Academic Council Meeting No. and Date: 8/ September 04, 2023

Agenda Number: 02 Resolution Number: 34,35 /2.15, 2.36

Vidya Prasarak Mandal's

B. N. Bandodkar College of Science (Autonomous), Thane

Syllabus for

Programme: Master of Science

Specific Programme:

[M.Sc. Physics (Semester I and II)]

Level 6.0

CHOICE BASED GRADING SYSTEM

Revised under NEP and Autonomy

From academic year 2023-24

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B. N. Bandodkar College of Science, (AUTONOMOUS)-Thane

Master program in Physics

Year (2 Yrs)	LEVEL	SEMESTER	Major: Mandatory		Major: Electives anyone		Research Methodology	On Job Training / Field project	Research project	Cum Credits	Degrees
I	6.0	SEM-I	**3*4 + 2 = 14**		Credits 4						
			Course 1	Credits 4	Course 1= Credits 4		**Credits 4**	NA	NA	22	PG Diploma in Physics (After 3 Yrs. degree UG)
			Course 2	Credits 4	**OR**						
			Course 3	Credits 4	Course 2 = Credits 4						
			Course 4	Credits 2	**OR**						
		SEM-II	Course 1	Credits 4	Course 1 = Credits 4		NA	**Credits 4**	NA	**22**	
			Course 2	Credits 4	**OR**						
			Course 3	Credits 4	Course 2 = Credits 4						
			Course 4	Credits 2	**OR**						
Cum Cr.for 1 Yr. PG Diploma			**28**		8		4	4		44	
II	6.5	SEM- III	Course 1	Credits 4	Course 1	Credits 4	NA	NA	**Credits 4**	22	Master program in Physics (After 3 Yrs. degree UG)
			Course 2	Credits 4	**OR**						
			Course 3	Credits 4	Course 2	Credits 4					
			Course 4	Credits 2	**OR**						
		SEM IV	Course 1	Credits 4	Course 1	Credits 4	NA	NA	**Credits 6**	**22**	
			Course 2	Credits 4	**OR**						
			Course 3	Credits 4	Course 2	Credits 4					
					OR						
Cum Cr. for integrated 1 Yr. PG Degree				**26**	**8**				**10**	**44**	
Cum Cr. for 2 Yr. PG Degree				**44**	**16**		**4**	**4**	**10**	**88**	

Preamble

The systematic and planned curricula of the M.Sc. Physics degree is a unique and multidisciplinary program me that provides theoretical and applied knowledge in a range of subjects, including physics, electronics, optics, mathematics, classical and quantum.

The curriculum for the M. Sc. (Physics) program me is designed to cater to the requirement of Choice Based Credit System following the University Grants Commission (UGC)guidelines. In the proposed structure, due consideration is given to Elective Courses (Discipline specific - Physics.

Furthermore, continuous assessment is an integral part of the CBCS, which will facilitate systematic and thorough learning towards better understanding of the subject. The systematic and planned curricula divided into 0ne years (comprised of two semesters)

PROGRAMME SPECIFIC OUT COME(PSOs)

- Motivate for pursuing higher studies in Physics and inculcate enough skills for becoming an entrepreneur.
- Gain knowledge of the advanced concepts in the branch of Physics, in various subjects such as Mathematical methods, quantum mechanics, Classical mechanics, Advanced electronic sand Solid states physics.
- Apply the basic knowledge of chemistry to perform various tasks assigned to them at the workplace in industry and academia to meet the global standards.
- Prepare for a career in research and academia through dedicated sessions and training.

BOS Chairperson : Dr.Sangita S.Meshram

Sr. No	Heading	Particulars
1	Title of the Course	**M.Sc. Physics**
2	Eligibility for Admission	**B.Sc. Physics** or equivalent qualification from other universities as may have been allowed by the relevant ordinances of this university
3	Passing Marks	40%
4	No. of Years / Semesters	Two
5	Level	PG
6	Level	PG
7	Pattern	Semester
8	i) Cum Cr. for integrated 1 Yr. PG Degree ii) PG Diploma in Physics (After 3 Yrs. degree UG) and Cum Cr. for 2 Yr. PG Degree iii) Master program in Physics (After 3 Yrs. degree UG)	

			Major		RM	OJT/FP	RP	Cum. Cr.	Degree
			Mandatory	Electives					PG Diploma (after3 Years Degree)
Year	**Level**	**Sem**	4	**4**	**4**			22	
		I	Mathematical Methods	**Credits4(2+2)**					
			Classical Mechanics	Electronic Structures of Solids **OR**					
			Quantum Mechanics-I	Solid State Physics					
			Physics Practical-I	Practical's					
			3*4+2=14	**4**					
		II	Advanced Electronics	**Credits 4 (2+2)**		**4**		**22**	
			Electrodynamics	Applied Thermodynamics **OR**					
			Quantum Mechanics-II	Solid State Devices					
			Physics Practical-II	Practical's					
Cum. Cr. For PG Diploma			**28**	**8**	**4**	**4**		**44**	

YEAR		COURSE CODE	COURSE TITLE	CREDITS
M.Sc. Sem-I	Mandatory Course-I	23BPPH1T1	Mathematical Methods	04
	Mandatory Course-II	23BPPH1T2	Classical Mechanics	04
	Mandatory Course-III	23BPPH1T3	Quantum Mechanics-I	04
	Mandatory Course Practical	23BPPH1P1	LAB-I	02
	Elective 1	23BPPH1T4	Electronic Structures of Solids	02
		23BPPH1P2	LAB-EI -1	02
	OR			
	Elective 2	23BPPH1T5	Solid State Physics	02
		23BPPH1P3	LAB-EI -2	02
	RM	23BPRM1T1	Research Methodology	04
			Total	**22**
M.Sc. Sem-II	Mandatory Course-I	23BPPH2T1	Advanced Electronics	04
	Mandatory Course-II	23BPPH2T2	Electrodynamics	04
	Mandatory Course-III	23BPPH2T3	Quantum Mechanics-II	04
	Mandatory Course Practical	23BPPH2P1	LAB-II	02
	Elective 1	23BPPH2T4	Applied Thermodynamics	02
		23BPPH2P2	LAB-EI -1	02
	OR			
	Elective 2	23BPPH2T5	Solid State Devices	02
		23BPPH2P3	LAB-EI -2	02
	OJT/FP	23BPPH2P4	Industrial Training/Field Project	04
			Total	**22**

Semester – I

Course: Paper-I	Course Code: 23BPPH1T1	Course Title: Mathematical Methods	Credit = 4	No. of Lecture in hrs. 60

Teaching Scheme		Evaluation Scheme			
Lectures (Hours per week)	Practical (Hours per week)	Tutorial (Hours per week)	Credit	Continuous Assessment (CA) Internal (Marks-40)	Semester End Examination (Marks-60)
04	NA	–	04	40	60

Learning Objectives

- To develop the ability to correlate fundamental theories of mathematics and Physics in order to enhance competency while applying for practical purpose.
- To gain theoretical knowledge of Harmonic functions, Tensor and use of Laplace's transform in solving differential equations.

