instruments: Block diagram, explanation and specification of low frequency signal generators – pulse generator and function generator – Brief idea for testing – specifications – Distortion factor meter – wave analysis. **Impedance Bridge & Q-Meters**: Block diagram of bridge – working principles of basic (balancing type) RLC bridge – Specifications of RLC bridge – Block diagram & working principles of a Q-meter – Digital LCR bridges.
UNIT - V Digital Instruments and Multimeter **10+3**
Principle and working of digital meters – Comparison of analog & digital meters – Working principle of time interval – frequency and period measurement using universal counter/frequency counter – time –base stability – accuracy and resolution. Test of lab skills will be of the following test items: Use of an oscilloscope. CRO as a versatile measuring device. Use of digital multimeter. Winding a coil/transformer. Circuit tracing of Laboratory electronic equipement. Trouble shooting a circuit Balancing of bridges.

	LECTURE	TUTORIAL	TOTAL
	45	15	60

TEXT BOOKS

1. BL Theraja A text book in electrical technology, S Chand and Co.
2. Venugopal,Digital circuits and systems, 2011, Tata McGraw Hill.
3. Subrata Ghoshal, Digital Electronics, 2012, Cengage Learning.

REFERENCES

1. MG Say, Performance and design of AC machines –ELBS Edn.
2. Shimon O. Vingron, Logic circuit design, 2012, Springer.

Mapping with Programme Outcomes

COs	PO_1	PO_2	PO_3	PO_4	PO_5	PO_6	PO_7	PO_8
CO_1	3	2	0	3	2	1	0	1
CO_2	3	2	0	3	2	1	0	1
CO_3	3	2	0	3	2	1	3	2
CO_4	3	2	0	3	2	1	0	2
CO_5	3	2	0	3	2	1	0	2
	15	10	0	15	10	5	2	8
Scaled to 1, 2, 3	3	2	0	3	2	1	1	2

3 – Strong: 2 – Medium: 1 – Low

XPH502A - SOLID STATE PHYSICS
COURSE OUTCOMES: CO1:Cog: U,Ap;***Demonstrate*** and ***apply*** knowledge of the crystal studies. CO2:Cog: U,Ap ,E;***Explain*** and ***apply*** the definition of the Lattice vibrations and Phonons in lattice dynamics. CO3:Cog : Ap***;Apply*** knowledge of Dia, Para, Ferri and ferromagnetic materials. CO4:Cog: Ap;***Solve*** problems concerning the definition of the dielectric properties of materials CO5:Cog: U, AP;***Explain***and ***apply*** the knowledge of energy bands of solids and their application to modern electrical devices

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COURSE CODE	COURSE NAME	L	T	P	C
XPH502A	SOLID STATE PHYSICS	3	1	0	4
		L	T	P	H
		3	1	0	4

UNIT - I Crystal Structure	**7+3**
Solids: Amorphous and Crystalline Materials. Lattice Translation Vectors. Lattice with a Basis – Central and Non-Central Elements, Unit cell, Miller Indices, Reciprocal Lattice, Types of Lattices, Brillouin Zones	
UNIT - II Elementary Lattice Dynamics	**8+3**
Lattice vibrations and Phonons, Linear Monoatomic and Diatomic Chains. Acoustical and optical phonons. Qualitative Description of the Phonon Spectrum in Solids. Dulog and Petit's Law, Einstein and Debye theories of specific heat aof solids, T^3 law.	
UNIT - III Magnetic Properties of Matter	**10+3**
Dia, Para, Ferri and ferromagnetic materials, Classical Langevin theory of dia- and Paramagnetic Domains. Quantum Mechanical Treatment of Paramagnetism. Curie's law, Weiss's Theory of Ferromagnetism and Ferromagnetic Domains. Discussion of B-H Curve, Hysteresis and Energy Loss.	
UNIT - IV Dielectric Properties of Materials	**10+3**
Polarization: Local Electric field at an Atom, Depolarization Field, Electric Susceptibility, Polarizability. Clausius Mosotti Equation, Classical theory of electric polarizability, Normal and Anomalous Dispersion - Langevin-Debye equation.	
UNIT - V Elementary band theory	**10+3**
Krong Penny model, Band gaps, conductors, Semiconductors and insulators, P and N type Semiconductors, conductivity of semiconductors, mobililty, Hall effect, Hall coefficient. **Superconductivity:** Superconducting Phenomena, Critical temperature, critical magnetic field, Meissner effect, Type I and Tupe II suiperconductors. London's equation and Penertration Depth, Isotope effect.	

	LECTURE	TUTORIAL	TOTAL
	45	15	60

TEXT BOOKS

1. Charless Kittel,Introduction to Solid State Physics, 8th Ed., 2004, Wiley India Pvt.Ltd.
2. J.P. Srivastava, Elements of solid state physics, 2nd Ed., 2006, Prentice-Hall of India.
3. Leonid V. Azaroff, Introduction to solids, 2004, Tata Mc-Graw Hill

REFERENCES
1. Neil W. Ashcroft and N. David Mermin, Solid State Physics, 1976, Cengage Learning. 2. 1/e M. Ali Omar,Elementary Solid State Physics, 1999, 3. M.A. Wahab, Pearson India. Solid State Physics, 2011, Narosa Publications.

Mapping with Programme Outcomes

COs	PO_1	PO_2	PO_3	PO_4	PO_5	PO_6	PO_7	PO_8
CO_1	3	2	0	3	3	3	0	1
CO_2	3	2	0	2	3	2	0	1
CO_3	3	2	0	2	3	2	3	2
CO_4	3	2	0	2	3	2	0	2
CO_5	3	2	0	2	3	2	0	2
	15	10	0	11	15	11	2	8
Scaled to 1, 2, 3	3	2	0	3	3	3	1	2

3 – Strong: 2 – Medium: 1 – Low

XPH502B- Atomic & Molecular Spectroscopy

COURSE OUTCOMES:

CO1:Cog: U;***Explain*** the atom through atomic spectra.
CO2:Cog: U;***Extend*** their knowledge of bonding and anti bonding of MOs
CO3:Cog :Ap; ***Develop*** their knowledge about various spectra of molecules.
CO4:Cog: An;***Analyze*** the Raman Spectroscopy and Electronic Spectroscopy of Molecules.
CO5:Cog: U, C;***Explain***Basic principles of NMR & ESR and ***Discuss*** Classical and quantum mechanical description

COURSE CODE	COURSE NAME	L	T	P	C
XPH502B	ATOMIC & MOLECULAR SPECTROSCOPY	3	1	0	4
		L	T	P	H
		3	1	0	4

Unit 1 : Basic atomic models	**7+3**
Optical spectrum of Hydrogen atom - Bohr's Postulates – Quantitative conclusions –Principal quantum number - Spectra of hydrogen-like atoms – Sommerfeld's extension of the Bohr model –Orbital quantum number –Lifting of orbital degeneracy - Limits of the Bohr-Sommerfeld theory – The Correspondence principle – Rydberg atoms –Lifting of orbital degeneracy in the spectra of Alkali atoms - Magnetic moment of orbital motion – Spin and magnetic moment of electron – Spin-orbit splitting in the Bohr model – Fine structure in Hydrogen atom	
Unit 2: Interactions with external fields and many-electron atoms	**8+3**
Zeeman effect – Normal and anomalous – Stark effect - Paschen-Back effect – Double resonance and Optical pumping – The spectrum of Helium – Electron repulsion and Pauli principle – Angular momentum coupling – X-ray from outer shell & Bremsstrahlung spectra – Emission line spectra – Fine structure of X-rays – Absorption spectra – Auger effect	
Unit 3: Rotational Spectroscopy	**10+3**

The rotation of molecules – Rotational spectra – Diatomic molecules – Rigid molecule – Intensities of spectral line – isotopic substitution – Non-rigid rotator – Polyatomic molecules – Techniques and Instrumentation – Chemical analysis	
Unit 4: Vibrational Spectroscopy	**10+3**
Vibrating diatomic molecule – Diatomic vibrating rotator –Vibration – Rotation spectrum of Carbon Monoxide – Breakdown of the Born-Oppenheimer approximation – Vibration of Polyatomic molecules – Analysis by infra-red techniques - Techniques and Instrumentation	
Unit 5: Raman Spectroscopy	**10+3**
Classical theory & Quantum theory of Raman scattering – Pure rotational Raman spectra – Vibrational Raman spectra – Polarization of Light and the Raman effect – Structure determination from Raman and IR spectroscopy - Techniques and Instrumentation – Near IR – FT Raman spectroscopy.	

	LECTURE	TUTORIAL	TOTAL
	45	15	60

TEXT BOOKS

1. Haken, Wolf, Springer-Verlag, *Atomic and Quantum Physics*, Second edition (1987).
2. Colin Banwell& Elaine McCash, *Fundamentals of Molecular spectroscopy*, Tata McGraw-Hill Publishing Company, Fourth edition (2005).

REFERENCES

1. 1 Arthur Beiser, *Concepts of Modern Physics*, Tata McGraw Hill Publishing company, Sixth edition (2005).
2. Aruldhas, *Molecular structure and Spectroscopy*, Prentice-Hall of India, First edition (2004).

Mapping with Programme Outcomes

Cos	PO_1	PO_2	PO_3	PO_4	PO_5	PO_6	PO_7	PO_8
CO_1	**3**	**2**	**0**	**3**	**2**	**1**	**0**	**1**
CO_2	**3**	2	**0**	**3**	**2**	**1**	**0**	**1**
CO_3	**3**	2	**0**	**3**	**2**	**1**	**3**	**2**
CO_4	**3**	2	**0**	**3**	**2**	**1**	**0**	**2**
CO_5	**3**	2	**0**	**3**	**2**	**1**	**0**	**2**
	15	10	**0**	**15**	**10**	**5**	**2**	**8**
Scaled to 1, 2, 3	**3**	2	**0**	**3**	**2**	**1**	**1**	**2**

3 – Strong: 2 – Medium: 1 – Low

XPH503A NUCLEAR AND PARTICLE PHYSICS
COURSE OUTCOMES: CO1:Cog: R,U;***Recall*** the general properties of nucleus and ***Discuss*** the angular momentum and magnetic moment. CO2:Cog: R, U,E;***List*** and ***Explain***the various models of nuclear CO3:Cog :U, An; ***Distinguish*** and ***Demonstrate*** the various radioactivity decay of nucleus CO4:Cog: Ap U, C; ***Classify*** the type of reaction and ***discuss*** the concepts CO5:Cog: U;***Classify*** the elementary particles

COURSE CODE	COURSE NAME	L	T	P	C
XPH503A	NUCLEAR AND PARTICLE PHYSICS	3	1	0	4
		L	T	P	H
		3	1	0	4

UNIT - I	**General Properties of Nuclei**	**7+3**
Constituents of nucleus and their Intrinsic properties, quantitative facts about size, mass, charge density (matter energy), binding energy, average binding energy and its variation with mass number curve, N/A plot, angular momentum, parity, magnetic moment, electric moments nuclear excites states.		
UNIT - II	**Nuclear Models**	**8+3**
Liquid drop model approach – Semiempirical mass formula and significance of various terms – condition of nuclear stability – Two nucleon separation energies – Fermi gas model (degenerate fermion gas, nuclear symmetry potential in Fermi gas) evidence for nuclear shell structure – nuclear magic numbers – basic assumption of shell model – concept of mean field – residual interaction – concept of nuclear force.		
UNIT - III	**Radioactivity decay**	**10+3**
Alpha decay: basics of α-decay processes, theory of α-emission, Gamow factor, Geiger Nuttal law, α-decay spectroscopy - β-decay: energy kinematics for β-decay, positron emission, electron capture, neutrino hypothesis – Gamma decay: Gamma rays emission &kinematics , internal conversion.		
UNIT - IV	**Nuclear Reactions**	**10+3**
Types of reactions – conservation laws – kinematics of reaction – Q-value – reaction rate, reaction cross section – Concept of compound and direct reaction, resonance reaction – Coulomb scattering (Rutherford scattering).		
UNIT - V	**Particle physics**	**10+3**
Particle interactions: basic features, types of particles and its families - Symmetries and Conservation Laws: energy and momentum, angular momentum, parity, baryon number, Lepton number, Isospin, Strangeness and charm, concept of quark model, color quantum number and gluons.		

	LECTURE	TUTORIAL	TOTAL
	45	15	60

TEXT BOOKS

1. Kenneth S. Krane, Introductory nuclear physics,wiley India Pt. Ltd., 2008.
2. Bernard L. Cohen, Concepts of nuclear physics, Tata Mcgraw Hill, 1998.

3. R.A. Dulap, Introduction to the physics of nuclei & particles, Thomson Asia, 2004.

REFERENCES

1. D. Griffith, Introduction to Elementary Particles, Hohn Wiley & Sons.
2. F.Halzen and A.D. Martin, Quarks and Leptons, Wiley India, New Delhi.
3. J.M. Blatt & V.F. Weisskopf, Theoretical Nuclear Physics, (Dover Pub. Inc., 1991)

Mapping with Programme Outcomes

COs	PO_1	PO_2	PO_3	PO_4	PO_5	PO_6	PO_7	PO_8
CO_1	**3**	**2**	**0**	**3**	**3**	**1**	**0**	**1**
CO_2	**3**	2	**0**	**2**	**0**	**2**	**0**	**1**
CO_3	**3**	2	**0**	**2**	**0**	**0**	**3**	**2**
CO_4	**3**	2	**0**	**0**	**3**	**0**	**0**	**2**
CO_5	**3**	2	**0**	**0**	**2**	**1**	**0**	**2**
	15	10	**0**	**7**	**8**	**4**	**2**	**8**
Scaled to 1, 2, 3	**3**	2	**0**	**2**	**2**	**1**	**1**	**2**

3 – Strong: 2 – Medium: 1 – Low

XPH503B- PRINCIPLE OF MODERN PHYSICS

COURSE OUTCOMES:

CO1:Cog: R,Ap, C;***Recall***Planck's constant and knowledge about photons and ***Solve*** the problems of stability and instability of atoms.

CO2:Cog: U,E;***Infer***theuncertainty principle and***Estimate*** minimum energy of a confined particle using uncertainty principle

CO3:Cog :U, E; ***Explain*** particle in box, energy eigenvalues and eigenfunctions, normalization and tunneling across a rectangular potential barrier.

CO4:Cog: R,U;***Recall***Size and structure of atomic nucleus and ***Demonstrate***nuclear forceand binding energy

CO5:Cog:R,U, E;***Define*** radioactive decay, Mean life and half-life and ***Explain***γ decay,β decay andα emission

.

COURSE CODE	COURSE NAME	L	T	P	C
XPH503B	PRINCIPLE OF MODERN PHYSICS	3	1	0	4
		L	T	P	H
		3	1	0	4

UNIT – I **7+3**

Planck's quantum, Planck's constant and light as a collection of photons; Photoelectric effect and Compton scattering. De Broglie wavelength and matter waves; Davisson-Germer experiment.Problems with Rutherford model- instability of atoms and observation of discrete atomic spectra; Bohr's quantization rule and atomic stability.

