SCHOOL OF HUMANITIES, SCIENCES & MANAGEMENT
DEPARTMENT OF PH YSICS

Periyar Nagar, Vallam, Thanjavur-613403, Tamilnadu
Phone +91-4362 264600, Fax +91-4362 264650
Email:headphy@pmu.edu, Web www.pmu.edu

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

CURRICULUM & SYLLABUS
FOR
M.Sc.PHYSICS

I – IV SEMESTER

(FULL TIME – 2 Years)

REGULATION 2018

BOS Date 26.5.2018
29th ACM 09.06.2018

PERIYAR MANIAMMAI INSTITUTE OF SCIENCE AND TECHNOLOGY

I. UNIVERSITY VISION AND MISSION

VISION

- To be a world class innovative,competitive,up-to-date, academic institution providing technological and other inputs appropriate to the branch of study student has chosen to specialize.

MISSION

UM1: Offering well balanced programme with scholarly faculty and state of art facilities to impart high level of knowledge.

UM2: Providing student centric education and foster their growth in creativity and entrepreneurship, critical thinking and collaborative work.

UM3: Involving progressive and meaningful research with concern for sustainability and environment.

UM4: Enabling the students to acquire the skill sets for global competencies.

UM5: Inculcating social responsibilities and ethics along with imparting knowledge.

II. DEPARTMENT VISION AND MISSION

VISION

To become a pioneer in Physics discipline with a strong research and teaching environment to adapt the challenges of international standards.

MISSION

DM1: To offer qualitative education to produce undergraduate, postgraduate and research scholars in Physics discipline leading to careers in the diversified domains of Government, research organization and academia.

DM2: To provide a platform that yields to advancement in Physics, resulting in innovative and creative ideas leading to new technologies and products.

DM3: To promote research activities in emerging fields of physics that would cater to the needs of the society .

DM4: To produce ethical, reliable, committed and successful professionalto the society.

Table1: Mapping of University Mission with Department Mission

	DM1	DM2	DM3	DM4	TOTAL
UM1	3	3	2	1	**9**
UM2	3	3	3	1	**10**
UM3	3	3	3	2	**11**
UM4	3	2	2	3	**10**
UM5	2	2	2	3	**9**

3 - Highly related 2 - Medium 1 - Low

III. PROGRAMME EDUCATIONAL OBJECTIVE (PEO's)

The Graduate will be

PEO-1: proficient in applying a broad understanding of the basic principles of physics to the solution of physical problems

PEO-2: able to become a highly professional teacher/professor or renowned scientist

PEO-3: able to plan, coordinate, communicate, organize, make decision and lead a team to solve problems and develop application using physics.

PEO-4: professional, ethical, responsible and will contribute to society through active management.

Table2: Mapping of Department Mission (DM) with Program Educational Objectives (PEOs)

	PEO-1	PEO-2	PEO-3	PEO-4	Total
DM1	3	2	1	0	**6**
DM2	2	1	3	0	**6**
DM3	2	0	1	0	**3**
DM4	0	0	0	3	**3**

3 - Highly related 2 - Medium 1 - Low

IV. GRADUATE ATTRIBUTES

Graduates Attributes (GAs) form a set of individually assessable outcomes that are the components indicative of the graduate's potential to acquire competence to practice at the appropriate level. The GAs are examples of the attributes expected of a graduate from an accredited programme. The Graduate Attributes of a Physicist are as follows:

GA-1: **Disciplinary Knowledge:** Apply knowledge of physics along with mathematics, chemistry and other domains appropriate to the programme.

GA-2: **Problem analysis and solution:** Identify, formulate, analyse and solve problems pertaining to physics by interdisciplinary approach

GA-3: **Design /Development of solutions:** Design and develop **s**olutions for problem with appropriate consideration to public health, safety, environment and society.

GA-5: **Tool usage:** Acquire, select, manipulate relevant techniques, resources and ICT tools to interpret solutions to the problems .

GA-6: **Ethics and Social responsibility:** Practice ethical codes as a physics professional and realize the responsibility to environment and society.

GA-7: **Effective Communication:** Professional communication with the society to comprehend and formulate reports, documentation, effective delivery of presentation and responsible to clear instructions.