Course Outcomes

- The learner will know the important fundamental concept of second order linear differential equations which helps the misunderstanding the reapplication in physics problem
- The learners will get comprehensive idea about Laplace transforms, its derivatives, Inverse Laplace transform and use of Laplace's transform in solving differential equations.

UNIT I	Complex Variables, Limits, Continuity, Derivatives, Cauchy-Riemann Equations, Analytic functions, Harmonic functions, Elementary functions: Exponential and Trigonometric, Taylor and Laurent series, Residues, Residue theorem, Principal part of the functions, Residues at poles, zeroes and poles of order m, Contour Integrals, Evaluation of improper real integrals, improper integral involving Sines and Cosines, Definite integral sin involving sine and cosine functions.	**15**
UNIT II	Matrices, Eigenvalues and Eigenvectors, orthogonal, unitary and Hermitian matrices, Diagonalization of Matrices, Applications to Physics problems. Introduction to Tensor Analysis, Addition and Subtraction of Tensors, summation convention, Contraction, Direct Product, Levi-Civita Symbol	**15**
UNIT III	General treatment of second order linear differential equations with non- constant coefficients, Power series solutions, Frobenius method, Legendre, Hermite and Laguerre polynomials, Bessel equations, Nonhomogeneous equation – Green's function, Sturm-Liouville theory.	**15**
UNIT IV	Integral transforms: three dimensional Fourier transforms and its applications to PDEs (Green function of Poisson's PDE), convolution theorem, Parseval's relation, Laplace trans forms, Laplace transform of derivatives, Inverse Laplace transform and Convolution theorem, use of Laplace's transform in solving differential equations.	**15**

Main Reference :

1. S.D. Joglekar, Mathematical Physics: The Basics, UniversitiesPress2005
2. S.D. Joglekar, Mathematical Physics: Advanced Topics, CRCPress2007
3. M.L. Boas, Mathematical methods in the Physical Sciences, WileyIndia2006
4. G.Arfken and H.J.Weber: Mathematical Methods for Physicists, Academic Press 2005

Additional references:

1. A.K.Ghatak, I.C.Goyaland S.J.Chua, Mathematical Physics, McMillan
2. A.C.Bajpai, L.R.Mustoe and D.Walker, Advanced Engineering Mathematics, John Wiley
3. E. Butkov, Mathematical Methods, Addison-Wesley
4. J. Mathews and R.L.Walker, Mathematical Methods of physics
5. P.Dennery and A.Krzywicki, Mathematics for physicists
6. T. Das and S.K.Sharma, Mathematical methods in Classical and Quantum Mechanics
7. R.V.Churchill and J W. Brown ,Complex variables and applications, VEd. McGraw. Hill
8. A.W.Joshi,Matrices and Tensors in Physics,Wiley India

Course: Paper-II	**Course Code: 23BPPH1T2**	**Course Title: Classical Mechanics**		**Credit = 4**	**No. of Lecture in hrs. 60**
Teaching Scheme		Evaluation Scheme			
Lectures (Hours per week)	Practical (Hours per week)	Tutorial (Hours per week)	Credit	Continuous Assessment (CA) Internal (Marks-40)	Semester End Examination (Marks- 60)
04	NA	–	04	40	60

Learning Objectives

- To enable learners to have comprehensive knowledge and understanding of the advanced concept sin Mechanics of a system of particles, Hamilton's principle, The Kepler's problem and Canonical Transformations.
- To apply the basic knowledge of Classical mechanics to perform various tasks assigned to them and accomplish a solution to problems encountered in the field of research.

Course Outcomes

- The fundamental concept in D'Alembert's principle and Lagrange's equations, Hamilton's principle
- Acquire the knowledge of The Two-Body Central Force Problem**:** Reduction to the equivalent one body
- Understand the concept of Small Oscillations and Poisson brackets

UNIT I	Mechanics of a particle, Mechanics of a system of particles, Frames of references, rotating frames, Centrifugal and Coriolis force, Constraints, D'Alembert's principle and Lagrange's equations, Velocity-dependent potentials and the dissipation function, Simple applications of the Lagrange formulation. Hamilton's principle, Calculus of variations, Derivation of Lagrange's equations from Hamilton's principle, Lagrange Multipliers and constrain text ruminations problems, Extension of Hamilton's principle to nonholonomic systems, Advantages of a variational principal formulation.	**15**
UNIT II	Conservation theorems and symmetry properties, Energy Function and he conservation of energy. The Two-Body Central Force Problem**:** Reduction to the equivalent one body problem, The equations of motion and first integrals, The equivalent one-dimensional problem and classification of orbits, The virial theorem, The differential equation for the orbit and integrable power-law potentials, The Kepler problem: Inverse square law of force, The motion in time in the Kepler problem, Scattering in a central force field, Transformation of the scattering problem to laboratory coordinates.	**15**
UNIT III	Small Oscillations: Formulation of the problem, the eigenvalue equation and the principal axis transformation, Frequencies of free vibration and normal coordinates, Forced and damped oscillations, Resonance and beats. Legendre transformations and the Hamilton equations of motion, Cyclic coordinates and conservation theorems, Derivation of Hamilton's equations from a variational principle.	**15**
UNIT IV	Canonical Transformations, Examples of canonical transformations, The simplistic approach to canonical transformations, Poisson brackets and other canonical invariants, Equations of motion, infinitesimal canonical transformations and conservation theorems in the Poisson bracket formulation, The angular momentum Poisson bracket relations.	**15**

Main Reference:

Classical Mechanics, H. Goldstein, PooleandSafko,3rd Edition, Narosa Publication (2001)

Additional references:

1. Classical Mechanics, N.C. Rana and P.S. Joag. Tata McGraw Hill Publication.
2. Classical Mechanics, S.N. Biswas, Allied Publishers (Calcutta)
3. Classical Mechanics, V. B. Bhatia, Nervosa Publishing (1997).
4. Mechanics, Landau and Lifshitz, Butterworth, Heinemann.
5. The Action Principle in Physics, R.V. Kamat, New Age Intel. (1995).
6. Classical Mechanics, VolI and II, E.A.Decalogue, John Wiley (1982).
7. Theory and Problems of Lagrange Dynamics, Schaum Series, McGraw (1967).
8. Classical Mechanics of Particles and Rigid Bodies, K.C. Gupta, Wiley Eastern (2001)

<table>
<tr><th>Course:
Paper-III</th><th>Course Code:
23BPPH1T3</th><th colspan="3">Course Title:
Quantum Mechanics - I</th><th colspan="2">Credit = 4</th><th>No. of Lecture in hrs. 60</th></tr>
<tr><td colspan="2">Teaching Scheme</td><td colspan="6">Evaluation Scheme</td></tr>
<tr><td>Lectures
(Hours per week)</td><td>Practical
(Hours per week)</td><td>Tutorial (Hours per week)</td><td>Credit</td><td colspan="2">Continuous Assessment (CA) Internal (Marks-40)</td><td colspan="2">Semester End Examination (Marks-60)</td></tr>
<tr><td>04</td><td>NA</td><td>–</td><td>04</td><td colspan="2">40</td><td colspan="2">60</td></tr>
<tr><td colspan="8">Learning Objectives</td></tr>
<tr><td colspan="8">• To enable learners to have comprehensive knowledge, understanding Postulates of Quantum mechanics, Gaussian Wave packet and free particle wave function
• To provide solutions to problems encountered in the field of analysis and research</td></tr>
<tr><td colspan="8">Course Outcomes</td></tr>
<tr><td colspan="8">• Understand various terms, functions and Principle used in quantum mechanics.
• Explore the applications of Schrodinger equation in Quantum mechanics.
• Understand the efficacy Schrodinger equation in one-dimensional barrier problems.</td></tr>
<tr><td>UNIT I</td><td colspan="6">Review of concepts:

Postulates of quantum mechanics, observables and operators, measurements, state function and expectation values, the time-dependent Schrodinger equation, time development of state functions, solution to the initial value problem. The Superposition principle, commutator relations, their connection to the uncertainty principle, complete set of commuting observables. Time development of expectation values, conservation theorems and parity.

Formalism:

Linear Vector Spaces and operators, Dirac notation, Hilbert space, Hermitian operator sand their properties, Matrix mechanics: Basis and representations, unitary transformations, the energy representation.

Schrodinger, Heisenberg and interaction picture.</td><td>15</td></tr>
<tr><td>UNIT II</td><td colspan="6">Wave packet: Gaussian wave packet, Fourier transform. Schrodinger equation solutions: one dimensional problem:

General properties of one-dimensional Schrodinger equation, Particle in a box, Harmonic oscillator by raising and lowering operators and Frobenius method, unbound states, one dimensional barrier problems, finite potential well</td><td>15</td></tr>
</table>

UNIT III	Schrodinger equation solutions: Three dimensional problems: Orbital angular momentum operators in cartesian and spherical polar coordinates, commutation and uncertainty relations, spherical harmonics, two particle problem- coordinates relative to center of mass, radial equation for a spherically symmetric central potential, hydrogen atom, eigenvalues and radial eigenfunctions, degeneracy, probability distribution.	**15**
UNIT IV	**Angular momentum** Ladder operators, eigenvalues and eigenfunctions of L^2 and L using spherical harmonics, angular momentum and rotations. Total angular momentum J; LS coupling; eigenvalues of J^2andJz. Addition of angular momentum, coupled and uncoupled representation of eigenfunctions, Clebsch Gordan coefficient for$j_1 = j_2 = ½$ and $j_1=1$ and $j_2= ½$. Angular momentum matrices, Pauli spin matrices, spin eigen functions, free particle wave function including spin, addition of two spins.	**15**

Main Reference:

1. Richard Liboff, Introductory Quantum Mechanics,4thedition, Pearson.
2. D J Griffiths, Introduction to Quantum Mechanics4thedition
3. A Ghatak and S Lokanathan, Quantum Mechanics: Theory and Applications,5thedition.
4. N Zettili, Quantum Mechanics: Concepts and Applications, 2ndedition, Wiley.

Additional references:

1. W Greiner, Quantum Mechanics: An introduction, Springer,2004
2. R Shankar, Principles of Quantum Mechanics, Springer,1994
3. P. M. Mathews and K. Venkatesan, A Textbook of Quantum Mechanics, Tata McGraw Hill (1977).
4. J. J. Sakurai Modern Quantum Mechanics, Addison – Wesley (1994).

Course: Paper-IV	Course Code: 23BPPH1T4	Course Title: Electronic structure of solids			Credit = 2	No. of Lecture in hrs. 30
Teaching Scheme		Evaluation Scheme				
Lectures (Hours per week)	Practical (Hours per week)	Tutorial (Hours per week)	Credit	Continuous Assessment (CA) Internal (Marks-20)	Semester End Examination (Marks-30)	
02	02	–	04	20	30	

Learning Objectives

- To enable learners to have comprehensive knowledge and understanding of electronic structure of solids.
- To gain theoretical knowledge of electronic band structure methods which has Cellular method; Augmented plane-wave (APW) method; Green's function (KKR) method and Orthogonalized plane wave (OPW) method

Course Outcomes

- Understand Prototype Electronic Structure and Somerfield theory of metals.
- Explore the various methods in the band structure calculations.

UNIT I	Prototype Electronic Structure, Free electron gas in Infinite Square well potential–Sommerfeld theory of metals. Electron energy levels in a periodic potential. Nearly-free electron approximation, The tight-binding method.	**15**
UNIT II	Electronic Band Structure Methods Cellular method; Augmented plane-wave (APW) method; Green's function (KKR) method; Orthogonalized plane wave (OPW) method; Pseudopotentials. Band structure / Fermi surface of selected metals – alkali and noble metals, simple multivalent metals, transition metals, rare- earths, semi-metals, semiconductors Siand Ge. Fermi surface probes: Electrons in a magnetic field - the de Haas-van Alfen effect. Magneto- acoustic effect, cyclotron resonance.	**15**

Main References: -

- H Ibach and H Luth, Solid State Physics, 3rd ed.; Springer, 2003. Chpts. 6,7,9.
- Neil W Ashcroft and N David Mermin, Solid State Physics. Holt, Rinehart and Winston, 1976.Chapters2, 8-17.
- Michael P Marder, Condensed Matter Physics, 2nd ed.; John Wiley and Sons, 2010.