UNIT – II **8+3**

Position measurement- gamma ray microscope thought experiment; Wave-particle duality, Heisenberg uncertainty principle- impossibility of a particle following a trajectory; Estimating minimum energy of a confined particle using uncertainty principle; Energy-time uncertainty principle.

UNIT – III	10+3
One dimensional infinitely rigid box- energy eigenvalues and eigenfunctions, normalization; Quantum dot as an example; Quantum mechanical scattering and tunneling in one dimension - across a step potential and across a rectangular potential barrier.	
UNIT – IV	**10+3**
Size and structure of atomic nucleus and its relation with atomic weight; Impossibility of an electron being in nucleus as a consequence of the uncertainty principle. Nature of nuclear force, NZ graph, semi-empirical mass formula and binding energy	
UNIT –V	**10+3**
Radioactivity: stability of nucleus; Law of radioactive decay; Mean life and half-life; -rayγ decay - energy released, spectrum and Pauli's prediction of neutrino; β decay; α emission.	

	LECTURE	TUTORIAL	TOTAL
	45	15	60

TEXT BOOKS

1. J.R.Taylor, C.D.Zafiratos, M.A.Dubson,Concepts of Modern Physics, Arthur Beiser, 2009, McGraw-Hill Modern Physics, 2009, PHI Learning

REFERENCES

1. Thomas A. Moore,Six Ideas that Shaped Physics: Particle Behave like Waves, 2003,
2. E.H. Wichman, McGraw Hill Quantum Physics, Berkeley Physics,Vol.4. 2008, Tata McGraw-Hill Co.
3. R.A. Serway, C.J. Moses, and C.A.Moyer,Modern Physics, 2005, Cengage Learning

Mapping with Programme Outcomes

Cos	PO_1	PO_2	PO_3	PO_4	PO_5	PO_6	PO_7	PO_8
CO_1	3	2	0	3	3	1	0	1
CO_2	3	2	0	3	2	2	0	1
CO_3	3	1	0	2	2	0	3	2
CO_4	3	1	0	0	2	0	0	2
CO_5	3	2	0	0	2	0	0	2
	15	8	0	8	11	3	2	8
Scaled to 1, 2, 3	3	2	0	2	3	1	1	2

3 – Strong: 2 – Medium: 1 – Low

XPH504A MICROPROCESSOR AND C PROGRAMMING

COURSE OUTCOMES:

CO1: Cog: U;***Explain***the basic concepts of digital computer, evolution of microprocessors.

CO2: Cog Ap;***Develop*** their knowledge about the architecture and instruction set of an eight bit 8085 microprocessor.

CO3: Cog: Ap; ***Organize*** assembly language to write programs for an 8085 microprocessor.

CO**4**: Cog:U;***Summarize*** Structure of C language, operators and library function

CO5: Cog: Ap;***Utilize***various input, out statement, loop statements, while do else statements and basic functions for programme

.

COURSE CODE	COURSE NAME	L	T	P	C
XPH504A	MICROPROCESSOR AND C PROGRAMMING	3	1	0	4
		L	T	P	H
		3	1	0	4

Unit 1 BASICS OF DIGITAL COMPUTER	**9+3**
Basic components of a digital computer - Evolution of microprocessors - Important INTEL microprocessors - Buses - Hardware, Software and Firmware - Memory - Semiconductor memories - RAM,ROM - Flash memory.	
Unit 2 INTEL 8085 AND ITS ARCHITECTURE	**9+3**
INTEL 8085 - Pin Diagram - Architecture - Various registers - Status Flags - Interrupts and their order of priority - Addressing modes - Direct, Register, Register indirect, Immediate and implicit addressing - Instruction set - Data transfer group - Arithmetic Group - Logical group - Branch control group and stack and I/O- Machine control group.	
Unit 3 ASSEMBLY LANGUAGE PROGRAMMING	**9+3**
Addition - Subtraction - Multiplication -Division of two 8- bit numbers - Finding the largest number in a data array - Finding the smallest number in a data array-Arranging a list of numbers in ascending or descending order.	
Unit 4 Introduction to C	**9+3**
Structure of 'C' – Fundamentals of C – Character set – identifiers and key words – data types constants – variables – declarations – expressions – symbolic constants – arithmetic operators- Relational, Logical and assignment operators, Unary, Bitwise and Ternary operators – conditional operators – I/O function – library function.	
Unit 5 Preliminaries and Functions	**9+3**
Data input and output – getchar, putchar, scanf, printf, gets, puts functions – Control statements- while, do…. While, for nested loops, if … else, switch, break, continue and goto statements. Basic functions – Return values and their types- Calling functions – storage class- automatic variables- External Variables- Static Variables- Recursion.	

	LECTURE	TUTORIAL	TOTAL
	45	15	60

TEXT BOOKS

1. B.Ram, Fundamentals of Microprocessors and Microcomputers, Dhanpat Rai publication pr. Ltd., New Delhi
2. Ramesh S.Goankar,Microprocessor Architecture, Programming and Applications with the 8085, Penram International Publishing (India) Pvt. Ltd.
3. Kenneth J.Ayala,The 8051 microcontroller Architecture, Programming and applications', second edition ,Penram international.

REFERENCES

1. Yn-cheng Liu, Glenn A. Gibson, "Microcomputer systems: The 8086 / 8088 Family architecture, Programming and Design", second edition, Prentice Hall of India, 2006.
2. Douglas V. " Microprocessors and Interfacing : Programming and Hardware", Hall, second edition , Tata McGraw Hill,2006.
3. A.K.Ray& K.M Bhurchandi, "Advanced Microprocessor and Peripherals – Architecture, Programming and Interfacing", Tata McGraw Hill , 2006.
4. Mohamed Ali Mazidi, Janice GillispieMazidi, "The 8051 microcontroller and embedded systems using Assembly and C", second edition, Pearson education /Prentice hall of India, 2007.
5. Venugopal, K.R. And Sudep, R.P.Programming with C, Tata McGraw Hill Pub. Co. Ltd.

6. E. Balagurusamy,Programming in C, Tata McGraw Hill Pub. Co.(2008).

Mapping with Programme Outcomes

COs	PO_1	PO_2	PO_3	PO_4	PO_5	PO_6	PO_7	PO_8
CO_1	3	2	0	3	3	3	0	1
CO_2	3	2	0	3	2	2	0	1
CO_3	3	2	0	3	2	0	3	2
CO_4	3	2	0	3	2	0	0	2
CO_5	3	2	0	3	2	1	0	2
	15	10	0	15	11	6	2	8
Scaled to 1, 2, 3	3	2	0	3	3	2	1	2

3 – Strong: 2 – Medium: 1 – Low

COURSE CODE	SUBJECT NAME	Category			
		L	T	P	CREDITS
XPH504B	MICROPROCESSOR AND MICROCONTROLLER	3	1	0	4

COURSE OUTCOMES:

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

		Domain	Level
CO_1	To study the basic concepts of digit al computer, evolutes ion microprocessors, semiconductor memories RAM and ROM	Cog	Understadning
CO_2	To study the architecture and instruction set of an eight bit 8085 microprocessor	Cog	Remebering
CO_3	To write assembly language programs for an 8085 microprocessor.	Cog	Evaluating
CO_4	To study Structure of C language, operators, library function	Cog	Understanding
CO_5	To study various input and out statement loop statements while do else statements	Cog	Analyzing

SYLLABUS:

UNIT I	**BASICS OF DIGITAL COMPUTER** Basic components of a digital computer - Evolution of microprocessors - Important INTEL microprocessors - Buses - Hardware, Software and Firmware - Memory - Semiconductor memories - RAM,ROM - Flash memory.	**9**
UNIT II	**INTEL 8085 AND ITS ARCHITECTURE** INTEL 8085 - Pin Diagram - Architecture - Various registers - Status Flags - Interrupts and their order of priority - Addressing modes - Direct ,Register, Register indirect, Immediate and implicit	**9**

UNIT III	**INSTRUCTION SET** Instruction set - Data transfer group - Arithmetic Group - Logical group - Branch control group and stack and I/O- Machine control group.	**9**
UNIT IV	**ASSEMBLY LANGUAGE PROGRAMMING** Addition - Subtraction - Multiplication -Division of two 8- bit numbers - Finding the largest number in a data array - Finding the smallest number in a data array-Arranging a list of numbers in ascending or descending order.	**9**
UNIT V	**MICROCONTROLLERS** Architecture of 8051 Microcontroller – signals – I/O ports – memory – counters and timers – serial data I/O – interrupts Interfacing -keyboard, LCD, ADC & DAC	**9**

Books for Study:

Fundamentals of Microprocessors and Microcomputers- B.Ram.

Microprocessor Architecture, Programming and Applications with the 8085, Ramesh. S.Goankar, Penram International Publishing (India) Pvt. Ltd.

'The 8051 microcontroller Architecture, Programming and applications'Kenneth J.Ayala, second edition ,Penram international.

Books for Reference:

"Microcomputer systems: The 8086 / 8088 Family architecture, Yn-cheng Liu,Glenn A.Gibson, Programming and Design", second edition, Prentice Hall of India , 2006 .

" Microprocessors and Interfacing : Programming and Hardware", Douglas V.Hall, second edition , Tata Mc Graw Hill ,2006.

"Advanced Microprocessor and Peripherals – Architecture, A.K.Ray & K.M Bhurchandi, Programming and Interfacing", Tata Mc Graw Hill , 2006.

"The 8051 microcontroller and embedded systems using Assembly and C",
Mohamed Ali Mazidi,Janice Gillispie Mazidi,second edition, Pearson education /Prentice hall of India , 2007.

Mapping with Programme Outcomes

COs	**PO_1**	**PO_2**	**PO_3**	**PO_4**	**PO_5**	**PO_6**	**PO_7**	**PO_8**
CO_1	**2**	**3**	**0**	**2**	**3**	**2**	**0**	**1**
CO_2	**2**	**2**	**0**	**2**	**2**	**1**	**0**	**1**
CO_3	**2**	**2**	**0**	**2**	**2**	**0**	**3**	**2**
CO_4	**2**	**2**	**0**	**0**	**2**	**0**	**0**	**2**
CO_5	**2**	**0**	**0**	**0**	**2**	**0**	**0**	**2**
	10	**9**	**0**	**6**	**11**	**3**	**2**	**8**
Scaled to 1, 2, 3	**2**	**2**	**0**	**2**	**3**	**1**	**1**	**2**

3 – Strong: 2 – Medium: 1 – Low

COURSE CODE	SUBJECT NAME	L	T	P	C
XPH505	PHYSICS PRACTICAL –V A	0	0	3	2
		L	T	P	H
		0	0	3	3

COURSE OUTCOMES:

CO1: Cog: Ana; Aff: Rec.; Psy: Mech; ***Use*** laboratory techniques such as accuracy of **measurements** and data **analysis**.

CO2: Cog: U; Aff: Rec.; Psy: Set, GR; ***Explain theconcepts*** that are learnt in the lecture sessions and ***follow*** hands-on learning experience in the laboratory sessions.

CO3: Cog: R; Aff: Rec.; Psy: Mech; Gain ***knowledge*** in the scientific methods and ***identify*** the process of **measuring** different Physical variables

CO4: Cog: Ap; Aff: Rec, Org;Psy: Mech; ***Manipulate***and ***complete*** all the experiments with excellent ***application*** knowledge

LIST OF EXPERIMENTS

1. Spectrometer – Grating –normal incidence
2. Field along the axis of a coil- H determination.
3. Demorgan's theorem verification using IC gates.
4. Voltage Doublers and Tripler.
5. Deflection magnetometer – M & H.
6. Air wedge – Determine the thickness of a thin wire.
7. Carey Foster Bridge – Specific Resistance.
8. Potentiometer – E.M.F of a Thermocouple.
9. Spectrometer – Refractive index of the prism.
10. Half adder and full adder using basic logic gates IC's.

TEXT BOOKS

1. BSc Practical Physics, C. L. Arora, (S. Chand)
2. An Advanced Course in Practical Physics, D. Chattopadhyay and P. C. Rakshit, (New Central Book Agency)
3. A Text Book of Advanced Practical Physics, S. Ghosh, (New Central Book Agency) 7 Semester 1 - Physics (Honours) Theory Paper.
4. Shukla R. K. and Anchal Srivastava, Practical Physics, New Age International (P) Ltd, Publishers, 2006.
5. Arora C. L., B.Sc Practical Physics, S. Chand and Company Ltd, 2007

REFERENCES

1. Squires G. L., Practical Physics, 4 th Edition, Cambridge University Press, 2001.
2. Halliday D., Resnick R. and Walker J., Fundamentals of Physics, 6th Edition, John Wiley and Sons, 2001.
3. Jenkins F.A. and White H.E., Fundamentals of Optics, 4th Edition, Mc Graw Hill Book Company, 2007.
4. Geeta Sanon, B. Sc., Practical Physics, 1st Edition, S. Chand and Company, 2007.
5. Benenson, Walter, and Horst Stocker, Handbook of Physics, Springer, 2002.

Mapping with Programme Outcomes

COs	PO_1	PO_2	PO_3	PO_4	PO_5	PO_6	PO_7	PO_8
CO_1	3	1		2	1	2	3	3
CO_2	3	1		2	1	2	3	2
CO_3	3	1		1	1	2	2	1
CO_4	3	1		2	1	2	3	2
	12	4		7	4	6	11	8
Scaled to 1, 2, 3	**3**	**1**		**2**	**1**	**2**	**3**	**2**

3 – Strong: 2 – Medium: 1 – Low

COURSE CODE	SUBJECT NAME	L	T	P	C
XPH506	PHYSICS PRACTICAL –VB	0	0	3	2
		L	T	P	H
		0	0	3	3

COURSE OUTCOMES:

CO1: Cog: Ana; Aff: Rec.; Psy: Mech; ***Use*** laboratory techniques such as accuracy of **measurements** and data **analysis**.

CO2: Cog: U; Aff: Rec.; Psy: Set, GR; ***Explain theconcepts*** that are learnt in the lecture sessions and ***follow*** hands-on learning experience in the laboratory sessions.

CO3: Cog: R; Aff: Rec.; Psy: Mech; Gain ***knowledge*** in the scientific methods and ***identify*** the process of **measuring** different Physical variables

CO4: Cog: Ap; Aff: Rec, Org;Psy: Mech; ***Manipulate***and ***complete*** all the experiments with excellent ***application*** knowledge.