GA-8: **Individual and teamwork:** Perform as an individual and as a leader in diverse teams and in multi-disciplinary environment.

GA-9: **Lifelong learning:** Recognize the need and have the ability to engage in independent learning for continual development as a physicist.

V. PROGRAMME OUTCOMES (PO'S)

The Graduates will be able to

PO1 : Obtain good knowledge of major concepts in all disciplines of physics.

PO2 : Solve the problem of universal physical laws and think mathematically and independently.

PO3 : Acquiring the skill technically and analytically enough to pursue their further studies.

PO4 : Having capability to expose the innovative and creative ideas which focus the physics applications.

PO5 : Bringing innovative, creative and interdisciplinary ideas to pursue high end research as project work.

PO6 : Follow the sense of academic and social eithcs among the students and with society.

PO7 : Able to recognize the need of continuous learning and scientific temperament for professional career.

PO8 : Taking up challenges as globally competitive physicists/researchers in diverse areas of theoretical and experimental physics.

Table 3: Mapping of Graduate Attributes (GA) with Program Outcomes (PO)

GA	PO-1	PO-2	PO-3	PO-4	PO-5	PO-6	PO-7	PO-8	Total
Disciplinary Knowledge	3	2	1	1	1	2	2	2	**14**
Problem analysis	2	3	0	0	1	1	3	2	**12**
Design / Development of solutions	2	1	3	3	2	0	1	2	**14**
Tool usage	1	3	3	2	1	2	1	1	**14**
Environment and sustainability	2	1	1	1	2	3	3	2	**15**
Ethics and Social responsibility	1	1	1	2	1	3	1	1	**11**
Effective communication	3	3	3	1	1	1	1	1	**14**
Individual and teamwork	2	2	1	2	3	2	2	1	**15**
Lifelong learning	1	2	1	2	2	1	2	3	**14**

Table4: Mapping of Program Educational Objectives (PEOs) with Program Outcomes (POs)

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	Total
PEO-1	3	3	3	3	2	1	2	1	**15**
PEO-2	3	3	3	3	2	1	2	1	**18**
PEO-3	1	3	3	2	1	1	2	1	**14**
PEO-4	1	2	1	3	1	3	2	1	**14**

3 - Highly related 2 - Medium 1 - Low

PERIYAR MANIAMMAI INSTITUTE OF SCIENCE AND TECHNOLOGY

(Under Section 3 of UGC Act, 1956)

M.Sc. Physics – Curriculum (2018 Regulations)

SEMESTER – I					
Subject Code	**Course Title**	**L**	**T**	**P**	**Credits**
YPH101 Core Course I	Mathematical Physics	4	1	0	5
YPH102 Core Course II	Classical Dynamics and Relativity	4	1	0	5
YPH103 Core Course III	Basic Electronics	4	1	0	5
YPH104 Core Course IV	Basic Practical (General & Electronics) - Lab	0	0	6	3
Elective Course I		4	0	0	4
	Total	**16**	**3**	**6**	**22**

SEMESTER – II					
Subject Code	**Course Title**	**L**	**T**	**P**	**Credits**
YPH201 Core Course V	Statistical Mechanics	4	1	0	5
YPH202 Core Course VI	Quantum Mechanics	4	1	0	5
YPH203 Core Course VII	Electromagnetic Theory	4	1	0	5
YPH204 Core Course VIII	Advanced General Experiments - Lab	0	0	6	3
Elective Course II		4	0	0	4
	Total	**16**	**3**	**6**	**22**

SEMESTER – III					
Subject Code	**Course Title**	**L**	**T**	**P**	**Credits**
YPH301 Core Course IX	Solid State Physics	4	1	0	5
YPH302 Core Course X	Special Electronics	4	1	0	5
YPH303 Core Course XI	Nuclear and Particle Physics	4	1	0	5
YPH304 Core Course XII	Advanced Electronics	0	0	6	3
Elective Course III		4	0	0	4
	Total	**16**	**3**	**6**	**22**

SEMESTER – IV					
Subject Code	**Course Title**	**L**	**T**	**P**	**Credits**
YPH401 Core Course XIII	Spectroscopy	4	1	0	5
YPH402 Core Course XIV	High Energy Physics	4	1	0	5
YPH403 Project	Project Work and Viva voce	-	-	20	10
	Total	**8**	**2**	**20**	**20**