Additional References:

- Brian Tanner, Introduction to the Physics of Electrons in Solids, CUP, 1995.
- MA Wahab, Solid State Physics, Narosa,2005
- G Grosso and G Paravicini, Solid State Physics, Academic Press, 2000.

Course: Paper-IV	Course Code: 23BPPH1T5	Course Title: Solid State Physics		Credit = 2		No. of Lecture in hrs. 30
Teaching Scheme		Evaluation Scheme				
Lectures (Hours per week)	Practical (Hours per week)	Tutorial (Hours per week)	Credit	Continuous Assessment (CA) Internal (Marks-20)	Semester End Examination (Marks-30)	
02	02	–	04	20	30	

Learning Objectives

- To enable learners to have comprehensive knowledge and understanding of solid state Physics.
- To gain theoretical knowledge of Laue Method, Rotating Crystal Method, Powder Method.

Course Outcomes

- Understand Diffraction of Waves by Crystals, Reciprocal Lattice and Interference of Waves.
- Explore the various experimental techniques to determine the value of lattice parameters.

UNIT I	**Diffraction of Waves by Crystals and Reciprocal Lattice** Bragg law, Scattered Wave Amplitude–Fourier analysis, Reciprocal Lattice Vectors, Diffraction Conditions, Brillouin Zones, Reciprocal Lattice to SC, BCC and FCC lattice. Interference of Waves, Atomic Form Factor, Elastic Scattering by crystal, Ewald Construction, Structure Factor, Temperature Dependence of the Reflection Lines, Experimental Techniques (Laue Method, Rotating Crystal Method, Powder Method) Scattering from Surfaces, Elastic Scattering by amorphous solids.	**15**
UNIT II	Lattice Vibrations and thermal properties Vibrations of Monoatomic Lattice, normal mode frequencies, dispersion relation. Lattice with two atoms per unit cell, normal mode frequencies, dispersion relation., Quantization of lattice vibrations, phonon momentum, Inelastic scattering of neutrons by phonons, Surface vibrations, Inelastic Neutron scattering. Anharmonic Crystal Interaction. Thermal conductivity – Lattice Thermal Resistivity, Umklapp Process, Imperfections	**15**

Main References: -

- Charles Kittel “Introduction to Solid State Physics”, 7th edition John Wiley & sons.
- J. Richard Christman “Fundamentals of Solid- State Physics” John Wiley & sons
- M.A. Wahab “Solid State Physics –Structure and properties of Materials” Narosa Publications1999.
- M. Ali Omar “Elementary Solid-State Physics” Addison Wesley (LPE)
- H. Ibach and H. Luth 3rd edition “Solid State Physics – An Introduction to Principles of Materials Science” Springer International Edition (2004)

Course:	Course Code: 23BPPH1P1	Course Title: Practical Lab - 1		Credit = 2		No. of practical Hrs. in 60
Teaching Scheme		Evaluation Scheme				
Lectures (Hours per week)	Practical (Hours per week)	Tutorial (Hours per week)	Credit	Continuous Assessment (CA) Internal (Marks-40)	Semester End Examination (Marks-50)	
-	4	–	02	-	50	

Learning Objectives

- To develop scientific temper and research-based skills accomplish to encounter in the field of research.
- To usage of subject fundamentals-principles with practical knowledge to design experiments, analyze and interpret data so as to reach to proper conclusions.
- Learner will train the handling of the equipment's like Michaelson's interferometer, four-point probe and Hall effect.

	Surface Tension by Quince's method
	Measurement of Torsional constant using oscillator
	Delayed linear weepusingIC555
	Regulator positive power supply using IC LM317-
	Regulator Negative power supply using IC LM 337
	Dual power supply using ICLM317 and LM 337
	Constant current supply using IC741and LM317
	Active filter second order - High Pass
	Active filter second order - Low Pass
	Active filter second order - Band Pass
	Active filter second order - Band Reject
	Waveform generator using ICS
	Instrumentation amplifier

<table>
<tr><th>Course:</th><th>Course Code: 23BPPH1P2 / 23BPPH1P3</th><th colspan="2">Course Title: Practical Lab – EI -1 / EI - 2</th><th>Credit = 2</th><th>No. of practical Hrs. in 60</th></tr>
<tr><td colspan="2">Teaching Scheme</td><td colspan="4">Evaluation Scheme</td></tr>
<tr><td>Lectures
(Hours per week)</td><td>Practical
(Hours per week)</td><td>Tutorial (Hours per week)</td><td>Credit</td><td>Continuous Assessment (CA) Internal (Marks-40)</td><td>Semester End Examination (Marks-50)</td></tr>
<tr><td>-</td><td>4</td><td>–</td><td>02</td><td>-</td><td>50</td></tr>
<tr><td rowspan="8">Lab – EI -1
23BPPH1P2</td><td colspan="5">Diffraction at Cylindrical object</td></tr>
<tr><td colspan="5">Wavelength of monochromatic light by diffraction at straight edge.</td></tr>
<tr><td colspan="5">Michaelson's interferometer (Na Light)</td></tr>
<tr><td colspan="5">Michaelson's interferometer (He-Ne laser)</td></tr>
<tr><td colspan="5">Analysis of sodium spectrum</td></tr>
<tr><td colspan="5">Determination/e using vacuum photo cell</td></tr>
<tr><td colspan="5">Diac-Triac phase control</td></tr>
<tr><td colspan="5">ON/OFF temperature controller using ICS</td></tr>
<tr><td colspan="6">OR</td></tr>
<tr><td rowspan="7">Lab – EI -2
23BPPH1P3</td><td colspan="5">Resistivity of a semiconductor or by four-point probe method.</td></tr>
<tr><td colspan="5">Temperature dependence of Zener/Avalanche breakdown diodes.</td></tr>
<tr><td colspan="5">DC hall effect</td></tr>
<tr><td colspan="5">Divergence and diffraction of helium neon/solid state laser beam.</td></tr>
<tr><td colspan="5">Carrire life-time</td></tr>
<tr><td colspan="5">Study of 8 Bit DAC</td></tr>
<tr><td colspan="5">16 channel digital multiplexer</td></tr>
</table>

References :

- Advanced Practical Physics-Worsnop and Flint
- Atomic spectra-H.E. White
- Experiments in modern physics– ellissinos
- A course of experiments with Laser- Sirohi
- Elementary experiments with Laser- G.White
- HBCSE Selection camp 2007Manual
- Solid state devices-W.D.Cooper
- Electronic text lab manual-P.B.Zbar
- Electronic Principles-A.P.Malvino
- Opeational amplifiers and linear Integrated circuits-Coughlin & Driscoll
- Practical analysis of electronic circuits through experimentation-L.MacDonald
- Integrated Circuits- K.R.Botkar
- Op-amps and linear integrated circuit technology- R.Gayakwad
- Digital Electronics –RogerT okheim
- Digital theory and experimentation using integrated circuits – Morris E. Levine (Prentice Hall)
- Practical analysis of electronic circuits through experimentation-Lome Macronaid (Technical Education Press)
- Logic design projects using standard integrated circuits - John F. Waker (John Wiley & sons)
- Practical applications circuits handbook – Anne Fischer Lent & Stan Miastkowski (Academic Press)
- Digital logic design, a stext lab manual- Anala Pandit (Nandu printers and publishers Pvt.Ltd.)