LIST OF EXPERIMENTS

1. Operational Amplifier – Differentiator, Integrator.
2. Tan C – determination of M & BH.
3. Focal length – Concave lens – Combination method (Two types)
4. Half subtractor and full subtractor using basic logic gates.
5. FET Characteristics and constants determination.
6. B.G – Figure of Merit – Voltage and Current Sensitiveness.
7. Newton's rings – Determination of radius of curvature of the lens R.
8. Half Adder, Full Adder using NAND/NOR gate
9. Spectrometer – i-d curve.
10. Construction Dual power supply 5-0-5 or 9-0-9v.

TEXT BOOKS

1. BSc Practical Physics, C. L. Arora, (S. Chand)
2. An Advanced Course in Practical Physics, D. Chattopadhyay and P. C. Rakshit, (New Central Book Agency)
3. A Text Book of Advanced Practical Physics, S. Ghosh, (New Central Book Agency) 7 Semester 1 - Physics (Honours) Theory Paper.
4. Shukla R. K. and Anchal Srivastava, Practical Physics, New Age International (P) Ltd, Publishers, 2006.
5. Arora C. L., B.Sc Practical Physics, S. Chand and Company Ltd, 2007.

REFERENCES

1. Squires G. L., Practical Physics, 4 th Edition, Cambridge University Press, 2001.
2. Halliday D., Resnick R. and Walker J., Fundamentals of Physics, 6th Edition, John Wiley and Sons, 2001.
3. Jenkins F.A. and White H.E., Fundamentals of Optics, 4th Edition, Mc Graw Hill Book Company, 2007.
4. Geeta Sanon, B. Sc., Practical Physics, 1st Edition, S. Chand and Company, 2007.
5. Benenson, Walter, and Horst Stocker, Handbook of Physics, Springer, 2002.

Mapping with Programme Outcomes

COs	**PO_1**	**PO_2**	**PO_3**	**PO_4**	**PO_5**	**PO_6**	**PO_7**	**PO_8**
CO_1	3	1		2	1	2	3	3
CO_2	3	1		2	1	2	3	2
CO_3	3	1		1	1	2	2	1
CO_4	3	1		2	1	2	3	2
	12	4		7	4	6	11	8
Scaled to 1, 2, 3	**3**	**1**		**2**	**1**	**2**	**3**	**2**

3 – Strong: 2 – Medium: 1 – Low

XPH601 RENEWABLE ENERGY

COURSE OUTCOMES:

CO1:Cog: Ap;***Identify*** the various alternate Sources of energy.

CO2:Cog:U;***Explain***Solar energy and applications of solar pond and solar energy, solar water heater, flat plate collector, solar distillation, solar cooker, solar green houses, solar cell absorption air conditioning.

CO3:Cog :U;***Demonstrate*** the fundamentals of wind energy.

CO4:Cog: C;***Discuss***Ocean Energy and Tide energy technologies

CO5:Cog: U, R;***Explain***Geothermal Energy, Geothermal resources, geothermal technologies and Hydro energy, hydropower technologies and ***Relate*** the environmental impact.

COURSE CODE	**COURSE NAME**	**L**	**T**	**P**	**C**
XPH601	**RENEWABLE ENERGY**	**0**	**0**	**4**	**2**
		L	**T**	**P**	**H**
		0	**0**	**4**	**4**

UNIT - I	**Alternate Sources of energy**	**7+3**

Fossil fuels and Nuclear energy, their limitation, need of renewable energy, non-conventional energy sources. An overview of developments in Offshore Wind Energy, Tidal Energy, Wav energy systems, Ocean Thermal Energy conversion, solar energy, biomass, biochemical conversion, biogas generation, geothermal energy tidal energy, Hydroelectricity.

UNIT - II	**Solar energy**	**8+3**

Solar energy, its importance, storage of solar energy, solar pond, non convective solar pond, applications of solar pond and solar energy, solar water heater, flat plate collector, solar distillation, solar cooker, solar green houses, solar cell absorption air conditioning. Need and characteristics of photovoltaic (PV) systems, PV models and equivalent circuits, and sun tracking systems.		
UNIT - III Wind Energy		**10+3**
Fundamentals of wind energy, wind Turbines and different electrical machines in wind turbines, Power electronic interfaces and grid interconnection topologies.		
UNIT - IV Ocean Energy		**10+3**
Ocean Energy Potential against wind and solar, wave characteristics and statistics, wave energy devices. Tide characteristics and Statistics, Tide energy technologies, Ocean Thermal energy, Osmotic power, ocean Bio-mass		
UNIT - V Geothermal and Hydro Energy		**10+3**
Geothermal Energy: Geothermal resources, geothermal technologies. Hydro energy: Hydropower resources, hydropower technologies, environmental impact of hydro power sources.		

	LECTURE	**TUTORIAL**	**TOTAL**
	45	**15**	**60**

TEXT BOOKS

1. G.D.Rai,Non conventional energy sources, Khanna publisher, New Delhi.
2. M.P. Agarwal,Solar energy, S Chand and Co. Ltd.
3. Suhas P Sukhative,Solar energy, Tata McGraw – Hill Publishing Company Ltd.

REFERENCES

1. Godfrey Boyle, Renewable energy, Power for a sustainable future, Oxford University Press, in association with The open University (2004).
2. Dr. P, Jayakumar, Solar energy Resource Assessment Handbook, (2009)

Mapping with Programme Outcomes

COs	**PO_1**	**PO_2**	**PO_3**	**PO_4**	**PO_5**	**PO_6**	**PO_7**	**PO_8**
CO_1	**3**	**2**	**0**	**3**	**2**	**2**	**0**	**1**
CO_2	**2**	1	**0**	**3**	**2**	**1**	**0**	**1**
CO_3	**2**	1	**0**	**3**	**2**	**1**	**3**	**2**
CO_4	**2**	1	**0**	**3**	**2**	**0**	**0**	**2**
CO_5	**2**	1	**0**	**3**	**2**	**0**	**0**	**2**
	11	6	**0**	**15**	**10**	**4**	**2**	**8**
Scaled to 1, 2, 3	**3**	2	**0**	**3**	**2**	**1**	**1**	**2**

XPH602A- QUANTUM MECHANICS

COURSE OUTCOMES:

CO1:Cog: U,E;***Recall***the properties of wave function and ***Interpret*** the wave function probability and probability current densities in three dimensions.

CO2:Cog: U,E;***Explain***the time dependent Schrodinger equation and its ***influence***.

CO3:Cog : Ap;***Identify*** the continuity of wave function, boundary condition and emergence of energy levelsand ***Applied*** in square well potential.

CO4:Cog: C; ***Discuss*** thetime independent Schrodinger equation in spherical polar coordinates and Orbital angular momentum quantum numbers l and m; s, p, d,.. shell.

CO5:Cog: U;**Explain**electron spin and spin angular momentum and Electron Magnetic Moment and Magnetic Energy.

COURSE CODE	COURSE NAME	L	T	P	C
XPH602A	QUANTUM MECHANICS	3	1	0	4
		L	T	P	H
		3	1	0	4

UNIT - I Time dependent Schrodinger Equation	**7+3**
Time dependent Schrodinger equation and dynamical evolution of a quantum state; Properties of wave function – Interpretation of wave function probability and probability current densities in three dimensions – Conditions for Physical Acceptability of wave functions – Normalization – Linearity and Superposition Principles – Eigenvalues and Eigenfunctions – Position – momentum & Energy operators; Expectation values of position and momentum – Wave function of a free particle.	
UNIT - II Time independent Schrodinger Equation	**8+3**
Hamiltonian, stationary states and energy eigenvalues; expansion of an arbitrary wave function as a linear combination of energy eigenfunctions – General solution of the time dependent Schrodinger equation in terms of linear combinations of stationary states – Application to the spread of Gaussian wave packet for a free particle in one dimension – wave packets – Fourier transforms and momentum space wave function – position –momentum uncertainty principle.	
UNIT - III General discussion of bound states in an arbitrary potential	**10+3**
Continuity of wave function, boundary condition and emergence of discrete energy levels – application to one – dimensional problem – square well potential, - Quantum mechanics of simple harmonic oscillator –energy levels and energy eigenfunctions using – Frobenius method.	
UNIT - IV Quantum theory of hydrogen-like atoms	**10+3**
Time independent Schrodinger equation in spherical polar coordinates – separation of variables for the second order partial differential equation – angular momentum operator and quantum numbers – Radial wavefunctions from Frobenius method – Orbital angular momentum quantum numbers l and m; s, p, d,.. shell (idea only).	
UNIT - V Atoms in Electric and Magnetic Fields	**10+3**
Electron Angular momentum – space quantization – Electron spin and spin angular momentum - Larmor's Theorem – Spin Magnetic Moment – Stern-Gerlach Experiment – Zeeman Effect: Electron Magnetic Moment and Magnetic Energy, Gyromagnetic Ratio and Bohr Magneton.	

	LECTURE	TUTORIAL	TOTAL

	45	**15**	**60**
TEXT BOOKS			
1.A Text Book of Quantum Mechanics, P.M. Mathews & K. Venkatesan, 2nd Ed., 2010, McGraw Hill. 2. Quantum Mechanics, Robert Eisberg and Robert Resnick, 2ndEdn., 2002, Wiley. 3. Quantum Mechanics, G. Aruldhas, 2ndEdn 2002, PHI Learning of India.			
REFERENCES			
1. Quantum Mechanics, Leoard I. Schiff, 3rdEdn, 2010, Tata McGraw Hill. 2. Quantum Mechanics, Bruce Cameron Reed, 2008, Jone and Bartlett Learning. 3. Quantum Mechanics for Scientists & Engineers, DA.B. Miller, 2008, Cambridge University Press.			

Mapping with Programme Outcomes

COs	**PO_1**	**PO_2**	**PO_3**	**PO_4**	**PO_5**	**PO_6**	**PO_7**	**PO_8**
CO_1	**3**	**2**	**0**	**2**	**3**	**1**	**0**	**1**
CO_2	**3**	2	**0**	**2**	**3**	**2**	**0**	**1**
CO_3	**3**	2	**0**	**2**	**3**	**0**	**3**	**2**
CO_4	**3**	2	**0**	**2**	**3**	**0**	**0**	**2**
CO_5	**3**	2	**0**	**0**	**0**	**0**	**0**	**2**
	15	10	**0**	**8**	**12**	**3**	**2**	**8**
Scaled to 1, 2, 3	**3**	2	**0**	**2**	**3**	**1**	**1**	**2**

XPH602B- MATERIAL SCIENCE

Course Outcome: ***On the successful completion of the course, students will be able to***		**Domain & Level**
CO1:	Recall and distinguish various crystal structures.	Cognitive (Remember, Analyze)
CO2:	Know about the impacts of defects at the atomic and microstructure scales.	Cognitive (Remember, Understand)
CO3:	Describe the various Ceramic, Electrical & Electronic Materials.	Cognitive (Remember, Analyze)
CO4:	Describe the basics of mechanical properties of material and identify how they can be tested.	Cognitive (Remember, Analyze)
CO5:	Recognize and Describe various Magnetic Materials and Nano Materials.	Cognitive (Remember)

SUBCODE	MATERIALS SCIENCE	L	T	P	C
XPH602B		3	1	0	4
		L	T	P	H
		3	1	0	4

UNIT - I	Crystal Structure	9 + 3

Atomic structure and inter-atomic bonding; Structure of crystalline solids; Lattices, unit cells; Crystal systems, Bravais lattices; Indexing of directions and planes, notations, Inter-planar spacings and angles, co- ordination number, packing factors.

UNIT – II	Defects in Crystals	9 + 3

Point defects; Dislocations, Types of dislocations, Burgers vector and its representation; Planar defects, stacking faults, twins, grain boundaries.

UNIT - III	Ceramic, Electrical & Electronic Materials	9 + 3

Ceramic Materials:Introduction, ceramic structures, silicate structures, processing of ceramics; Properties, glasses; Composite Materials- Introduction, classification, concrete, metal-matrix and ceramic –matrix composites.Electrical& Electronic Properties of Materials: Electrical Conductivity, Electronic and Ionic Conductivity, Intrinsic and Extrinsic Semi conductivity, Semiconductor Devices, Dielectric Properties, Piezo-electricity.

UNIT – IV	Mechanical Properties of Materials	9 + 3

Concepts of stress and strain, Stress-Strain diagrams; Properties obtained from the Tensile test; Elastic deformation, Plastic deformation. Impact Properties, Strain rate effects and Impact behavior. Hardness of materials.

UNIT - V	Magnetic Materialsand Nano Materials	9 + 3

Magnetic Materials: Introduction, Magnetic fields or quantities, types of magnetism, classification of magnetic materials, soft magnetic materials, H magnetic materials, Ferrites, Ferro, Para Magnetic materials.NanoMaterials:Introduction – Nano material preparation, purification, sintering nano particles of Alumina and Zirconia, Silicon carbide, nanoop, nano-magnetic, nano-electronic, and other important nano materials.

	LECTURE	TUTORIAL	TOTAL
	45	15	60

Text Books:

1	Askeland D.R.,& P. P. Fullay (2007), The Science and Engineering of Materials – 7thCengage Learning Publishers.
2	William D. Callister, Jr (2008), Callister‟s Materials Science and Engineering, (Adopted by R. Balasubramaniam) Wiley-Eastern

Reference books :

1	A.S. Edelstein and R.C. CammarataEd.(1998), Nano Materials: Synthesis, Properties and Applications, Inst. Of Physics Publishing, UK.
2	Raghavan V (2007), Materials Science and Engineering - A First Course, Prentice Hall, India
3	James F. Shackelford (1996), Introduction to Materials Science for Engineers, Prentice Hall, India

Mapping with Programme Outcomes

Cos	PO_1	PO_2	PO_3	PO_4	PO_5	PO_6	PO_7	PO_8
CO_1	3	2	0	2	3	1	0	1
CO_2	3	2	0	2	3	2	0	1
CO_3	3	2	0	2	3	0	3	2
CO_4	3	2	0	2	3	0	0	2
CO_5	3	2	0	0	0	0	0	2
	15	10	0	8	12	3	2	8
Scaled to 1, 2, 3	3	2	0	2	3	1	1	2

3 – Strong: 2 – Medium: 1 – Low

XPH603A MICRO ELECTRO MECHANICAL SYSTEM

COURSE OUTCOMES

CO1:Cog: U; ***Demonstrate***architecture of embedded system, classification and applications.

CO2:Cog: U,Ap ,E;***Explain***architecture of 8051, overview of 8051 familyand ***apply*** 8051 assembly language programme.

CO3:Cog : U;***Summarize*** addressing modes, assembly language instructions, arithmetic &logic instructions for 8051.

CO4:Cog: Ap;***Utilize***Assembly Language and ***Develop***I/O port program for 8051.

CO5:Cog: U, An; ***Examine*** the structure of embedded program and ***Show*** the embedded system design.