22+22+22+20 = 86 Credits

Note : L – Lecture Hours; T – Tutorial Hours; P – Practical Hours & C – Credits

Elective Course – I

Subject Code	Course Title
YPH105A	Numerical Methods in Physics
YPH105B	Geophysics
YPH105C	Thin film Science and Characterization Techniques

Elective Course – II

Subject Code	Course Title
YPH205A	Laser and its Applications
YPH205B	Nano Science
YPH205C	Non – Destructive Testing Technology

Elective Course – III

Subject Code	Course Title
YPH305A	Crystal Growth and Characterization Techniques
YPH305B	Automation Science & Techniques
YPH305C	Research Methodology

CREDIT SUMMARY							
SEMESTER		**I**	**II**	**III**	**IV**	**TOTAL**	**% OF TOTAL CREDITS**
Core	Theory	15	15	15	10	55	63.95
	Lab	3	3	3	-	9	10.46
Elective		4	4	4	-	12	13.95
Project		-	-	-	10	10	11.63
Total		**22**	**22**	**22**	**20**	**86**	**100**

COURSE CODE	COURSE NAME	L	T	P	C
YPH101	MATHEMATICAL PHYSICS	4	1	0	5

Course Outcome:

On the successful completion of the course, students will be able to			
		Domain	**Level**
CO_1	Understanding the role of vectors and tensors in physics	Cognitive	Understanding
CO_2	Analyzing the complex variables	Cognitive	Applying & Analyzing
CO_3	Understanding the differential equations and special functions	Cognitive	Understanding
CO_4	Understanding the concept of Fourier transform, vector spaces and Greens functions	Cognitive	Applying & Understanding
CO_5	Understand the Groups and its theory	Cognitive	Understanding

Unit I: VECTORS AND TENSORS **9+3**

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 **9+3**

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 **9+3**

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 9+3

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 properties expression 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 Mathematics for Engineers and Physicist, 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)

Mapping with Program Outcomes

COs	**PO_1**	**PO_2**	**PO_3**	**PO_4**	**PO_5**	**PO_6**	**PO_7**	**PO_8**
CO_1	**3**	**2**	**2**	**1**	**2**	**3**	**2**	**1**
CO_2	**2**	3	**1**	**2**	**2**	**1**	**1**	**2**
CO_3	**3**	1	**3**	**2**	**3**	**1**	**1**	**3**
CO_4	**3**	1	**1**	**2**	**3**	**3**	**1**	**1**
CO_5	**2**	3	**1**	**3**	**1**	**3**	**2**	**0**
Total	**13**	10	**8**	**10**	**11**	**13**	**9**	**7**
Scaled	**3**	2	**2**	**2**	**3**	**3**	**2**	**2**

3 – Strong: 2 – Medium: 1 – Low 1-5= 1, 6-10 = 2, 11-15= 3

COURSE CODE	COURSE NAME	L	T	P	C
YPH102	CLASSICAL DYNAMICS & RELATIVITY	4	1	0	5

Course Outcome:

On the successful completion of the course, students will be able to			
		Domain	**Level**
CO_1	**Understanding** the fundamental principles of classical mechanics and Lagrangian formulation	Cognitive	Understanding
CO_2	**Analysing** and **applying** the Lagrangian formulation to the rigid body dynamics and oscillatory motion	Cognitive	Applying & Analyzing
CO_3	**Understanding** Hamiton's formulation	Cognitive	Understanding
CO_4	**Remember** the concept non linear dynamics and **derive** the solution	Cognitive	Applying & Remember
CO_5	***Understand*** the concepts of relativity, Lorentz transformations and ***how*** its differ from general theory of relativity	Cognitive	Understanding & Remember