Course: Paper-I	**Course Code: 23BPRM1T1**	**Course Title: Research Methodology**		**Credit = 4**	**No. of practical Hrs in 60**
Teaching Scheme		Evaluation Scheme			
Lectures (Hours per week)	Practical (Hours per week)	Tutorial (Hours per week)	Credit	Continuous Assessment (CA) Internal (Marks-40)	Semester End Examination (Marks- 60)
04	-	–	04	40	60

Learning Objectives

- To create awareness and understanding the terms like intellectual property, patents, copyrighted.
- To know trade secrets, IP infringement issues, economic value of intellectual property and study of various related international agreements.
- To apply the knowledge gained about various principles, techniques and tools in problem and target identification and validation, lead finding and optimization.

Course Outcomes

- To enable the student to be able to extract information from journals and digital resources.
- Understanding tools to analyses the data, writing and presenting scientific papers.
- Describe research, identification of research problems, and preparation of proposals.
- Practice ethics in all the domains of research.
- Analyze the results using mathematical and statistical tools.

UNIT I	**Unit1: Research resources** Print:[5L] Primary, Secondary and Tertiary sources. Journals: Journal abbreviations, abstracts, current titles, reviews, monographs, dictionaries, text-books,current contents, Introduction to Physical Abstracts and Beilstein, Subject Index, Substance Index, Author Index, Formula Index, and other Indices with examples. Digital: [5L] Web sources, E-journals, Journal access, TOC alerts, Hot articles, Citation Index, Impact factor, H-index, E-consortium, UGC infonet, E-books, Internet discussion groups and communities, Blogs, preprint servers, Search engines, Sciurus, Google Scholar, , Wiki-databases,, Science Direct, SciFinder, Scopus. Information Technology and Library Resources:[5L] The Internet and World wide web, Internet resources for Physics, finding and citing published information.	**15**
UNIT II	**Unit II: DATA ANALYSIS** **[15L]** The Investigative Approach: Making and recording Measurements, SI units and their use, Scientific methods and design of experiments. Analysis and Presentation of Data: Descriptive statistics, choosing and using statistical tests, Chemometrics, Analysis of Variance (ANOVA), Correlation and regression, curve fitting, fitting of linear equations, simple linear cases, weighted linear case, analysis of residuals, general polynomial fitting, linearizing transformations, exponential function fit, r and its abuse, basic aspects of multiple linear regression analysis.	**15**
UNIT III	Methods of scientific research and writing Scientific papers Reporting practical and project work, writing literature surveys and reviews, organizing a poster display, giving an oral presentation. Writing Scientific Papers: Justification for scientific contributions, bibliography, description of methods, conclusions, the need for illustration, style, publications of scientific work, writing ethics, avoiding plagiarism.	**15**
UNIT IV	Safety and hazards Safe working procedure and protective environment, protective apparel, emergency procedure, first aid, laboratory ventilation, Introduction to Risk and Risk Management, Legal Implications of Safety , Physical Hazards, Mechanical Hazards, Electrical Hazards, Radiation Hazards, Chemical Hazards, Pressure Hazards, Thermal Hazards, Noise Hazards, Additional Safety Issues, Emergency Procedures.	**15**

Semester – II

Course: Paper-I	**Course Code: 23BPPH2T1**	**Course Title: Advanced Electronics**			**Credit = 4**	**No. of Lectures in Hrs 60**
Teaching Scheme		Evaluation Scheme				
Lectures (Hours per week)	Practical (Hours per week)	Tutorial (Hours per week)	Credit	Continuous Assessment (CA) Internal (Marks-40)	Semester End Examination (Marks-60)	
04	NA	–	04	40	60	

Learning Objectives

- The course aims at the detailed mechanistic study of Instrumentation Circuits and Designs.
- The course aims at the detailed interception of Microprocessors and Microcontrollers
- The course also aims detailed understanding of Data Transmission Systems.

Course Outcomes

- The learners will be able to learn Programming and Applications with the 8085.
- The learners will be able to acquire information about 8051Microcontrollers and its instruction sets.
- The learners will be able to understand Analog and Digital Transmissions and fiber optic communication system.

UNIT I	**Microprocessors and Microcontrollers:** **Microprocessors**: Counters and Time Delays, Stack and Sub-routines RSG: Microprocessor Architecture, Programming and Applications with the 8085 : R.S.Gaonkar,5thEdition,Penram International **Introduction to Microcontrollers:** Introduction, Microcontrollers and Microprocessors, History of Microcontrollers and Microprocessors, Embedded versus External Memory Devices, 8–bit and 16–bit Microcontrollers, CISC and RISC Processors, Harvard and Von Neumann Architectures, Commercial Microcontroller Devices. AVD: Ch.1 **8051 Microcontrollers**: Introduction, MCS–51 Architecture, Registers in MCS-51, 8051 Pin Description, Connections,8051 Parallel I/O Ports and Memory Organization. AVD: Ch. 2, 3 **8051 Instruction set and Programming**: MCS-51AddressingModesand Instruction set. 8051 Instructions and Simple programs using Stack Pointer. AVD: Ch.4 Reference: AVD: Microcontrollers(Theory and Applications) by Ajay V. Deshmukh, TMH	**15**