COURSE CODE	COURSE NAME	L	T	P	C
XPH603A	MICRO ELECTRO MECHANICAL SYSTEM	3	1	0	4
		L	T	P	H
		3	1	0	4

UNIT - I INTRODUCTION	**7+3**
history of MEMS, market for MEMS, overview of MEMS processes, properties of silicon, a sample MEMS process. Basics of Microtechnology: definitions and terminology, a sample process, lithography and etching. MEMS Biosensors: Bio Flow Sensors, MEMS Images. Introduction to MEMS Pro design software.	
UNIT - II MICROMACHINING	**8+3**
Subtractive processes (wet and dry etching), additive processes (evaporation, sputtering, epitaxial growth). Fundamental Devices and Processes: basic mechanics and electrostatics for MEMS, parallel plate actuators, pull-in point, comb drives.	
UNIT - III FUNDAMENTAL DEVICES AND PROCESSES	**10+3**
More electrostatic actuators; MEMS foundries, Cronos MUMPs (multi user MEMS process). MUMPs Multi User MEMS Process: JDS Uniphase MUMPs processing sequence and design rules. MUMPs and SUMMIT: design rules; applications; micro hinges and deployment actuators.	
UNIT - IV CMOS MEMS	**10+3**

CMOS foundry processes, integrated IC/MEMS, MEMS postprocessing, applications. Cleanroom lab techniques: clean rooms, gowning procedures; safety, fire, toxicity; acids and bases; photolithography.

UNIT – V SCALING LAWS AND MEMS ASSEMBLY	**10+3**

Scaling Laws. Wireless MEMS: mechanical and electrical resonators, Q-factor, switches, filters. Power for MEMS: thin film batteries, micro fuel cells, energy fields. MEMS Packaging and Assembly: microassembly: serial and parallel, deterministic and stochastic; microgrippers: HexSil process; packaging techniques. The Future of MEMS: bioMEMS – neural implants, gene chips, diagnostic chips; MEMS in space; mechanical computers; invisible and ubiquitous computing.

	LECTURE	**TUTORIAL**	**TOTAL**
	45	**15**	**60**

TEXT BOOKS

1. HSU, TAI RAN, Mems And Microsystems Design And Manufacture, Tata McGraw-Hill,2002.
2. Rai-Choudhury, Prosenjit; MEMS and MOEMS Technology and Applications SPIE 2000.

REFERENCES

1. Mohamed Goad-el-Hak, "MEMS: Introduction and Fundamentals",CRC Press edition 2005
2. Vijay K. Varadan, K. J. Vinoy, S. Gopalakrishnan, "Smart Material Systems and MEMS: Design and Development Methodologies".

Mapping with Programme Outcomes

COs	**PO_1**	**PO_2**	**PO_3**	**PO_4**	**PO_5**	**PO_6**	**PO_7**	**PO_8**
CO_1	**2**	**3**	**0**	**3**	**3**	**2**	**0**	**1**
CO_2	**2**	2	**0**	**2**	**2**	**1**	**0**	**1**
CO_3	**2**	2	**0**	**2**	**2**	**0**	**3**	**2**
CO_4	**2**	2	**0**	**1**	**2**	**0**	**0**	**2**
CO_5	**2**	0	**0**	**0**	**2**	**0**	**0**	**2**
	10	9	**0**	**8**	**11**	**3**	**2**	**8**
Scaled to 1, 2, 3	**2**	2	**0**	**2**	**3**	**1**	**1**	**2**

3 – Strong: 2 – Medium: 1 – Low

XPH603B - NUMERICAL METHODS IN PHYSICS

COURSE OUTCOMES:

CO1: Cog: E,Ap;***Identify*** errors and ***Measure*** errors using General formula.

CO2: Cog: R,E;***Define*** various iteration method and ***Determine*** the false position using these method.

CO3: Cog :R, Ap;***Find*** the unequal intervals***Applying*** various interpolation formula.

CO4: Cog: U, Ap, E;***Explain*** numerical differentiation and integration and ***Solve***problems by Newton's forward, trapezoidal, Simpson'srule.

CO5:Cog: U, AP;**Explain**n^{th} order ordinary differential equations and **apply** the knowledge to Solve the differential equation.

COURSE CODE	COURSE NAME	L	T	P	C
XPH603B	NUMERICAL METHODS IN PHYSICS	3	1	0	4
		L	T	P	H
		3	1	0	4

Unit I **7+3**

Errors and the measurements General formula for errors – Errors of observation and measurement – Empirical formula – Graphical method – Method of averages – Least square fitting – curve fitting – parabola, exponential.

Unit II **8+3**

Numerical solution of algebraic and transcendental equations The iteration method – The method of false position – Newton – Raphson method – Convergence and rate of convergence – C program for finding roots using Newton – Raphson method. Simultaneous linear algebraic equations Gauss elimination method – Jordon's modification – Gauss – Seidel method of iteration.

Unit III **10+3**

Interpolation Linear interpolation – Lagrange interpolation Gregory – Newton forward and backward interpolation formula – Central difference interpolation formula – Gauss forward and backward interpolation formula – Divided differences – Properties – Newton's interpolation formula for unequal intervals.

Unit IV **10+3**

Numerical differentiation and integration, Newton's forward and backward difference formula to compute derivatives – Numerical integration: the trapezoidal rule, Simpson's rule – Extended Simpson's rule.

Unit V **10+3**

Numerical Solutions of ordinary differential equations Nth order ordinary differential equations – Power series approximation – Pointwise method – Solutions of Taylor series – Euler's method – Improved Euler's method – Runge-Kutta method – second and third order – Runge-Kutta method for solving first order differential equations.

	LECTURE	TUTORIAL	TOTAL
	45	15	60

TEXT BOOKS

1. S.S. Sastry, Introductory Methods of Numerical analysis, Prentice, Hall of India, New Delhi (2003) 3rd Edition.
2. M. K. Venkatraman, Numerical methods for Physicists.

REFERENCES

1. Numerical Methods in Science and Engineering – The National Publishing Co., Madras (2001).
2. W.H. Press, B.P.Flannery, S.A.Teukolsky, W.T.Vetterling,Numerical Recipes in C, Cambridge University (1996).
3. K.P.N. Murthy,Monte Carlo : Basics ISRP, Kalpakkam, 2000.

Mapping with Programme Outcomes

Cos	PO_1	PO_2	PO_3	PO_4	PO_5	PO_6	PO_7	PO_8
CO_1	3	2	0	2	3	1	0	1
CO_2	2	2	0	2	2	0	0	1
CO_3	2	2	0	2	2	0	3	2
CO_4	2	2	0	3	1	0	0	2
CO_5	2	2	0	3	0	2	0	2
	11	10	0	12	6	3	2	8
Scaled to 1, 2, 3	3	2	0	3	2	1	1	2

3 – Strong: 2 – Medium: 1 – Low

COURSE CODE	SUBJECT NAME	L	T	P	C
XPH604	PHYSICS PRACTICAL –VI A	0	0	3	2
		L	T	P	H
		0	0	3	3

COURSE OUTCOMES:

CO1: Cog: Ana; Aff: Rec.; Psy: Mech; ***Use*** laboratory techniques such as accuracy of **measurements** and data **analysis**.

CO2: Cog: U; Aff: Rec.; Psy: Set, GR; ***Explain theconcepts*** that are learnt in the lecture sessions and ***follow*** hands-on learning experience in the laboratory sessions.

CO3: Cog: R; Aff: Rec.; Psy: Mech; Gain ***knowledge*** in the scientific methods and ***identify*** the process of **measuring** different Physical variables

CO4: Cog: Ap; Aff: Rec, Org;Psy: Mech; ***Manipulate***and ***complete*** all the experiments with excellent ***application*** knowledge

.

LIST OF EXPERIMENTS

1. NAND, NOR Universal gates – Verification.
2. RC Coupled Transistor Amplifier – Band width.
3. UJT relaxation oscillator.
4. RS- Filp Flop.
5. Operational amplifier – Adder and subtractor.
6. Emitter Follower.
7. AstableMultivibrator.
8. Monostable multivibrator using transistor.
9. Microprocessor – 8 bit addition and subtraction.
10. Microprocessor – 8 bit multiplication and division.

TEXT BOOKS

1. B.Sc Practical Physics, C. L. Arora, (S. Chand)
2. An Advanced Course in Practical Physics, D. Chattopadhyay and P. C. Rakshit, (New Central Book Agency)
3. A Text Book of Advanced Practical Physics, S. Ghosh, (New Central Book Agency) 7 Semester 1 - Physics (Honours) Theory Paper.
4. Shukla R. K. and Anchal Srivastava, Practical Physics, New Age International (P) Ltd,

Publishers, 2006.
5. Arora C. L., B.Sc Practical Physics, S. Chand and Company Ltd, 2007.

REFERENCES

1. Squires G. L., Practical Physics, 4 th Edition, Cambridge University Press, 2001.
2. Halliday D., Resnick R. and Walker J., Fundamentals of Physics, 6th Edition, John Wiley and Sons, 2001.
3. Jenkins F.A. and White H.E., Fundamentals of Optics, 4th Edition, Mc Graw Hill Book Company, 2007.
4. Geeta Sanon, B. Sc., Practical Physics, 1st Edition, S. Chand and Company, 2007.
5. Benenson, Walter, and Horst Stocker, Handbook of Physics, Springer, 2002.

Mapping with Programme Outcomes

COs	PO_1	PO_2	PO_3	PO_4	PO_5	PO_6	PO_7	PO_8
CO_1	3	1		2	1	2	3	3
CO_2	3	1		2	1	2	3	2
CO_3	3	1		1	1	2	2	1
CO_4	3	1		2	1	2	3	2
	12	4		7	4	6	11	8
Scaled to 1, 2, 3	**3**	**1**		**2**	**1**	**2**	**3**	**2**

3 – Strong: 2 – Medium: 1 – Low

COURSE CODE	SUBJECT NAME	L	T	P	C
XPH605	PHYSICS PRACTICAL –VI B	0	0	3	2
		L	T	P	H
		0	0	3	3

COURSE OUTCOMES:

CO1: Cog: Ana; Aff: Rec.; Psy: Mech; ***Use*** laboratory techniques such as accuracy of **measurements** and data **analysis**.

CO2: Cog: U; Aff: Rec.; Psy: Set, GR; ***Explain theconcepts*** that are learnt in the lecture sessions and ***follow*** hands-on learning experience in the laboratory sessions.

CO3: Cog: R; Aff: Rec.; Psy: Mech; Gain ***knowledge*** in the scientific methods and ***identify*** the process of **measuring** different Physical variables

CO4: Cog: Ap; Aff: Rec, Org;Psy: Mech; ***Manipulate***and ***complete*** all the experiments with excellent ***application*** knowledge

LIST OF EXPERIMENTS

1. JK-Flip Flop.
2. Decade counter 7490.
3. Wien's bridge oscillator.
4. FET Amplifier – Band width.
5. Feedback Amplifier - Transistor.

6. B.G. – Comparison of mutual inductance.
7. Half Subtractor and Full Subtractor using NAND/NOR gates.
8. Microprocessor – Decimal to Octal and Octal to Decimal Conversion.
9. Microprocessor –Study of DAC Interfacing.
10. Microprocessor – Decimal to Hexadecimal and Hexadecimal to Decimal Conversion.

.

TEXT BOOKS

1. BSc Practical Physics, C. L. Arora, (S. Chand)
2. An Advanced Course in Practical Physics, D. Chattopadhyay and P. C. Rakshit, (New Central Book Agency)
3. A Text Book of Advanced Practical Physics, S. Ghosh, (New Central Book Agency) 7 Semester 1 - Physics (Honours) Theory Paper.
4. Shukla R. K. and Anchal Srivastava, Practical Physics, New Age International (P) Ltd, Publishers, 2006.
5. Arora C. L., B.Sc Practical Physics, S. Chand and Company Ltd, 2007.

REFERENCES

1. Squires G. L., Practical Physics, 4 th Edition, Cambridge University Press, 2001.
2. Halliday D., Resnick R. and Walker J., Fundamentals of Physics, 6th Edition, John Wiley and Sons, 2001.
3. Jenkins F.A. and White H.E., Fundamentals of Optics, 4th Edition, Mc Graw Hill Book Company, 2007.
4. Geeta Sanon, B. Sc., Practical Physics, 1st Edition, S. Chand and Company, 2007.
5. Benenson, Walter, and Horst Stocker, Handbook of Physics, Springer, 2002.

Mapping with Programme Outcomes

COs	**PO_1**	**PO_2**	**PO_3**	**PO_4**	**PO_5**	**PO_6**	**PO_7**	**PO_8**
CO_1	3	1		2	1	2	3	3
CO_2	3	1		2	1	2	3	2
CO_3	3	1		1	1	2	2	1
CO_4	3	1		2	1	2	3	2
	12	4		7	4	6	11	8
Scaled to 1, 2, 3	**3**	**1**		**2**	**1**	**2**	**3**	**2**

3 – Strong: 2 – Medium: 1 – Low

Syllabus for M.Sc. Physics

YPH101 Core Course I MATHEMATICAL PHYSICS 3 1 0 4
Course Objectives : To familiarize the students with the mathematical techniques that will be useful in understanding theoretical treatment in different courses taught in this class and for developing a strong background if they want to pursue research in theoretical physics
Course Outcome: **At the end of the course students will be able to** • Master the basic elements of complex mathematical analysis • Solve differential equations that are common in physical sciences • Apply group theory and integral transforms to solve mathematical problems of interest in physics .
Unit I: VECTORS AND TENSORS Vector analysis : Gradient –Divergence –Curl-second order derivatives – Gauss's theorem-Stoke's theorem-Green's theorem – Curvilinear coordinates spherical polar-cylindrical coordinates. Tensor analysis : Cartesian tensors – law of transformation of first and second order tensors- addition, subtraction and multiplication (inner and outer product) of tensors –rank ,covariant, contravariant and mixed tensors- symmetric and antisymmetric tensors- Quotient law.
Unit 2 : Complex Analysis Functions of complex variables – Differentiability -- Cauchy-Riemann conditions – Complex integration – Cauchy's integral theorem and integral formula – Taylor's and Laurent's series – Residues and singularities - Cauchy's residue theorem – Evaluation of definite integrals
Unit 3: Differential equations and Special functions Second order differential equations, Power Series method, Frobenius method, Bessel functions of first and second kind, Generating Function, Integral representation and recurrence relations and orthogonally, Legendre functions: Generating functions, recurrence relations and special properties, orthogonality, Associated Legendre functions: recurrence relations, parity and orthogonality, Hermite and Laguerre functions: Solution of Hermite and Lageurre differential equation, generating function and Recurrence relation.
Unit 4 FOURIER TRANSFORM, VECTOR SPACES AND GREEN FUNCTIONS Fourier Transform: Fourier transform – sine and cosine transform – properties Faultung's theorem- application in heat conduction and spectroscopy. Vector spaces: Definition –Linear dependence-Linear independence of vectors- Linear spaces –Basis-change of basis – Inner product space – Schmidt's orthogonalisation procedure – Schwartz's inequality – Hilbert spaces

properties. Green's function: Definition and construction –symmetry propertiesexpression for Green's functions in terms of Eigen functions-Green's functions for simple and second order operator.