Unit I : Fundamental Principles and Lagrangian Formulation 9+3

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 9+3

a) Rigid Body Dynamics

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 **9+3**

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 **9+3**

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 – Solutions

Unit 5 : Relativity **9+3**

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

Mapping with Program Outcomes

COs	**PO_1**	**PO_2**	**PO_3**	**PO_4**	**PO_5**	**PO_6**	**PO_7**	**PO_8**
CO_1	**2**	**2**	**2**	**1**	**2**	**3**	**2**	**1**
CO_2	**2**	1	**1**	**2**	**2**	**2**	**2**	**2**
CO_3	**3**	1	**2**	**2**	**3**	**1**	**1**	**3**
CO_4	**3**	1	**1**	**2**	**3**	**1**	**2**	**2**
CO_5	**2**	1	**1**	**3**	**1**	**3**	**2**	**2**
Total	**12**	8	**7**	**10**	**11**	**10**	**9**	**10**
Scaled	**3**	2	**2**	**2**	**3**	**2**	**2**	**2**

3 – Strong: 2 – Medium: 1 – Low 1-5= 1, 6-10 = 2, 11-15= 3

COURSE CODE	COURSE NAME	L	T	P	C
YPH103	BASIC ELECTRONICS	4	1	0	5

Course Outcome:

On the successful completion of the course, students will be able to			
		Domain	**Level**
CO_1	***Recall*** the basics & function of junction diode, Varactor diode LED and Analysis the function of LED, laser and photo diode.	Cognitive	Understand and evaluate
CO_2	***Demonstrate*** the transistor construction and working characteristics and **Analyse t**he behavior of the transistors and related devices	Cognitive	Understand and Evaluate
CO_3	**Understand** the concept of operational amplifier and how it is function as amplifier.	Cognitive	Understand &Analyzing
CO_4	**Apply** the concepts of opp-amp in oscillators and converters	Cognitive	Applying & Understanding
CO_5	**Understand** the IC fabrication and IC timer	Cognitive	Understanding

UNIT – 1 SEMICONDUCTOR DIODES 9+3

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 – Opto-electronic diodes – LASER diode, LED and photo diode.

UNIT – 2 TRANSISTORS AND POWER SEMI-CONDUCTOR DEVICES 9+3

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 9+3

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) 9+3

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 9+3

Basic monolithic ICs – equitaxial 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)

Mapping with Program Outcomes

COs	**PO_1**	**PO_2**	**PO_3**	**PO_4**	**PO_5**	**PO_6**	**PO_7**	**PO_8**
CO_1	**2**	**2**	**2**	**1**	**1**	**3**	**2**	**2**
CO_2	**2**	3	**1**	**2**	**1**	**3**	**2**	**2**
CO_3	**1**	2	**3**	**2**	**1**	**3**	**2**	**3**
CO_4	**3**	1	**3**	**2**	**1**	**3**	**2**	**3**
CO_5	**2**	3	**1**	**3**	**1**	**3**	**2**	**2**

total	**10**	11	**10**	**10**	**5**	**15**	**10**	**12**
Scaled	**2**	3	**2**	**2**	**1**	**3**	**2**	**3**

3 – Strong: 2 – Medium: 1 – Low 1-5= 1, 6-10 = 2, 11-15= 3

COURSE CODE	COURSE NAME	L	T	P	C
YPH104	**BASIC PRACTICAL (General & Electronics) – Lab**	**0**	**0**	**6**	**3**

Course Outcome:

On the successful completion of the course, students will be able to			
		Domain	**Level**
CO_1	***Explain the concepts*** that are learnt in the lecture sessions and ***follow*** hands-on learning experience in the laboratory sessions.	Cognitive, psychometric	Understand and reception
CO_2	***Explain the concepts*** that are learnt in the lecture sessions and ***follow*** hands-on learning experience in the laboratory sessions.	Cognitive, psychometric	Understand and Reception
CO_3	Gain ***knowledge*** in the scientific methods and ***identify*** the process of **measuring** different modulus	Mech, psychometric	Remeber; Aff: Receive
CO_4	Gain ***knowledge*** in the scientific methods and ***identify*** the process of **measuring** different Physical variables	Cognitive, psychometric	Rem; Aff: Rec.;
CO_5	***Manipulate*** and ***complete*** all the experiments with excellent ***application*** knowledge	Cognitive, psychometric	Applying; Aff: Rec, Orgonize