UNIT II	**Analog and Data Acquisition Systems:** **Power Supplies**: Linear Power supply, Switch Mode Power supply, Uninterrupted Power Supply, Step up and Step down Switching Voltage Regulators. **Inverters:** Principle of voltage driven inversion, Principle of current driven inversion, sine wave inverter, square wave inverter. **Signal Conditioning:** Operational Amplifier, Instrumentation Amplifier using IC, Precision Rectifier, Voltage to Current Converter, Current to Voltage Converter, Op-Amp Based Butterworth Higher Order Active Filters and Multiple Feedback Filters, Voltage Controlled Oscillator, Analog Multiplexer, Sample and Hold circuits, Analog to Digital Converters, Digital to Analog Converters.	**15**
UNIT III	**Data Transmissions, Instrumentations Circuits & Designs:** 1.**Data Transmission Systems:** Analog and Digital Transmissions, Pulse Amplitude Modulation, Pulse Width Modulation, Time Division Multiplexing, Pulse Modulation, Digital Modulation, Pulse Code Format, Modems. **Optical Fiber:** Introduction to optical fibers, wave propagation and total internal reflection in optical fiber, structure of optical fiber, Types of optical fiber, numerical aperture, acceptance angle, single and multimode optical fibers, optical fiber materials and fabrication, attenuation, dispersion, splicing and fiber connectors, fiber optic communication system, fiber sensor, optical sources and optical detectors for optical fiber.	**15**
UNIT IV	**Instrumentation Circuits and Designs:** Microprocessors/ Microcontrollers based D C motor speed controller. Microprocessors /Microcontrollers based temperature controller. Electronic weighing single pan balance using strain gauge/ load cell. Opticalanalogcommunicationsystemusingfiberlink.Electronicintensity meter using optical sensor. IR remote controlled ON/OFF switch.	**15**

Main Reference :

1. Microprocessor Architecture, Programming and Applications with the 8085 R. S. Gaonkar, 4th Edition. Penram International.
2. The8051Microcontroller and Embedded Systems, Dr. Rajiv Kapadia, Jaico Publishing House.
3. The 8051 Microcontroller & Embedded Systems by M. A. Mazidi, J.G. Mazidi and R. D. Mckinlay
4. The 8051 Microcontroller : K. J. Ayala : Penram International Programming & customizing the 8051 Mocrocontroller: Myke Predko, TMH
5. Power Electronics and its applications,Alok Jain,2nd Edition, Penram International India.
6. Op-Amps and Linear Integrated Circuits - R. A. Gayakwad , 3rd Edition Prentice Hall India.
7. Operational Amplifiers and Linear Integrated Circuits, Robert F. Coughlin and Frederic F. Driscoll, 6th Edition, Pearson Education Asia.
8. Optical Fiber Communications, Keiser,G.Mcgraw Hill, Int. Student Ed.
9. Electronic Communication Systems; 4th. Ed. Kennedy and Davis, (Tata- McGraw. Hill, 2004.
10. Electronic Instrumentation, H.S.Kalsi,Tata-McGraw.Hill,1999

Course: Paper-II	**Course Code: 23BPPH2T2**	**Course Title: Electrodynamics**	**Credit = 4**	**No. of lecture Hrs in 60**

Teaching Scheme		Evaluation Scheme			
Lectures (Hours per week)	Practical (Hours per week)	Tutorial (Hours per week)	Credit	Continuous Assessment (CA) Internal (Marks-40)	Semester End Examination (Marks- 60)
04	NA	–	04	40	60

Learning Objectives

- To enable learners to have comprehensive knowledge and understanding of the advanced concept sin
- Maxwell's equations, Lorentz Transformations, Electromagnetic waves and Lagrangian formalism
- To apply the basic knowledge of Electrodynamics to perform various tasks assigned to them at the workplace in industry and academia to meet the job requirements as per global standards.

Course Outcomes

- The fundamental concept in D'Alembert's principle and Lagrange's equations, Hamilton's principle
- Understand and write the mechanism of Electromagnetic waves and Lagrangian formalism
- The learners will be able to understand radiation, Electric and Magnetic dipole radiation.

UNIT I	Maxwell's equations, The Pointing vector, The Maxwellian stress tensor, Lorentz Transformations, Four Vectors and Four Tensors, The field equations and the field tensor, Maxwell equations in covariant notation	**15**
UNIT II	Electromagnetic waves in vacuum, Polarization of plane waves. Electromagnetic waves in matter, frequency dependence of conductivity, frequency dependence of polarizability, frequency dependence of refractive index. Wave guides, boundary conditions, classification of fields in wave guides, phase velocity and group velocity, resonant cavities	**15**
UNIT III	Moving charges in vacuum, gauge transformation, The time dependent Green function, The Lienard- Wiechert potentials, Leinard- Wiechert fields, application to fields-radiation from a charged particle, Antennas, Radiation by multipole moments, Electric dipole radiation, Complete fields of a time dependent electric dipole, Magnetic dipole radiation	**15**
UNIT IV	Relativistic covariant Lagrangian formalism: Covariant Lagrangian formalism for relativistic point charges. The energy-momentum tensor, Conservation laws.	**15**

Main Reference:
1. W.Greiner, Classical Electrodynamics(Springer-Verlag,2000) (WG).
2. M.A. Heald and J.B. Marion, Classical Electromagnetic Radiation, 3rd edition (Saunders, 1983) (HM)

Additional references:
1. J.D.Jackson,ClassicalElectrodynamics,4Thedition,(John Wiley & sons) 2005 (JDJ)
2. W. K. H. Pan of sky and M. Phillips, Classical Electricity and Magnetis m,2nd edition, (Addison - Wesley) 1962.
3. D.J. Griffiths, Introduction to Electrodynamics,2nd Ed., Prentice Hall, India,1989
4. J. R. Reitz, E. J. Milford and R. W. Christy, Foundation of Electromagnetic Theory, 4th ed., Addison -Wesley, 1993

Course: Paper-III	**Course Code: 23BPPH2T3**	**Course Title: Quantum Mechanics - II**		**Credit = 4**		**No. of lecture Hrs in 60**
Teaching Scheme		Evaluation Scheme				
Lectures (Hours per week)	Practical (Hours per week)	Tutorial (Hours per week)	Credit	Continuous Assessment (CA) Internal (Marks-40)	Semester End Examination (Marks-60)	
04	NA	–	04	40	60	

Learning Objectives

- To gain knowledge of the Time independent and dependent perturbation theory
- To Understand Fermi's Golden Rule, sudden and adiabatic approximations and applications'
- To study Approximation Methods Variation Method: WKB approximation in Quantum Mechanics
- .

Course Outcomes

- Understand various terms, functions and Principle used in quantum mechanics.
- The learners will be able to learn the Dirac equation for identical particles and its application for the description of characteristics of particles.
- Understand and write the mechanism of quantum theory of scattering cross section
- The learners will be able to understand Approximation Methods and can predict about the structure of atoms or molecules.