Unit 5 Group Theory

Basic definitions – Multiplication table – Subgroups, Cosets and Classes – Direct Product groups – Point groups -- Space groups – Representation theory – Homomorphism and isomorphism– Reducible and irreducible representations – Schur's lemma – The great Orthogonality theorem – Character table -- C3v and D3h as examples – Elementary ideas of rotation groups

Books for Study

1. A.W. Joshi, Matrices and Tensors in Physics, Wiley Eastern Ltd., New Delhi (1975)
2. P.K.Chattopadhyay, Mathematical Physics, Wiley Eastern Ltd., New Delhi (1990)
3. L.A.Pipes and L.R. Harvill, Applied Matematics for Engineers and Physcists, McGraw Hill Company, Signgapore (1967)
4. Mathematical Physics, B.D.Gupta,Vikas Publishing House, 2007

Books for Reference

1. Eugene Butkov, Mathematical Physics, Addison Wesley, London (1973)
2. A.K. Ghattak, T.C.Goyal and S.J. Chua, Mathematical Physics, Macmillan, New Delhi (1995)
3. G.Arfken and H.J.Mathemattical Methods for Physicists, 4th ed. M.D.Greenberg, Advanced Engineering Mathematics, 2nd ed. International ed.,Prentice – Hall International, NJ, (1998)
4. E.Kreyszig, Advanced Engineering Mathematics, 8th ed. Wiley, NY (1999)

YPH102 Core Course II CLASSICAL DYNAMICS & RELATIVITY 3 1 0 4

Course Objectives

To equip the students with the knowledge of Lagrangian and Hamiltonian principles, equations, canonicaltransformations and small oscillations, so that students may apply these equations and principles inmodern physics research

Course outcome :

At the end of the course students will be able to

- Know the difference between Newtonian mechanics and Analytic mechanics
- Solve the mechanics problems using Lagrangian formalism, a different method from Newtonian mechanics
- Understand the connection between classical mechanics and quantum mechanics from Hamiltonian formalism

Unit I : Fundamental Principles and Lagrangian Formulation

Mechanics of a particle and system of particles – Conservation laws – Constraints – Generalized coordinates – D' Alembert's principle and Lagrange's equation – Hamilton's principle – Lagrange's equation of motion and its applications – conservation theorems and symmetry properties – Motion under central force General features – The viral theorem – the Kepler problem Scattering in a central force field.

Unit 2: Laguangian Formulation: Applications

a) Rigid Body Dynamies

Euler angles – Moments and products of inertia – Euler's equations – Symmetrical top.

b) Oscillatory Motion

Theory of small oscillations – Normal modes and frequencies – Two coupled harmonic oscillators – Linear triatomic molecule Wave motion – wave equation – Phase velocity – Group Velocity dispersion.

Unit 3 : Hamilton's Formulation

Hamilton's canonical equations of motion – Hamilton's equations from variational principle – Principle of least action – Canonical transformations – Poisson brackets – Hamilton – Jacobi method – Action and angle variables – Kepler's problem in action – angle variables.

Unit 4 : Nonlinear Dynamics

Regular and Chaotic Motions: Linear and nonlinear oscillators, phase trajectories – fixed points and limit cycles – period doubling phenomenon and onset of chaos in logistic map and Duffing oscillator – Non linear components – MLC oscillators and its dynamics - Soliton and solitary waves - Linear and nonlinear waves – KdV equation – Numerical experiments of Kruskal and Zabusky – Solitons

Unit 5 : Relativity

Reviews of basic ideas of special relativity – Energy momentum four vector – Minkowski's four dimensional space – Lorentz transformation as rotation in Minkowski's space – Compositions of L.T. about two orthogonal directions – Thomas precession – Invariance of Maxwell's equations under Lorentz transformation – Elements of general theory of relativity.

Books for study

1. H.Goldstein, Classical Mechanics, Narosa Book distributors, New Delhi (1980)
2. M.Lakshmanan and S.Rajasekar: Nonlinear Dynamics: Integrability, Chaos and Patterns, Springer – Verlag, Berlin (2003), Springer (India) 2004
3. M.Lakshmanan and K.Murali: Chaos in Nonlinear Oscillators, world Scientific Co., Singapore (1996). Chapters 2-4
4. Classical Mechanics, R.Bhatia, Narosa Publications.

Books for Reference

Publications Modern Physics, Beiser, Addison – Wesley series in physics

YPH103 Core Course III	BASIC ELECTRONICS	3 1 0 4

Course Objectives:

- To understand the basic working of Semiconducting devices and Linear Integrated Circuits.
- To give an emphasis to the student to know the various semiconductor devices and its working.
- To give clear understanding of various fabrication techniques of semiconducting devices.
- To introduce the basic building blocks of linear integrated circuits.

Course Outcome:

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

- Understand the fundamentals of Semiconductor Device Physics
- Know the physical principles crucial to the functionality and operation of basic semiconductor devices.
- Enrich their knowledge in understanding the linear and non-linear applications of operational amplifiers.

UNIT – 1 SEMICONDUCTOR DIODES

The continuity equation – Application of the continuity equation for an abrupt PN junction under forward and reverse bias – Einstein equation – Varactor diode – Schottky diode – Tunnel diode – Gunn diode – Optoelectronic diodes – LASER diode, LED and photo diode.

UNIT – 2 TRANSISTORS AND POWER SEMI-CONDUCTOR DEVICES

JFET: structure and working – I –V characteristics under different conditions – biasing circuits – CS amplifier design – MOSFET: Depletion and Enhancement type MOSFET – UJT characteristics – relaxation oscillator.

SCR characteristics – application in power control DIAC, TRIAC, BJT, and IGBT, Turn-on and turn-off characteristics, switching losses.

UNIT – 3 OPERATIONAL AMPLIFIER

Operational amplifier characteristics – inverting and non-inverting amplifier – instrumentation amplifier – voltage follower –integrating and differential circuits – log & antilog amplifiers – op-amp as comparator – Voltage to current and current to voltage conversions-active filters : low-pass, high pass, band pass & band rejection filters-Solving simultaneous and differential equations (Analog computations).

UNIT – 4 OP-AMP APPLICATIONS (OSCILLATORS AND CONVERTORS)

Wien Bridge, phase shift oscillators and twin-T oscillators – triangular, saw-tooth and square wave generators-Schmitt's trigger – sample and hold circuits – Voltage control oscillator – phase

locked loops. Basic D to A conversion: weighted resistor DAC – Binary R-2R ladder DAC – Basic A to D conversion: counter type ADC – successive approximation converter – dual slope ADC.

UNIT – 5 IC FABRICATIONS AND IC TIMER

Basic monolithic ICs – eqitaxial growth – masking –etching impurity diffusion fabricating monolithic resistors, diodes, transistors and capacitors – circuit layout – contacts and inter connections – charge coupled device – applications of CCDs.555 timer – description of the functional diagram – mono stable operation – applications of mono shots – astable operation-pulse generation.

Books for study

1. J.Milman and C.C. Halkias, Integrated Electronics, McGraw Hill (1972)
2. A. Mottershed, Semiconductor Devices and Applications, New Age Int Pub,
3. Milman and Taub, Pulse, digital and switching waveforms, McGraw Hill (1965)
4. Ben.G.Streetman, Solid state electronic devices, Printice Hall, Englewood cliffs, NJ (1999)
5. R.A.Gayakwad, Op-Amps&Linear integrated circuits, Printice Hall India Pvt Ltd.(1999)

Books for Reference

1. T.F.Schubert and E.M.Kim, "Active and Nonlinear Electronics", John Wiley Sons, New York (1996)
2. L.Floyd, Electronic Devices, "Pearson Education" New York (2004)
3. Dennis Le Crissitte, Transitors, Printice Hall India Pvt. Ltd (1963)
4. M.Goodge, Semiconductor Device Technology Mc Millan (1983)
5. S.M.Sze, Physices of Semiconductor Devices, Wiley-Eastern Ltd (1981)

YPH104 Core Course IV BASIC PRACTICAL (General & Electronics) – Lab 0 0 6 3

General Lab

Course Objectives:

- To make the student familiarize with the basics of experimental physics .
- To enable the student to explore the concepts involved in the thermodynamics and heat
- To make the student understand the basic concepts in modern optics
- To allow the student to understand the fundamentals of instruments involved

Course Outcome:

- At the end of the course,
- The student should have had a knowledge on the different experimental techniques.
- The student should have understood the basics of physics involved in experiments
- The student should be able to apply the concepts of physics and do the interpretation and acquire the result.

Any fifteen Experiments
(Choosing a minimum of six experiments from each part)

A. General Experiments

1. Determination of Young's modulus, rigidity modulus and Poisson ratio by forming elliptical fringes
2. Determination of Young's modulus, rigidity modulus and Poisson ratio by forming hyperbolic fringes
3. Determination of bulk modulus of a liquid by ultrasonic wave propagation
4. Determination of Stefan's constant
5. Identification and determination of wavelengths of prominent lines using Hartmann's formula by spectrum photography – Copper arc spectrum
6. Identification and determination of wavelengths of prominent lines using Hartmann's formula by spectrum photography – Iron arc spectrum
7. BH loop – Energy loss of a magnetic material – Anchor ring using B.G.
8. Determination of dielectric constant at high frequency by Lecher wire
9. Determination of e/m of an electron by magnetron method
10. Determination of e/m of an electron by Thomson's method
11. Determination of L of a coil by Anderson's method
12. Photoelectric effect (Planck's constant Determination)

B. Electronics Lab

Course Objectives:

- To make the student familiarize with the basics of electronics .
- To enable the student to explore the concepts involved in the oscillators
- To make the student understand the basic concepts in Ic‟s and digital devices
- To allow the student to understand the fundamentals of multivibrators

Course Outcome:

At the end of the course,

- The student should have had a knowledge on the different experimental techniques involved in electronics.
- The student should be able to independently construct the circiuts
- The student should be able to apply the concepts of electronics and do the interpretation and acquire the result.

13. Study of a feedback amplifier – Determination of bandwidth, bandwidth and gain product constancy , input and output impedances.
14. Transistor power amplifier
15. Darlington pair amplifier
16. Design and study of monostable multivibrator
17. Design and study of bistable multivibrator
18. Design and study of Wein bridge Oscillator (Op-amp)
19. Design and study of phase shift Oscillator (Op-amp)
20. Characteristics of JFET
21. Characteristics of UJT

22. Characteristics of SCR
23. Characteristics of LDR
24 Common source amplifier using FET
25 Common drain amplifier using FET
26 Relaxation oscillator using UJT (or) Op-amp
27. Active 2nd order filter circuits
28. Construction of an Instrumentation amplifier

YPH201 Core Course V	**STATISTICAL MECHANICS**	**3 1 0 4**

Course Objectives:

- The course is to understand the basics of Thermodynamics and Statistical systems.
- Understand the various laws of thermodynamics
- Acquire the knowledge of various statistical distributions.
- To comprehend the concepts of Enthalpy, phase transitions and thermodynamic functions.

Course Outcome:

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

- Basic knowledge of thermodynamic systems
- Understand the basic idea about statistical distrbutions
- Impart the knowledge about the phase transitions and potentials
- Understand the applications of statistical laws

Unit 1 : Thermodynamics

Laws of thermodynamics – Zeroth law - Energy and First law – Entropy and second law – Nernest theorem and Third law - Calculation of entropy changes in reversible processes – The principle of increase of entropy – Thermodynamic variables potentials – Enthalpy, Helmholtz and the Gibbs functions – Maxwell thermodynamic relations (4) - Gibbs Phase rule – Chemical potential – Phase transitions – The Clausius-Clapeyron equation – van der Waals equation of state.

Unit 2 : Kinetic Theory

Distribution function and its evolution -- Boltzmann transport equation and its validity – Boltzmann's H-theorem – Maxwell-Boltzmann distribution – Transport phenomena – Mean free path – Conservation laws – Hydrodynamics (no derivation).

Unit 3 : Classical Statistical Mechanics

Review of probability theory – Macro-and micro states – Statistical equilibrium – Phase space and ensembles – Density function -– Liouville's theorem – Maxwell- Boltzmann distribution law – Micro canonical ensemble – Ideal gas – Entropy – Partition function – Principle of equipartition

of energy – Canonical and grand canonical ensembles.

Unit 4 : Quantum Statistical Mechanics

Basic concepts – Quantum ideal gas – Bose-Einstein and Fermi-Dirac distribution laws – Sackur-Tetrode equation – Equations of state – Virial co-efficient - Bose-Einstein condensation.

Unit 5 : Applications of Q.S.M.

Ideal Bose gas : Photons – Black body and Planck radiation – Photons – Specific heat of solids – Liquid Helium. Ideal Fermi gas : Properties – Degeneracy – Electron gas – Pauli paramagnetism. Ferromagnetism : Ising (one dimensional model) and Heisenberg models.

Books for Study

1. B. K. Agarwal and M. Eisner, Statistical Mechanics (Wiley Eastern Limited, New Delhi, 1994).
2. F. Reif, Fundamentals of Statistical and Thermal Physics (McGraw Hill, Singapore, 1985).

Book for Reference

1. K. Huang, Statistical Mechanics (Wiley Eastern Limited, New Delhi, 1963).
2. N. Sears and L. Salinger, Thermodynamics (Narosa, New Delhi, 1989).
3. W. Greiner, L. Neise and H. Stocker, Thermodynamics and Statistical Mechnaics (Springer, New York, 1995).

YPH202 Core Course VI : QUANTUM MECHANICS 3 1 0 4

Unit 1: Schrödinger Equation and General Formulation

Schrödinger Equation – Physical meaning and conditions on the wave function – Expectation values and Ehrenfest's theorem – Hermitian operators and their properties – Commutator relations – Uncertainty principle with proof - Bra and ket vectors - Hilbert space – Schrödinger, Heisenberg and interaction pictures.

Unit 2: Exactly Solvable Systems

Linear harmonic oscillator -- Solving the one dimensional Schrödinger equation - Abstract operator method – Particle in a box – Square well potential - Rectangular barrier potential – Eigen function and Eigen values - Rigid rotator – Hydrogen atom.

Unit 3: Approximation Methods

Time independent perturbation theory: Non-degenerate and degenerate perturbation theories -- Stark effect – WKB Approximation -- Application to tunneling problem and quantization rules.Time dependent perturbation theory: Harmonic Perturbation – Transition probability.

Unit 4 : Scattering Theory and Angular Momentum

Scattering theory: Scattering cross section – Green's function approach – Born Approximation – Partial wave analysis. Angular momentum: Matrix Representation of J -- Spin angular momentum --Eigenvalues -- Addition of angular momenta -- Clebsch-Gordan coefficients($J_1 = J_2 = 1/2$)

Unit 5: Relativistic Quantum Mechanics

Klein-Gordon equation for a free particle and in an electromagnetic field – Dirac equation for a free particle -- Charge and current densities -- Dirac matrices – Plane wave solution – Negative energy states – Zitterbewegung – Spin angular momentum – Spin-orbit coupling.