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

Mapping with Program Outcomes

COs	**PO_1**	**PO_2**	**PO_3**	**PO_4**	**PO_5**	**PO_6**	**PO_7**	**PO_8**
CO_1	**3**	**2**	**2**	**1**	**1**	**2**	**2**	**3**
CO_2	**3**	**1**	**2**	**2**	**1**	**1**	**2**	**2**
CO_3	**3**	**2**	**2**	**1**	**1**	**1**	**2**	**3**
CO_4	**3**	**2**	**2**	**1**	**2**	**1**	**2**	**2**
CO_5	**3**	**2**	**2**	**1**	**2**	**1**	**2**	**3**
total	**15**	**9**	**10**	**6**	**7**	**6**	**10**	**13**
Scaled	**3**	**2**	**2**	**2**	**2**	**2**	**2**	**3**

3 – Strong: 2 – Medium: 1 – Low 1-5= 1, 6-10 = 2, 11-15= 3

COURSE CODE	COURSE NAME	L	T	P	C
YPH201	STATISTICAL MECHANICS	4	1	0	5

Course Outcome:

On the successful completion of the course, students will be able to			
		Domain	**Level**
CO_1	**Understanding** the concepts of thermodynamics laws and rules	Cognitive	Understanding
CO_2	**Analyze** the kinetic principle and **apply** the rules in thermo-dynamical functions	Cognitive	Applying & Analyzing
CO_3	**Understand** how statistics of the microscopic world can be used to **explain** the thermal features of the macroscopic world	Cognitive	Understanding
CO_4	**Understand** the quantum mechanical formulation of statistical mechanics.	Cognitive	Applying & Understanding
CO_5	**Describe** the concept and role of indistinguishability in the theory of gases	Cognitive	Remembering

Unit 1 : Thermodynamics **9+3**

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 **9+3**

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 **9+3**

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 **9+3**

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. **9+3**

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).

Mapping with Program Outcomes

COs	**PO_1**	**PO_2**	**PO_3**	**PO_4**	**PO_5**	**PO_6**	**PO_7**	**PO_8**
CO_1	**3**	**2**	**2**	**3**	**2**	**3**	**2**	**2**
CO_2	**2**	3	**1**	**2**	**2**	**1**	**2**	**2**
CO_3	**2**	1	**3**	**2**	**2**	**2**	**2**	**2**
CO_4	**3**	2	**1**	**2**	**3**	**3**	**2**	**1**
CO_5	**2**	3	**1**	**3**	**1**	**3**	**2**	**1**
Total	**12**	11	**8**	**12**	**10**	**12**	**10**	**8**
Scaled	**3**	3	**2**	**3**	**2**	**3**	**2**	**2**

3 – Strong: 2 – Medium: 1 – Low 1-5= 1, 6-10 = 2, 11-15= 3

COURSE CODE	COURSE NAME	L	T	P	C
YPH202	QUANTUM MECHANICS	4	1	0	5

Course Outcome:

On the successful completion of the course, students will be able to			
		Domain	**Level**
CO_1	**Recall** the Schrödinger equation and the general formulation	Cognitive	Remembering
CO_2	**Solve** the schrodinger equations	Cognitive	Applying & Analyzing
CO_3	**Develop** a knowledge and **understanding** of perturbation theory, quantize rule, and Probability of transitions	Cognitive	Applying & Understanding
CO_4	**Applying** the semi-classical theory to the scattering Problems and **Understand** the concept angular momentum	Cognitive	Applying & Understanding
CO_5	**Acquire** the knowledge in relativistic quantum mechanics	Cognitive	Understanding

Unit 1: Schrödinger Equation and General Formulation 9+3

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 9+3

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 9+3

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 **9+3**

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 **9+3**

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).

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**	**2**	**1**	**2**	**3**	**2**	**1**
CO_2	**2**	3	**1**	**2**	**2**	**1**	**2**	**2**
CO_3	**3**	1	**3**	**2**	**3**	**1**	**1**	**3**
CO_4	**3**	1	**1**	**2**	**3**	**3**	**2**	**1**
CO_5	**2**	3	**1**	**3**	**1**	**3**	**2**	**0**
Total	**13**	10	**8**	**10**	**11**	**11**	**9**	**7**
Scaled	**3**	2	**2**	**2**	**3**	**3**	**2**	**2**