UNIT I	Perturbation Theory: Time independent perturbation theory: First order and second order corrections to the energy eigenvalues and eigenfunctions. Degenerate perturbation Theory: first order correction to energy. Time dependent perturbation theory: Harmonic perturbation, Fermi's Golden Rule, sudden and adiabatic approximations, applications	**15**

UNIT II	Approximation Methods 1. Variation Method: Basic principle, applications to simple potential problems, He- atom. 2. WKB Approximation: WKB approximation, turning points, connection formulas, Quantization conditions, applications.	**15**
UNIT III	Scattering Theory Laboratory and center of mass frames, differential and total scattering cross-sections, scattering amplitude, Partial wave analysis and phase shifts, optical theorems S-wave scattering from finite spherical attractive and repulsive potential wells, Born approximation	**15**
UNIT IV	Identical Particles: Symmetric and antisymmetric wave functions, Bosons and Fermions, Pauli Exclusion Principle, slater determinant. Relativistic Quantum Mechanics The Klein Gordon and Dirac equations. Dirac matrices, spinors, positive and negative energy solutions physical interpretation. Nonrelativistic limit of the Dirac equation.	**15**

Main Reference:

1. Richard Liboff, Introductory Quantum Mechanics,4thedition, Pearson.
2. DJ Griffiths, Introduction to Quantum Mechanics 4thedition
3. A Ghatak and S Lokanathan, Quantum Mechanics: Theory and Applications, 5th edition.
4. N Zettili, Quantum Mechanics: Concepts and Applications, 2nd edition, Wiley.
5. J.Bjorken and S.Drell, Relativistic Quantum Mechanics, McGraw-Hill (1965).

Additional references:

1. W Greiner, Quantum Mechanics: An introductions pringer, 2004
2. R Shankar, Principles of Quantum Mechanics, Springer,1994
3. P.M. Mathews and K.Venkatesan, A Textbook of Quantum Mechanics, Tata McGraw Hill (1977).
4. J.J.Sakurai Modern Quantum Mechanics, Addison-Wessley (1994).

Course: Paper-IV	Course Code: 23BPPH2T4	Course Title: Applied Thermodynamics	Credit = 2	No. of lecture Hrs in 30

Teaching Scheme		Evaluation Scheme			
Lectures (Hours per week)	Practical (Hours per week)	Tutorial (Hours per week)	Credit	Continuous Assessment (CA) Internal (Marks-20)	Semester End Examination (Marks-30)
02	02	–	04	20	30

Learning Objectives

- To gain knowledge of the Thermodynamic properties of pure substances and Joule-Thomson effect
- To understand the Equilibrium Concept in Thermodynamics
- To develop the skill to solve the problems encountered in the field of thermal an Thermodynamics.

Course Outcomes

- Understand Prototype Electronic Structure and Somerfield theory of metals.
- To learn the concept of Thermodynamic cycles.
- To understand the evolution of phase diagrams, metastable phase diagrams, calculation of phase diagrams.
- To apply the concept of Otto cycle, Diesel cycle in Automobiles

UNIT I	Properties of Pure Substances: Thermodynamic properties of pure substances in solid, liquid and vapor phases, P-V-T behavior of simple compressible substances, phase rule, thermodynamic property tables and charts, ideal and real gases, equations of state, compressibility chart. Thermodynamic Relations: T-ds relations, Maxwell equations, Liquefaction of gases: Joule-Thomson effect, Joule-Thomson coefficient, coefficient of volume expansion, adiabatic and isothermal compressibility's, Clapeyron equation.	**15**
UNIT II	Equilibrium Concept in Thermodynamics Unary, binary and multicomponent systems, phase equilibria, evolution of phase diagrams, metastable phase diagrams, calculation of phase diagrams, thermodynamics of defects. Solution models Some Thermodynamic cycles: Carnot vapor power cycle, Ideal Rankine cycle, Rankine Reheat cycle, Otto cycle, Diesel cycle,	**15**

Main References: -

1. H Ibach and H Luth, Solid State Physics, 3rd ed.; Springer, 2003. Chpts. 6,7,9.
2. M. Modell and R.C. Reid, Thermodynamics and its Applications, Prentice-Hall, Englewood Cliffs, New Jersey, 1983.
3. H.B. Callen, Thermodynamics and an Introduction to Thermostatics, Jonh Wiley & Sons, New York, 1985.
4. R. T. DeHoff, Thermodynamics in Materials Science, McGraw-Hill, Singapore,
5. Physical Chemistry of Metals: L.S. Darken and R. W. Gurry
6. Thermodynamics of Solids: R. A. Swalin
7. Phase Transformations in Metals and Alloys: D.A. Porter and K.E. Easterling
8. Principles of Extractive Metallurgy: H.S.Ray
9. Brian Tanner, Introduction to the Physics of Electrons in Solids, CUP, 1995.

Course: Paper-IV	**Course Code: 23BPPH2T5**	**Course Title: Solid State Devices**	**Credit = 2**	**No. of lecture Hrs in 30**

Teaching Scheme		Evaluation Scheme			
Lectures (Hours per week)	Practical (Hours per week)	Tutorial (Hours per week)	Credit	Continuous Assessment (CA) Internal (Marks-20)	Semester End Examination (Marks-30)
02	02	–	04	20	30

Learning Objectives

- To gain knowledge of the advanced concepts in semiconductors
- To study Introduction to Integrated circuits**.**
- To develop the skill to solve the problems encountered in the field of semiconductor Industry

Course Outcomes

- Learners will able to distinguish between Bipolar Junction Transistor and Heterojunction bipolar transistors
- Learner will get the know knowledge of metal – semiconductor field effect transistor and its device
- Learners will able to use concepts of MOSFET in MOS devices

UNIT I	Semiconductor Devices I: Metal – Semiconductor Contacts: Schottky barrier – Energy band relation, Capacitance- voltage (C-V) characteristics, Current-voltage (I-V) characteristics; Ideality factor, Barrier height and carrier concentration measurements; Ohmic contacts. Bipolar Junction Transistor (BJT): Static Characteristics; Frequency Response and Switching. Semiconductor heterojunctions, Heterojunction bipolar transistors, Quantum well structures.	**15**
UNIT II	Semiconductor Devices II: Metal-semiconductor field effect transistor (MESFET)- Device structure, Principles of operation, Current voltage (I-V) characteristics, High frequency performance. Modulation doped field effect transistor (MODFET); Introduction to ideal MOS device; MOSFET fundamentals, Measurement of mobility, channel conductance etc. from Ids vs, Vds and Ids vs Vg characteristics. Introduction to Integrated circuits**.**	**15**

Main References: -

1. S. M. Sze; Semiconductor Devices: PhysicsandTechnology,2nd edition, John Wiley, New York, 2002.
2. B.G. Streetman and S. Benerjee; Solid State Electronic Devices,5th edition, Prentice Hall of India, NJ, 2000.
3. W. R. Runyan; Semiconductor Measurements and Instrumentation, McGraw Hill, Tokyo, 1975.
4. Adir Bar-Lev: Semiconductors and Electronic devices, 2nd edition, Prentice Hall, Englewood Cliffs, N.J., 1984.