Books for Study

1. P. M. Mathews and K. Venkatesan, A Text Book of Quantum Mechanics (Tata McGraw Hill, New Delhi, 1987).
2. A. Goswami, Quantum Mechanics (W. C. Brown, Dubuque, 1992).
3. Quantum Mechanics, Kakani & Chandiliya.
4. Quantum Physics, Srivatsa.

Book for Reference

1. L. Schiff, Quantum Mechanics (Tata McGraw Hill, New Delhi, 1968).
2. V. K. Thankappan, Quantum Mechanics (Wiley-Eastern, New Delhi, 1985).
3. J. Singh, Quantum Mechanics: Fundamentals and Applications to Technology (John-Wiley, New York, 1997).

YPH203 Core Course VII : ELECTROMAGNETIC THEORY **3 1 0 4**

Course Objectives:

- To make the student understand the basic concepts in Electromagnetism
- To allow the student to have a deep knowledge of the fundamentals of Electromagnetism

Course Outcomes:

At the end of the course:

- The student should have understood the basics of electromagnetism
- The student should be able to apply the concepts of Electrodynamics

Unit 1 : Introduction to Electrostatics

Coulomb's law – Electric field – Gauss Law – Scalar potential – Surface distribution of charges and dipoles – Poisson and Laplace Equations – Green's theorem – Dirichlet and Neumann boundary conditions – Electrostatic boundary value problems : Solution using Green's function – Method of Images – Illustrations : Point charge in the presence of (i) a grounded conducting sphere, (ii) a charged, insulated and conducting sphere, (iii) near a conducting sphere at fixed potential and (iv) conducting sphere in a uniform electric field – Green's function for the sphere

Unit 2 : Electrostatics of Macroscopic Media

Multipole expansion – Elementary treatment of electrostatics with ponderable media – Boundary value problems with dielectrics -- Illustrations : (i) a point charge embedded at a distance away from a dielectric interface, (ii) dielectric sphere in a uniform electric field and (iii) spherical cavity in a dielectric medium with applied electric field – Molecular polarizability and electric susceptibility – Electrostatic energy in dielectric media.

Unit 3 : Magnetostatics

Biot and Savart law – Force between current carrying conductors – Differential equations of magnetostatics and Ampere's law – Vector potential – Magnetic field of a localized current distribution, magnetic moment – Force and torque and energy of a localized current distribution in an external magnetic induction - Macroscopic equations – Boundary conditions on B and H -- Methods of solving boundary value problems in magnetostatics – Uniformly magnetized sphere.

Unit 4 : Electromagnetics

Faraday's law of induction – Maxwell's displacement current – Maxwell equations - Maxwell equations in terms of vector and scalar potentials – Gauge transformations – Lorentz gauge, Coulomb gauge – Poynting's theorem – Conservation of energy and momentum for a system of charged particles and electromagnetic fields.

Unit 5 : Plane Electromagnetic Waves and Wave Propagation

Plane waves in a nonconducting medium – Linear and circular polarization, Stokes parameters – Reflection and refraction of electromagnetic waves at a plane interface between dielectrics – Fields at the surface of and within a conductor – Propagation of electromagnetic waves in hollow metallic cylinders : Cylindrical and rectangular wave guides -- TM and TE modes – Wave propagation in optical fibers

Books for Study

1. J. D. Jackson, Classical Electrodynamics (Wiley Eastern Ltd., New Delhi, 1999).
2. D. Griffiths, Introduction to Electrodynamics (Prentice-Hall, New Delhi, 1999).

Book for Reference

1. R. P. Feynman et al, The Feynman Lectures on Physics, Vol.II (Narosa, New Delhi, 1989).

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YPH204 Core Course VIII : ADVANCED GENERAL EXPERIMENTS – LAB 0 0 6 3

(Any Twelve)

1. Forbe's method of determining thermal conductivity using thermocouples
2. Determination of carrier concentration and Hall coefficients in semiconductors.
3. Determination of magnetic susceptibility of liquid by Guoy method.
4. Determination of magnetic susceptibility of liquids by Quincke's method.
5. Determination of dielectric constant of a liquid by RF oscillator method.
6. Determination of wavelength and thickness of a film by using Michelson's interferometer.
7. Brass spectrum – Determination of composition.
8. Salt analysis by using Spectrograph.
9. ALO band spectrum.
10. Charge of an electron by spectrometer.
11. Polarizability of liquids by finding the refractive indices at different wavelengths.
12. Determination of wavelength of monochromatic source using biprism.
13. Determination of refractive index of liquids using biprism (by scale & telescope method).
14. Determination of specific rotatory power of a liquid using polarimeter.
15. Rydberg's constant using spectrometer.
16. Determination of coefficient of coupling by AC bridge method.
17. Four probe method – Determination of resistivities of powdered samples.
18. Determination of dielectric loss using CRO.
21. Particle size determination using He-Ne Laser.
22. Optical fibre - Diode Laser wave length and particle size and numerical aperture of an Optical fibre

YPH301 Core Course IX : SOLID STATE PHYSICS 3 1 0 4

COURSE OBJECTIVES:

• To understand the basic concepts in Solid state Physics.
• To have comprehensive idea on properties of materials.

COURSE OUTCOMES:

At the end of the course, the students will be able to understand the
• Basic concepts on properties of materials in solid state physics.
• Phenomenon of superconductivity and its properties.
• Different techniques used for synthesis and fabrication of nanomaterials.

Unit 1: Crystal Structure

Crystal classes and symmetry – 2D, 3D lattices – Bravais lattices – Symmetry point groups – Space groups – Reciprocal lattice – Ewald's sphere construction – Bragg's law – Systematic absences – Atomic scattering factor – Diffraction – Structure factor – Experimental techniques – Laue, Powder, Rotation methods – Phase problem – Electron density distribution (elementary ideas only).

Unit 2: Lattice Vibrations and Thermal Properties

Vibration of monoatomic lattices – Lattices with two atoms per primitive cell – Quantization of lattice vibrations – Phonon momentum – Inelastic scattering of neutrons by phonons -- Lattice heat capacity – Einstein model – Density of modes in one-dimension and three-dimension – Debye model of the lattice heat capacity – Thermal conductivity – Umklapp process.

Unit 3: Free Electron Theory, Energy Bands and Semiconductor Crystals

Energy levels and density of orbitals – Fermi-Dirac distribution – Free electron gas in three-dimensions – Heat capacity of the electron gas – Electrical conductivity and Ohm's law – Motion in magnetic fields – Hall effect – Thermal conductivity of metals – Nearly free electron model – Electron in a periodic potential – Semiconductors – Band gap – Effective mass – Intrinsic carrier concentration.

Unit 4: Diamagnetism, Paramagnetism, Ferro magnetism and Antiferromagnetism

Langevin classical theory of Diamagnetism and paramagnetism – Weiss theory - Quantum theory of paramagnetism – Demagnetization of a paramagnetic salt – Paramagnetic susceptibility of conduction electrons - Hund's rules – Kondo effect -- Ferroelectric order – Curie point and the exchange integral – Temperature dependence of saturation magnetization – Magnons – Ferromagnetic order – Antiferromagnetic order –Ferromagnetic domains – Origin of domains – Coercive force and hysteresis – Phase transistion- order disorder phenomena – Type I, Type – II curie temperature.

Unit 5: Dielectrics and Ferroelectrics and Superconductivity

Macroscopic electric field – Local electric field at an atom – Dielectric constant and polarizability – Clausius-Mossotti equation – Polarizaion catastrophe – Ferroelectric domains -- Occurrence of

Superconductivity – Meissner effect – Thermodynamics of superconducting transition – London equation – Coherence length – BCS theory – Flux quantization – Type I and Type II Superconductors – Josephson superconductor tunneling – DC and AC Josephson effect – SQUID – Recent developments in high Temperature Superconductivity – Application of superconductors.

Books for Study

1. C. Kittel, Introduction to Solid State Physics (Wiley Eastern, New Delhi, 1977).
2. A. J. Dekker, Solid State Physics (McMillan, Madras, 1971).
3. S. O. Pillai, Solid State Physics (New Age International, New Delhi, 1995).
4. Introduction to Solid state Physics, Ali omar.

Book for Reference

1. N. W. Ashcrof and N. D. Mermin, Solid State Physics (Holt, Rinehart and Winston, Philadelphia).
2. J. S. Blakemore, Solid State Physics (Cambridge University Press, Cambridge,1974).
3. M. M. Woolfson, An Introduction to X-ray Crystallography (Cambridge University Press, Cambridge, 1991).

YPH302 Core Course X : SPECIAL ELECTRONICS 3 1 0 4

COUSRE OBJECTIVES:

• To understand the concepts of microprocessors and microcontrollers

Course OUTCOMES:

At the end of the course, the students will be able to understand

• the working of digital electronic devices.

• the concepts of working model of microprocessors and microcontrollers

Unit 1 : Microcontroller Architecture

Introduction to Microcontroller – 8031 Microcontroller family (8031, 8032, 8052, 8051) – Organization of 8051 Microcontroller – Register structure – Special function registrars – Input / Output pins – Ports – Configurations – Programmed memory, Date memory – Counters and timers – serial data input, outputs – addressing modes.

Unit 2 : Instruction and programming

Assembly language programming for 8031/51 – Microcontroller family – Data transfer instruction – Arithmetic instruction – Branch instruction – Bit manipulation – instructions – rotate instructions – Instruction for stack operations – Programmes – multiplications – division – Greatest, smallest number in an array – ascending and descending order – evaluating simple expression of string manipulations – Pattern comparison – delay, routines – calculation time delay.

Unit 3 : I / O Interfaces

Data transfer schemes – Parallel data transfer – programmed data transfer, interrupt driven data transfer – DMA data transfer – serial data transfer – Interfacing devices – 8255 I/O ports

programming – 8251 serial communication interface – 8253 timer interface – 6845 CRT controller – 8357 – DMA controller.

Unit 4 : Antennas and Microwaves

Antennas: Thin linear antenna – Non-resonant antenna – Loop antenna – Radiation fields – Polarization – Isotopic radiator – Power gain – Effective parameters of an antenna – Dipole arrayed antenna – VHF, UHF and microwave antennas. Microwave generation and application: Klystron – Magnetron – Travelling wave tubes – Microwave propagation through wave guides – Attenuators – Crystal detection – Measurement of SWR – Transmitters and receivers.

Unit 5 : Colour Television

Essentials of colour television – Perception – Three colour theory – Luminescence – Hueand saturation – TV camera – Image orthicon – VIDICON – Luminescence signal – TV display tubes: CRT, LED, LCD and Plasma display. Modulation of colour difference signals – PAL of colour TV systems – PAL, NTSC, SECAM colour TV systems – PAL colour receiver – Block diagram – Merits and demerits.

Books for Study

1. The 8031 Microcontroller Architecture Programming and applications, Kenneth J.Ayla – Penram International Space Publishing (India), second edition.
2. Microprocessor and interfacing – Programming and hardware, DOUGLASV.HALL
3. Introduction to microprocessor, Aditya P.Mathur/ Guonka.
4. Atwatts, Introduction to Microwave theory (McGraw Hill Ltd, Singapore, 1980).
5. R. R. Gulati, Monochrome and Colour Television (Wiley Eastern, New Delhi, 1995).

YPH303 Core Course XI NUCLEAR AND PARTICLE PHYSICS 3 1 0 4

Course Objectives

- To study the general properties of nucleus
- To study the nuclear forces and nuclear reactions.
- To introduce the concept of elementary particles

Course Outcomes

At the end of the course, the students can able to

- Acquire basic knowledge about nuclear and particle physics
- Develop the nuclear reactions and neutron physics.
- Understand the nuclear fission and fusion reactions.
- Impart the knowledge about the nuclear forces and elementary particles

Unit 1 : Basic Nuclear Properties

Nuclear size, shape, mass – Charge distribution – Spin and parity – Binding energy – Semi

empirical mass formula – Nuclear stability – Mass parabola -- Nature of nuclear forces – Ground state of deuteron – Magnetic dipole moment of deuteron – Proton-neutron scattering at low energies – Scattering length, phase shift – Properties of nuclear forces – Spin dependence – Charge symmetry – Charge independence – Repulsion at short distances – Exchange forces – Meson theory.

Unit 2 : Radioactive Decays

Alpha emission – Geiger-Nuttal law – Gamow theory – Neutrino hypothesis – Fermi theory of beta decay – Selection rules – Nonconservation of parity – Gamma emission – Selection rules – Transition probability – Internal conversion – Nuclear isomerism – Interaction of charged particles and X-rays with matter – Basic principles of particle detectors – Ionization chamber – Proportional counter and G.M counters – Solid state detectors – Scintillation and semiconductor detectors.

Unit 3 : Nuclear Reactions and Nuclear Models

Q-values and kinematics of nuclear cross sections – Energy and angular dependence – Reciprocity theorem – Breit-Wigner formula – Compound nucleus – Resonance theory – Optical model -- Shell model – Liquid drop model – Collective model.

Unit 4 : Accelerators and Reactors

Cyclotron – Synchrocyclotron – Betaron – Synchrotron – Linear accelerators -- Characteristics of fission – Mass distribution of fragments – Radioactive decay processes – Fission cross section – Energy in fission – Bohr-Wheeler's theory of nuclear fission – Fission reactors – Thermal reactors – Homogeneous reactors –Heterogeneous reactors – Basic fusion processes - Characteristics of fusion – Solar fusion – Controlled fusion reactors.

Unit 5 : Elementary Particles

Building blocks of nucleus – Nucleons, leptons, mesons, baryons, hyperons, hadrons, strange particles - Classification of fundamental forces and elementary particles – Basic Conservation laws – Additional Conservation laws : Baryonic, leptonic, strangeness and isospin charges/quantum numbers – Gell-Mann- Nishijima formula – Multiplets - Invariance under time reversal (T) charge conjugation (C) and parity (P) – TCP theorem -- Parity nonconservation in weak interactions – CP violation – Eight-fold way and supermultiples – SU(3) symmetry and quark model.

Books for Study

1. K. S. Krane, Introductory Nuclear Physics (John-Wiley, New York, 1987).
2. S. B. Patel, Nuclear Physics: An Introduction (Wiley-Eastern, New Delhi, 1991).
3. B. L. Cohen, Concepts of Nuclear Physics (Tata McGraw Hill, New Delhi, 1988).
4. H. S. Hans, Nuclear Physics: Experimental and Theoretical (New AgeInternational Publishers, New Delhi, 2001).
5. D. C. Cheng and G. K. O'Neill, Elementary Particle Physics: An Introduction (Addison-Wesley, 1979).
6. D. Griffiths, Introduction to Elementary Particles (Wiley International, New York, 1987).