3 – Strong: 2 – Medium: 1 – Low 1-5= 1, 6-10 = 2, 11-15= 3

COURSE CODE	COURSE NAME	L	T	P	C
YPH203	ELECTROMAGNETIC THEORY	4	1	0	5

Course Outcome:

On the successful completion of the course, students will be able to			
		Domain	**Level**
CO_1	**Recall** and **understand** the basic concepts of electrostatics	Cognitive	Remembering& Understanding
CO_2	**Infer** the boundary value problems with dielectrics and **Relates** polarizability & susceptibility	Cognitive	Understanding & Applying
CO_3	**Recognizes** of basic laws of magneto-statics and **Solve** the boundary value problem	Cognitive	Remembering & Applying
CO_4	**Understand** the concepts related to Faraday's law, induced emf and Maxwell's equations	Cognitive	Understanding
CO_5	**Describe** the propagation of electromagnetic waves in different media and **Apply** the theory of electromagnetic waves in practical problems	Cognitive	Remembering & Applying

Unit 1 : Introduction to Electrostatics **9+3**

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 **9+3**

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 **9+3**

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 **9+3**

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 **9+3**

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).

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**	**2**	**2**	**2**	**3**	**2**	**2**
CO_2	**3**	2	**2**	**2**	**2**	**2**	**2**	**2**
CO_3	**3**	2	**3**	**2**	**3**	**2**	**2**	**3**
CO_4	**3**	1	**2**	**2**	**3**	**3**	**2**	**2**
CO_5	**2**	3	**1**	**3**	**1**	**3**	**2**	**2**
Total	**14**	10	**10**	**11**	**11**	**13**	**10**	**11**
Scaled	**3**	2	**2**	**3**	**3**	**3**	**2**	**3**

3 – Strong: 2 – Medium: 1 – Low 1-5= 1, 6-10 = 2, 11-15= 3

COURSE CODE	COURSE NAME	L	T	P	C
YPH204	ADVANCED GENERAL EXPERIMENTS – LAB	0	0	6	3

Course Outcome:

On the successful completion of the course, students will be able to			
		Domain	**Level**
CO_1	**Learn** various experimental and analytical abilities to address real world problems	Cognitive, psychometric	Understand and reception
CO_2	Set up testing strategies and select proper instruments to **evaluate** performance	Cognitive, psychometric	Understand and evaluating
CO_3	**Comprehend** the concepts through simple experiments	Cognitive/ psychometric	Rem; Aff: Receive
CO_4	**Adopt** the skills related to research, education, and industry- academia	Cognitive/ psychometric	Understand; Aff: Receive
CO_5	**Evaluate** theoretical calculations using experimental observations.	Cognitive, psychometric	Applying ; evaluating

(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

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**	**2**	**2**	**1**	**1**	**3**	**1**
CO_2	**2**	2	**2**	**1**	**1**	**1**	**3**	**2**
CO_3	**2**	2	**2**	**1**	**2**	**1**	**2**	**1**
CO_4	**3**	2	**3**	**1**	**1**	**2**	**3**	**3**
CO_5	**2**	3	**2**	**1**	**1**	**1**	**3**	**2**
Total	**12**	11	**11**	**6**	**6**	**6**	**14**	**9**
Scaled	**3**	3	**3**	**2**	**2**	**2**	**3**	**2**

3 – Strong: 2 – Medium: 1 – Low 1-5= 1, 6-10 = 2, 11-15= 3

COURSE CODE	**COURSE NAME**	**L**	**T**	**P**	**C**
YPH301	**SOLID STATE PHYSICS**	**4**	**1**	**0**	**5**

Course Outcome:

On the successful completion of the course, students will be able to			
		Domain	**Level**
CO1	**Infer** the basics of crystal structure and **Relate** crystalline structure to X-ray diffraction data and the reciprocal lattice.	Cognitive	Remembering
CO2	**Understand** the influence of lattice vibrations on thermal behavior.	Cognitive	Understanding
CO3	**Understand** the origin of energy bands, and **how** they influence electronic behavior	Cognitive	Understanding Applying.

CO4	**Distinguish** between classical and quantum theory of magnetic material.	Cognitive	Applying & Understanding
CO5	**Analyse** the role of dielectrics and superconductors	Cognitive	Understanding

Unit 1: Crystal Structure **9+3**

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 **9+3**

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 **9+3**

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 **9+3**

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 Ferro-electrics and Superconductivity **9+3**

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).