Additional References:

1. Jasprit Singh; Semiconductor Devices: Basic Principles, John Wiley, New York, 2001.
2. Donald A. Neamen; Semiconductor Physics and Devices: Basic Principles, 3rd edition, Tata McGraw-Hill, New Delhi, 2002.
3. M. Shur; Physics of Semiconductor Devices, Prentice Hall of India, New Delhi, 1995.
4. Pallab Bhattacharya; Semiconductor Optoelectronic Devices, Prentice Hall of India, New Delhi, 1995.
5. S. M. Sze; Physics of Semiconductor Devices,2nd edition,Wiley Eastern Ltd., New Delhi, 1985.

Course:	Course Code: 23BPPH2P1	Course Title: Practical Lab – II		Credit = 2		No. of Practical Hrs in 60
Teaching Scheme		Evaluation Scheme				
Lectures (Hours per week)	Practical (Hours per week)	Tutorial (Hours per week)	Credit	Continuous Assessment (CA) Internal (Marks-40)	Semester End Examination (Marks- 50)	
-	4	–	02	-	50	

Learning Objectives

- Gain a deep understanding of the fundamental principles underlying the various topics, such as optics, electronics, signal processing, and numerical methods.
- Develop the ability to analyze and explain the theoretical foundations of each topic, including relevant equations, laws, and concepts.
- Apply theoretical knowledge to solve problems and make predictions in practical scenarios related to the respective fields.

Course Outcomes: -

- Upon mastering the topics, students can develop advanced technical competence in fields such as optics, electronics, signal processing, and numerical methods.
- They will be equipped with the knowledge and skills to design, analyze, and implement complex systems and solutions in various scientific, engineering, and technological applications.

	Zee-man effect using Fabry-Perotetalon / Lummer-Gehrecke plate.
	Ultrasonic interferometry velocity measurements in different fluids.
	Measurement of refractive index of liquids using laser
	IV/CV measurement on semiconductor specimen semiconductor measurements.
	Characteristics of a Geiger Muller counter and measurement of dead time.
	Double slit Fraunhofer diffraction
	Adder subtractor circuits using ICS
	Studyofpresettablecounters74190and74193
	TTL characteristics of totem pole open collector and tristate devices.
	Switching voltage regulator integrated circuits
	Pulse width modulation for speed control of DC toy motor.
	Numerical integration/solving ODEs using C++ or Python
	Introduction to Scilab

References:

1. Advance practical physics-Worsnop and Flint
2. Experiments In modern physics: Mellissions
3. Medical Electronics-Khandpur
4. Sirohi - A course of experiments with He-Ne Laser; Wiley Eastern Ltd
5. Semiconductor measurements-Runyan
6. Experimental physics for students-Whittle&. Yarwood
7. Manual of experimental physics--EV-Smith
8. Digital Principles and applications- Malvino and Leach
9. Digital circuit practice – Jain & Anand
10. Electronic Instrumentation-H.S. Kalsi
11. Integrated Circuits-K. R. Botkar
12. Digital circuit practice-R. P. Jain
13. Semiconductor electronics-Gibson
14. Introduction to solid state physics- C. Kittel
15. Electronic engineering-Millman Halkias
16. Electronic Instrumentation-W. D. Cooper
17. Manual of experimental physics. V. Smith
18. Semiconductor measurements—Runyan
19. Solid state physics — A. J. Dekkar
20. Experimental physics for students : Whittle & Yarwood
21. Experiments in digital principles- D. P. Leach
22. Microprocessor fundamentals- Schaum Series-Tokheim
23. Microprocessor Architecture, Programming and Applicationswiththe8085 - R. S. Gaonkar
24. Digital Electronics by Roger Tokheim
25. Helfrick & Cooper, PHI

8085 Kit User manual

Course:	**Course Code: 23BPPH2P2 / 23BPPH2P3**	**Course Title: Practical Lab – EI -1 / EI - 2**		**Credit = 2**	**No. of practical Hrs 60**
Teaching Scheme		Evaluation Scheme			
Lectures (Hours per week)	Practical (Hours per week)	Tutorial (Hours per week)	Credit	Continuous Assessment (CA) Internal (Marks-40)	Semester End Examination (Marks- 50)
-	4	–	02	-	50

Lab – EI -1 **23BPPH2P2**	Measurement of dielectric constant, curie temperature and verification of curie Weiss law for ferroelectric material
	Barrier capacitance of a junction diode.
	Faraday effect Magneto optic effect
	Characteristics of Junction Field effect transistor.
	Carrier mobility by conductivity.

	Shift registers
	Energy Bandgap of germanium Diode
OR	
Lab – EI -2 **23BPPH2P3**	Characteristics of Solar Cell.
	Measurement of dielectric constant
	Linear voltage differential transformer
	Energy bandgap by Four Probe method
	Study of 8085 microprocessor kit and execution of simple programs
	Waveform generation using 8085
	Interfacing TTL with buzzers, relays, motors and solenoids.

Course: Paper-I	**Course Code: 23BPPH2P4**	**Course Title: Industrial Training / Field Project**		**Credit = 4**	**No. of Hrs 120**
Teaching Scheme		Evaluation Scheme			
Lectures (Hours per week)	Practical (Hours per week)	Tutorial (Hours per week)	Credit	Continuous Assessment (CA) Internal (Marks-40)	Semester End Examination (Marks-60)
08	-	–	04	40	60

Learning Objectives

- To provide students the opportunity to test their interest in a particular career before permanent commitments are made.
- To acquire knowledge and abilities that will be useful in their jobs

Course Outcomes

- Recognize a company's organizational structure.
- Develop the work habits and attitudes required for career success (technical aptitude, professional attitude, organizational skills, etc.).
- Improve your writing and reporting abilities for technical documents.