YPH304 Core Course XII: ADVANCED ELECTRONICS LAB 0 0 6 3

A. Digital Electronics and ICs
(Choosing a minimum of six experiments)

1) Half and Full wave precision rectifier using IC 741
2) Astable and bistable and monostable multivibrator using IC 555
3) Digital to analog converter - R-2R method and Weighted method
4) Study the function of multiplexer and demultiplexer
5) Study the function of decoder and encoder
6) Flip flops (RS, JK, Master & slave)
7) Half adder and Full adder, Half subtractor and Full Subtractor (using only NAND & NOR gates)
8) BCD to seven segment display
9) Study of counter using IC 7490 (0-9 and 00-99)

B. Microcontroller Practicals
(Choosing a minimum of five experiments)

1. Microcontroller – addition, subtraction (8 Bit)
2. Microcontroller – addition, subtraction (Array)
3. Microcontroller – Multiplication 8 bit by 8 bit and 16 bit by 8 bit
4. Microcontroller – Division by 8 bit by 8 bit and 16 bit by 8 bit
5. Microcontroller – To find the largest and smallest number in an array
6. Microcontroller – Pattern comparison .
7. Microcontroller – Ascending and descending order.
8. Microcontroller – Wave form generation.
9. Study of 2× 2 bit RAM.

C. Automation Lab

PLC Lab
(Choosing a minimum of two experiments)

1) Pump control
2) Selective bandwidth
3) Gate control system
4) Starter Control
5) Furnace control door

Sensorics
(Choosing a minimum of two experiments)

1) Behavior of inductive sensors NBN
2) Behavior of capacitive sensors CJ
3) Behavior of magnetic sensor MB

4) Behavior of through beam sensor
5) Response curve of capacitive sensor

YPH401 Core Course XIII	SPECTROSCOPY	3 1 0 4

Course Objectives:

- To make the student understand the principles of microwave spectroscopy
- To enable the student to explore the field of vibrational spectroscopy
- To make the student understand the basic concepts in nuclear spectroscopy
- To allow the student to understand the fundamentals of surface spectroscopy

Course Outcomes:

At the end of the course:

- The student should have had a knowledge on the techniques and instrumentation of microwave spectroscopy
- The student should have understood the basics of NMR and other spectroscopic techniques
- The student should be able to interpret spectra of the samples

Unit 1 : Atomic Spectra

Quantum states of electron in atoms – Hydrogen atom spectrum – Electron spin – Stern-Gerlach experiment – Spin-orbit interaction – Two electron systems – LS-JJ coupling schemes – Fine structure – Spectroscopic terms and selection rules – Hyperfine structure - Exchange symmetry of wave functions – Pauli's exclusion principle – Periodic table – Alkali type spectra – Equivalent electrons – Hund's rule.

Unit 2: Atoms in External Fields and Quantum Chemistry

Atoms in External Fields : Zeeman and Paschen-Back effect of one and two electron systems -- Selection rules – Stark effect . Quantum Chemistry of Molecules : Covalent, ionic and van der Waals interactions – Born-Oppenheimer approximation – Heitler-London and molecular orbital theories of H2 – Bonding and anti-bonding MOs – Huckel's molecular approximation – Application to butadiene and benzene.

Unit 3: Microwave and IR Spectroscopy

Rotational spectra of diatomic molecules – Effect of isotopic substitution – The non-rigid rotor - Rotational spectra of polyatomic molecules – Linear, symmetric top and asymmetric top molecules – Experimental techniques -- Vibrating diatomic molecule – Diatomic vibrating rotator – Linear and symmetric top molecules – Analysis by infrared techniques – Characteristic and group frequencies

Unit 4: Raman Spectroscopy and Electronic Spectroscopy of Molecules

Raman spectroscopy : Raman effect -- Quantum theory of Raman effect – Rotational and vibrational Raman shifts of diatomic molecules – Selection rules. Electronic spectroscopy of

molecules : Electronic spectra of diatomic molecules - - The Franck-Condon principle – Dissociation energy and dissociation products – Rotational fine structure of electronic vibration transitions

Unit 5: Resonance Spectroscopy

NMR: Basic principles – Classical and quantum mechanical description – Bloch equations – Spin-spin and spin-lattice relaxation times – Chemical shift and coupling constant -- Experimental methods – Single coil and double coil methods – High resolution methods. ESR: Basic principles – ESR spectrometer – nuclear interaction and hyperfine structure – relaxation effects – g-factor – Characteristics – Free radical studies and biological applications.

Books for Study

1. C. N. Banwell, Fundamentals of Molecular Spectroscopy (McGraw Hill, New York, 1981).

Book for Reference

1. B. P. Straughan and S. Walker, Spectroscopy Vol.I. (Chapman and Hall, New York, 1976).
2. R. P. Feynman et al. The Feynman Lectures on Physics Vol. III. (Narosa, New Delhi, 1989).
3. H. S. Mani and G. K. Mehta, Introduction to Modern Physics (Affiliated East West, New Delhi, 1991).
4. A. K. Chandra, Introductory Quantum Chemistry (Tata McGraw Hill, New Delhi, 1989).
5. Pople, Schneiduer and Berstein, High Resolution NMR (McGraw Hill, New York).
6. Manas Chanda, Atomic Stucture and Chemical Bond (Tata McGraw Hill, New Delhi, 1991).
7. Ira N. Levine, Quantum Chemistry (Prentice-Hall, New Delhi, 1994).
8. Arthur Beiser, Concepts of Modern Physics (McGraw Hill, New York, 1995).
9. C.P. Slitcher, Principles of Magnetic Resonance (Harper and Row).

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YPH403 Core Course XV : High Energy Physics 3 1 0 4

UNIT-I : Nuclear Interactions

Nuclear forces - Two body problem - Ground state of deuteron - Magnetic moment - Quadruple moment - Tensor forces - Meson theory of nuclear forces - Yukawa potential - Nucleon-nucleon scattering - Low energy n-p scattering - Effective range theory - Spin dependence, charge independence and charge symmetry of nuclear forces - Isospin formalism.

UNIT-II: Nuclear decay

Beta decay - Fermi's theory - Fermi-Kurie Plot - Fermi and Gamow - Teller selection rules - Allowed and forbidden decays - Decay rates - Theory of Neutrino - Helicity of neutrino - Helicity measurement - Theory of electron capture - Non-conservation of parity - Gamma decay - Internal conversion - Multipole transitions in nuclei - Nuclear isomerism - Angular correlation in successive gamma emissions.

UNIT – III : Particle interaction and fields

Classical and quantum pictures of interactions – Yukawa theory of quantum exchange – boson propagator – Feynman diagram – Basic ideas on the theories of weak, electroweak, strong, gravitational and electromagnetic interactions – interaction cross section – decays and resonances.

UNIT – IV : Particle Physics and Cosmology

Hubble's law and the expanding universe – Friedmann equation – cosmic microwave radiation: the hot Big Bang – Radiation and matter eras – Nucleosynthesis in the Big Bang – Baryon-antibaryon asymmetry – Dark mater – Inflation – Neutrino astronomy.

UNIT – V : Scattering of Elementary Particles

Scattering: Electron-muon, neutrino-electron, elastic lepton-nucleon, deep inelastic and partons, deep inelastic and quarks – experimental results on quarks distribution in the nucleon – sum rules.

Books for Study

P.H.Perkins, , 1982, Introduction to high energy Physics, Addison – Wesley, London.
1. K.S. Krane, 1987, Introductory Nuclear Physics, Wiley, New York.
2. D. Griffiths, 1987, Introduction to Elementary Particle Physics, Harper and Row, New York.
3. R.R. Roy and B.P. Nigam, 1983, Nuclear Physics, New Age International, New Delhi.
4. I. Kaplan, 1989, Nuclear Physics, 2nd Edition, Narosa, New Delhi.
5. H.A. Enge, 1975, Introduction to Nuclear Physics, Addison Wesle, London.

Books for Reference

1. Y.R. Waghmare, 1981, Introductory Nuclear Physics, Oxford-IBH, New Delhi.
2. Ghoshal, Atomic and Nuclear Physics, Volume 2.
3. J.M. Longo, 1971, Elementary Particles, McGraw-Hill, New York.
4. R.D. Evans, 1955, Atomic Nucleus, McGraw-Hill, New York.
5. B.L. Cohen, 1971, Concepts of Nuclear Physics, TMH, New Delhi.
6. M.K. Pal, 1982, Theory of Nuclear Structure, Affl. East-West, Chennai.
7. W.E. Burcham and M. Jobes, 1995, Nuclear and Particle Physics, Addison-Wesley, Tokyo.

YPH105A Elective Course – I NUMERICAL METHODS IN PHYSICS 3 0 0 3

Course Objectives:

- To understand the basic Numerical methods and programming.
- To have an idea to apply numerical methods into research areas

Course Outcome:

At the end of the course, the students will be able to apply the basic concepts of numerical methods in relevant fields.

Unit I

Errors and the measurements General formula for errors – Errors of observation and measurement – Empirical formula – Graphical method – Method of averages – Least square fitting – curve fitting – parabola, exponential.

Unit II

Numerical solution of algebraic and transcendental equations The iteration method – The method of false position – Newton – Raphson method – Convergence and rate of convergence – C program for finding roots using Newton – Raphson method. Simultaneous linear algebraic equations Gauss elimination method – Jordon's modification – Gauss – Seidel method of iteration.

Unit III

Interpolation Linear interpolation – Lagrange interpolation Gregory – Newton forward and backward interpolation formula – Central difference interpolation formula – Gauss forward and backward interpolation formula – Divided differences – Properties – Newton's interpolation formula for unequal intervals.

Unit IV

Numerical differentiation and integration Newton's forward and backward difference formula to compute derivatives – Numerical integration: the trapezoidal rule, Simpson's rule – Extended Simpson's rule.

Unit V

Numerical Solutions of ordinary differential equations Nth order ordinary differential equations – Power series approximation – Pointwise method – Solutions of Taylor series – Euler's method – Improved Euler's method – Runge-Kutta method – second and third order – Runge-Kutta method for solving first order differential equations.

Books for study

1. Introductory Methods of Numerical analysis – S.S. Sastry, Prentice – Hall of India, New Delhi (2003) 3rd Edition.
2. Numerical methods for Physicists – M. K. Venkatraman.

Books for Reference

1. Numerical Methods in Science and Engineering – The National Publishing Co.Madras (2001).
2.Numerical Recipes in C, W.H.Press, B.P.Flannery, S.A.Teukolsky, W.T.Vetterling,Cambridge University (1996).
3. Monte Carlo : Basics, K.P.N. Murthy, ISRP, Kalpakkam, 2000.

YPH105B Elective Course – II GEOPHYSICS 3 0 0 3

UNIT I Introductions

Concept of fields: scalar, vector and rastar, conservation laws; mass, momentum, energy and charge, Constitutive relations and dynamical equations, elastic, viscous, electromagnetic and thermal.

UNIT II Electrical & Electromagnetic Prospecting

Electrical properties of rocks – Current flow in a homogenous media – Electrode arrays - Current flow across layers of differing resistivities- Principles of electromagnetic- Electromagentic waves in lossy dielectric materials -Snell's law – Reflection/transmission coefficients – Common mid-point (CMP) reflection measurements – Field methods – Vertical Electrical Sounding (VES).

UNIT III Gravity and Magnetic prospecting

Basic equations and Earth's gravity field - Measurement of gravity: Absolute gravity and Relative gravity – Basic equations and units of magnetic field – Gravity prospecting instruments: Stable and unstable gravimeters, borehole and airborne gravimeters- Applications of gravity and magnetic prospecting in oil/gas, minerals and groundwater exploration.

UNIT IV Seismic Prospecting Methods

Propagation of Seismic Waves in Linear and Nonlinear medium, Waveforms and their characteristics - Seismic data enhancement and Test Shooting, Explosive and Non Explosive sources of Seismic Energy for P-Wave, Seismic source energy For S-Wave.- Mapping of Geological Structures (Faults, Reef, Pinchouts, Anticlines) - Applications of seismic methods in Hydrocarbon, Mining , Groundwater and Engineering studies. Mapping of Geological structures.

UNIT V Geo physical application in Disaster management

Introduction to seismology, Earthquakes and Plate Tectonics – Richter – Merchlle scale – Seismograph - Seismogram - Faulting and fracture, secondary effects of earthquakes: landslides, tsunami, fires and fatalities.

Books for study

Outlines of Geophysical Prospecting - A manual for geologists, by Ramachandra Rao, M.B., Prasaranga, University of Mysore, Mysore, 1975.

YPH105C Elective Course–III Thin film Science and characterization Techniques 3 0 0 3

Course Objectives:

- To teach the fundamentals of the scientific principles behind thin-film technology.
- To give an emphasis to the student to know the various characterization techniques of thin films.
- To give clear understanding of various fabrication techniques of thin films.
- To know the proper use of equipment and experimentation procedures related to thin film fabrication.

Course Outcome:

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

- Understand various techniques to grow thin films.
- Study the mechanical and electrical properties of thin films.
- Apply the concept of thin films in the fabrication of various electronic devices.

UNIT I: PREPARATION METHODS

Electrolytic deposition, cathodic and anodic films, thermal evaporation, cathodic sputtering, chemical vapour deposition. Molecular beam epitaxial and laser ablution methods.

UNIT II: THICKNESS MEASUREMENT AND MONITORING

Electrical, mechanical, optical interference, microbalance, quartz crystal methods.

Analytical techniques of characterization: X-ray diffraction, electron microscopy, high and low energy electron diffraction, Auger emission spectroscopy. Photoluminescence(PL) – Raman Spectroscopy, UV-Vis-IR Spectrophotometer – AFM – Hall effect – SIMS – X-ray Photoemission Spectroscopy (XPS) – Vibrational Sample Magnetometers, Rutherford Back Scattering (RBS).

UNIT III: THERMODYNAMICS AND KINETICS OF THIN FILM FORMATION

Film growth – five stages – Nucleation theories – Incorporation of defects and impurities in films – Deposition parameters and grain size – structure of thin films.

UNIT IV: MECHANICAL & ELECTRICAL PROPERTIES OF FILMS

Mechanical Properties: Elastic and plastic behavior – Optical properties – Reflectance and transmittance spectra – Absorbing films – Optical constants of film material – Multilayer films. Anisotropic and gyrotropic films.

Electric properties to films: Conductivity in metal, semiconductor and insulating films. Discontinuous films, Superconducting films, Dielectric properties.

UNIT V: APPLICATIONS

Micro and optoelectronic devices, quantum dots, Data storage, corrosion and wear coatings –

Polymer films, MEMS, optical applications –Applications in electronics–electric contacts, connections and resistors, capacitors and inductances – Applications of ferromagnetic and superconducting films – active electronic elements, micro acoustic elements using surface waves– integrated circuits–thin films in optoelectronics and integrated optics.

REFERENCES:

1. M.Ohring, „The Materials Science of Thin Films", Academic Press, 2nd edition(2001).
2. Zexian Cao, „Thin film growth - Physics, materials science and applications", Woodhead .
3. Publishing Limited, (2011).
4. H.Bubert and H.Jenett, „Surface and Thin Film Analysis – Principles, Instrumentations, Applications", Wiley – VCH Verlag GmbH (2002).
5. Krishna Seshan, „Handbook of Thin-Film Deposition Processes and Techniques", Noyes Publications & William Andrew Publishing, 2nd edition(2002).

YPH201A Elective Course–IV LASER AND ITS APPLICATIONS 3 0 0 3

UNIT I :

Spontaneous emission, Stimulated emission, Populationinversion, Fabry Perot etalon, table two mirror opticalresonators, Longitudinal and transverse modes of lasercavity, Mode selection, Gain in a regenerative laser cavity.

UNIT II :

Two level laser system, Threshold for three and four levellaser systems, Mode locking, Pulse shortening- pico secondand femto second operation, Spectral narrowing andstabilization, Gaussian beam and its properties

UNIT III

Ammonia maser, Nitrogen laser, Carbon dioxide laser, Excimerlaser, Dye laser, Ruby laser, Nd-YAG laser, Diode –pumpedsolid state lasers, Semiconductor lasers, High power lasersystems,.

UNIT IV :

Laser induced fluorescence, Raman scattering and itsapplications, Non-linear interaction of light with matter, Laserinduced multi-photon processes and their applications.

UNIT V :

Ultra high resolution spectroscopy with lasers and itsapplications, Propagation of light in a medium with variablerefractive index, Optical fibers, Light wave communication,Qualitative treatment of medical and engineeringapplications of lasers, Material processing.

Books for study

1. Introduction to laser physics, Koichi Shimoda
2. Introduction to laser physics, B A Lengyl
3. Lasers, Svelto
4. Optical electronics, Yariv
5. Laser spectroscopy, Demtroder

YPH205B Elective Course – V	**Nano Science**	**3 0 0 3**	

Course Objectives:

The course is to understand the basic knowledge on nanomaterial characterization

- Understand the various process techniques available of nanostructure materials.
- Acquire the knowledge of various nano nanomaterial characterization
- To enhance the various analytical technique to understand the nano properties and characteristics of nano materials.

Course Outcome:

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

- Basic knowledge of Nanoscience and nanotechnology characterization techniques
- Under the basic idea about the nano material and nano structure
- Impart the knowledge about the properties and characteristics techniques of nano materials Understand the applications of nanomaterials

Unit- I

Introduction to nanoscience and technology (Nature vs Nano) - Importance of nanomaterials – classification – Nanostructures – Types and properties - Optical , Electronic and Magnetic materials; Engineering challenges for Nanotechnology, Potential impaction devices and systems, examples- Basic physics of naonomaterials, quantum confinement, molecular assembly, surface alignment, size effects.

Unit – II

Useful techniques for nanoscience and technology – nanofabrication; lithography electron beam lithography, molecular beam epitaxy, chemical vapor deposition, electrochemical deposition, solution chemistry – structureal characterization ; SPM, XRD, AFM,TEM,SEM - Optical property characterization; UV–Vis, Fluorescene, Raman and IR – composition analysis; XPS and Auger Spectroscopy.

Unit – III

Techniques for nanoscience characterization and fabrication of nanoscale systems and devices – scanning probe microsacopy, nanotweezers electron microscopy, molecular manufacture , nano fabrication, nono lithography , focused ion beam, electron beam lithography, fullerences.

Unit – IV

Molecular Electronics; molecular wire, Molecular Diode, Transistor and switch – Characterization and performance.

Unit – V

Nanoscale in biology and biometric materials mineralized tissues, apatite crystals,

organic/inorganic matrix, precipitation, artificial bone, cell structure membranes actin, macro molecules bloadhesion, ligand – receptor interactions, collagen structure, bone morphogenic proteins, cell migration, cell attachments, phagocytasis, macrophage response.

Books for study

1. Charles P.Poole Jr. & Frank J.Owns. "Introduction to Nanotechnology" wiley,2003.

Books for Reference

1. M.Ratner.et al ., Nanotechnolgy; A Gentle introduction , Prentice- Hall, ISBN 0-13- 101400-5, 2003.
2. Nanotechnolgy; Basic science and Engineering Technologies, CRC Press.
3. A.S Edelstien and R.C. Coronmarata, Nanomaterials; systhesis, Properties and Applications, 2ed,IOP(U.K), 1996.

YPH205C Elective Course–VI NON–DESTRUCTIVE TESTING TECHNOLOGY 3 0 0 3

Course objectives:

Non-destructive evaluation forms an important part of Quality assurance of the developed material in the industry. This course covers the non destructive methods of testing materials like

- Liquid penetrant testing
- Magnetic particle testing
- Eddy current testing
- X-ray and Gamma ray inspection
- Ultrasonic inspection

Course outcome:

At the completion of the course, students would have got familiarized with

- Visual testing and liquid penetration inspection of material
- Generation of magnetic field and magnetic particle testing of material
- Generation of Eddy currents and testing of material
- Radiographic inspection of material
- Generation of ultrasonics and inspection of material

UNIT I SURFACE NDE TECHNIQUES – I

Visual inspection – Basic principles – Microscope – Bore scope – Endoscope – flexible fibre – optic Borescope – Telescope – Holography – Applications.

Liquid Penetrant testing – Physical principles – Procedure for penetrant testing – penetrant testing materials – penetrant – cleaners and emulsifiers – developers –penetrant testing methods–

Applications & limitations.

UNIT II SURFACE NDE TECHNIQUES – II

Magnetic particle testing – Magnetism – Basic Definitions and principle of MPT- Magnetizing techniques –procedure used for testing a component – equipment used for MPT – sensitivity – Limitations.

Eddy current testing – Principles – instrumentation for ECT – high sensitivity techniques – inspection of heat exchanger tubes by single frequency ECT system – multi frequency ECT- high frequency ECT – Limitations.

UNIT III BASIC PRINCIPLES OF RADIOGRAPHY

Electromagnetic Radiation sources – X –ray source – Production of X-ray – High energy X-ray source – Gamma-ray sources – properties of X-ray and gamma ray – Radiation attenuation in the Specimen – Effect of radiation on Film — Radiographic imaging – Geometrical factors – Radiographic film – intensifying screen – Film density – radiographic sensitivity – penetrameter.

UNIT IV RADIOGRAPHY INSPECTION TECHNIQUES

Inspection techniques – Single wall single image technique – Double wall penetration technique – Application of radiographic inspection – limitations - real-time radiography – Safety in industrial radiography – radiation units – limits for radiation exposure – methods for exposure control – Radiation monitoring.

UNIT V ULTRASONIC TESTING

Properties of sound beam – sound waves – velocity of ultrasonic waves – Behavior of ultrasonic waves – Ultrasonic flow detection equipment – modes of display A-scan ,B- scan, C- scan-immersion testing- applications of ultrasonic testing – advantages – Limitations.

Books for Study

1. American Society of metals: “Non-Destructive Inspection and Quality Control”; Metals Hand Book, Vol.11, 8th Edition, Metal Park.
2. Krautkramer, Josef and Hebert Krautkramer. “Ultrasonic Testing of Meterials”, 3rd Edition, Newyork, Springer – verlag.

Books for Reference

1. Baldev Raj, T.Jayakumar and M.Thavasimuth. "Practical Non – Destructive Testing", 3rd Edition, Narosa Publishing House, 2008.

YPH305A Elective Course–VII CRYSTAL GROWTH AND CHARACTERIZATION TECHNIQUES 3 0 0 3

UNIT I NUCLEATION AND GROWTH

Nucleation – Different kinds of nucleation – Concept of formation of critical nucleus – Classical theory of nucleation – Spherical and cylindrical nucleus.

UNIT II SOLUTION GROWTH TECHNIQUE

Low temperature solution growth : Solution – Solubility and supersolubility – Expression of supersaturation - Miers T-C diagram – Constant temperature bath and crystallizer – Seed preparation and mounting – Slow cooling and solvent evaporation methods.

UNIT III GEL GROWTH TECHNIQUE

Principle – Various types – Structure of gel – Importance of gel – Experimental procedure – Chemical reaction method – Single and double diffusion method – Chemical reduction method – solubility reduction method – Complex and decomplexion method – Advantage of gel method.

UNIT IV MELT GROWTH TECHNIQUE

Bridgman technique – Basic process – Various crucibles design – Thermal consideration – Vertical Bridgman technique – Czochralski technique – Experimental arrangement – Growth process

UNIT V CHARACTERIZATION TECHNIQUE

X-Ray Diffraction (XRD) – Powder and single crystal – Fourier transform Infrared analysis (FT-IR) – Elemental analysis – Atomic absorption spectroscopy (AAS) – Elemental dispersive – X – ray analysis (EDAX) – Scanning Electron Microscopy (SEM) – UV-VIS spectrograph – Etching (Chemical) – Vickers Micro hardness.

Books for study

1. J.C. Brice, Crystal Growth Processes, John Wiley and Sons, New York (1986).
2. P.Santhana Ragavan and P.Ramasamy, Crystal Growth Processes and Methods, KRU Publications, Kumbakonam (2001).

YPH305B Elective Course – VIII Automation Science and Techniques 3 0 0 3

OBJECTIVES:

Toknow the fundamental principles, design and operation of hydraulic and pneumatic machines, components and systems and their application in recent automation revolution.

TolearntheApplicationsofFluidPower SysteminautomationofMachineToolsand othersEquipments

UNITI FLUID POWER SYSTEMSAND FUNDAMENTALS (9)

Introductiontofluidpower,Advantages of fluidpower,Applicationof fluidpowersystem. Types offluidpowersystems,Properties ofhydraulic fluids–Generaltypesoffluids – Fluidpowersymbols.BasicsofHydraulics- ApplicationsofPascalsLaw-Laminar and Turbulent flow–Reynold'snumber–Darcy'sequation–Lossesinpipe,valvesand fittings.

UNITII HYDRAULIC SYSTEM&COMPONENTS (9)

SourcesofHydraulic Power:Pumpingtheory–Pumpclassification–Gear pump,Vane Pump,piston pump,construction andworkingofpumps –pumpperformance–Variable displacementpumps.Fluid PowerActuators:Linearhydraulicactuators–Types of hydrauliccylinders–Singleacting,Double acting specialcylindersliketanden,Rodless, Telescopic,Cushioningmechanism,Construction ofdoubleacting cylinder,Rotary actuators–Fluidmotors,Gear,VaneandPistonmotors.

UNITIII DESIGNOFHYDRAULIC CIRCUITS (9)

ConstructionofControlComponents:Directionalcontrolvalve–3/2wayvalve–4/2 wayvalve–Shuttlevalve–checkvalve– pressurecontrolvalve–pressurereducing valve,sequencevalve,Flowcontrolvalve–Fixedand adjustable,electricalcontrol solenoidvalves,Relays,ladderdiagram.Accumulators andIntensifiers:Types of accumulators–Accumulatorscircuits,sizingofaccumulators,intensifier–Applications ofIntensifier –Intensifier circuit.

UNITIV PNEUMATIC SYSTEMSAND COMPONENTS (9)

PneumaticComponents:Properties ofair–Compressors–Filter,Regulator,LubricatorUnit–Aircontrolvalves, Quick exhaustvalves,pneumatic actuators.Fluid PowerCircuit Design, Speed control circuits, synchronizing circuit, Penumo hydraulic circuit, Sequential circuitdesignfor simpleapplicationsusingcascademethod.

UNITV DESIGNOFFLUIDIC CIRCUITS WITH SENSORS (9)

Servosystems–HydroMechanicalservosystems,Electro hydraulicservosystemsand proportionalvalves.Fluidics–Introductionto fluidicdevices,simplecircuits,Introduction toElectroHydraulicPneumaticlogiccircuits,ladderdiagrams,PLCapplicationsin fluid powercontrol.Fluidpower circuits;failureandtroubleshooting.

TEXTBOOKS:

1. AnthonyEsposito,"FluidPower withApplications",PearsonEducation2005.
2. Majumdar S.R., "Oil Hydraulics Systems- Principles and Maintenance", TataMcGraw-Hill, 2001.

REFERENCES:

1. Srinivasan.R,"HydraulicandPneumaticcontrols",VijayNicole,2006.
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4. AnthonyLal,"Oil hydraulicsintheserviceofindustry", Alliedpublishers,1982.
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YPH305C Elective Course – IX RESEARCH METHODOLOGY 3 0 0 3

Course Objectives :

- The aim of this paper is to develop research skill in scholars and enable them to carry out research in the concerned branch of subject

Course Outcome:

- To give an advance exposure to the students about the research,
- To develop acquaintance with intensive techniques and skills of research process,
- To familiarize the art and style of writing a research report and
- To know the recent developments in research protection internationally.

UNIT I Introduction – Selection of Research Problem

Research: Objective, Motivation, innovation types, approaches and significance research methods versus methodology. Research process.

Defining research problem, necessity of defining the problem, selecting a problem, study on the societal benefits, social importance, impact on local and global issues.

UNIT II Literature Survey and Report writing

Methods of literature survey; library and Internet, search engines for literature survey, availability of literature and databases on the topic of research. Significance of report writing, steps in writing report, layout of research report, types of reports, oral presentation, mechanics of writing research report, precautions of writing research reports.

UNIT III – Data Analysis

Precision and accuracy – Determinate and random errors – Distribution of random errors – normal distribution curve – statistical treatment of finite samples-T – test and F-test-criteria for rejection of an observation – the Q-test – Significant figures and computation rules – Data plotting – least square analysis – significance of correlation coefficient.

UNIT IV – Computer Applications

Basics of internet services – various sources of abstracts, articles and papers – browsing and downloading – TOC Registration-online journals – e-books, courseware and technical reports – different file formats like DOC, PDS, PS, HTML – conversion of one file format to anther-use of MS Office suite- word, Excel, Power Point and Access for scientific and other applications –free and open source software (FOSS) and e-learning materials.

UNIT V – IPR and other issues

TRIPS-Indian WTO patent laws, patent cooperation treaty convention, patenting, patent and IPR related agencies in India and abroad. Format of (UGC, CSIR) research proposals funding agencies for research.

Reference:

1. C.R. Kothari, Research Methodology: Methods and Techniques, New Age, International Publisher (2005).
2. N. Gurumani, Research Methodology for Biological Science, MJP Publishers, Chennai (2006)
3. W.L. Cocharn, "Statistical Methods", Oxford and IBH Publication, New Delhi (1976)
4. K.V. Raman, Computer in Chemistry, Tata McGraw Hill, New Delhi (1993)
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