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**	**2**	**2**	**1**	**1**	**2**	**1**
CO_2	**2**	1	**2**	**2**	**2**	**2**	**1**	**1**
CO_3	**2**	2	**3**	**2**	**2**	**2**	**1**	**1**
CO_4	**2**	3	**2**	**2**	**2**	**2**	**2**	**2**
CO_5	**2**	3	**2**	**3**	**3**	**2**	**2**	**2**
Total	**11**	11	**11**	**11**	**10**	**9**	**8**	**7**
Scaled	**3**	3	**3**	**3**	**2**	**2**	**2**	**2**

3 – Strong: 2 – Medium: 1 – Low 1-5= 1, 6-10 = 2, 11-15= 3

COURSE CODE	COURSE NAME	L	T	P	C
YPH302	SPECIAL ELECTRONICS	4	1	0	5

Course Outcome:

On the successful completion of the course, students will be able to			
		Domain	**Level**
CO1	**Assess** and **explain** the Microcontroller's internal architecture	Cognitive	Remembering
CO2	**Understand** and **Classify** the instruction set of microcontroller and **distinguish** the use of different instructions and **apply** it in assembly language programming for 8031/51.	Cognitive	Applying & Understanding
CO3	**Understand** and **realize** the Interfacing of memory & various I/O devices.	Cognitive	Applying, Understanding
CO4	**Understand** the concepts of antennas and the characteristics of microwaves	Cognitive	Understanding
CO5	**Analysis** of TV Pictures, Receiver, Picture Tubes and **Comprehends** various Colour Television systems.	Cognitive	Understanding analyzing

Unit 1 : Microcontroller Architecture **9+3**

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 **9+3**

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 **9+3**

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 **9+3**

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 **9+3**

Essentials of colour television – Perception – Three colour theory – Luminescence – Hue and 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).

Mapping with Programme Outcomes

Cos	**PO_1**	**PO_2**	**PO_3**	**PO_4**	**PO_5**	**PO_6**	**PO_7**	**PO_8**
CO_1	**2**	**2**	**2**	**2**	**1**	**2**	**2**	**3**
CO_2	**2**	1	**2**	**2**	**2**	**2**	**1**	**3**
CO_3	**1**	2	**2**	**3**	**2**	**2**	**2**	**3**
CO_4	**2**	3	**2**	**2**	**2**	**2**	**2**	**2**
CO_5	**2**	3	**2**	**1**	**3**	**2**	**2**	**2**
Total	**9**	11	**10**	**10**	**10**	**10**	**9**	**13**
Scaled	**2**	3	**2**	**2**	**2**	**2**	**2**	**3**

3 – Strong: 2 – Medium: 1 – Low 1-5= 1, 6-10 = 2, 11-15= 3

COURSE CODE	COURSE NAME	L	T	P	C
YPH303	Nuclear and Particle Physics	4	1	0	5

Course Outcome:

On the successful completion of the course, students will be able to			
		Domain	**Level**
CO_1	***Recall*** the general properties of nucleus and ***Discuss*** the properties of nuclear forces.	Cognitive	Understanding Remembering
CO_2	***Distinguish*** and ***Demonstrate*** the various radioactivity decay of nucleus and particle detector	Cognitive	Understanding Analyzing
CO_3	***List*** the various nuclear models and ***Explain*** nuclear reactions	Cognitive	Understanding Evaluation
CO_4	**Understanding** the basics and properties of Accelerators and Reactors	Cognitive	Understanding
CO_5	**Acquire** the knowledge in elementary particles and ***Classify*** the elementary particles	Cognitive	Understanding Analyzing

Unit 1 : Basic Nuclear Properties **9+3**

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 **9+3**

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 **9+3**

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 **9+3**

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 **9+3**

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 non-conservation in weak interactions – CP violation – Eight-fold way and super-multiples – 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)

Mapping with Program Outcomes

COs	**PO_1**	**PO_2**	**PO_3**	**PO_4**	**PO_5**	**PO_6**	**PO_7**	**PO_8**
CO_1	**3**	**2**	**2**	**1**	**2**	**3**	**2**	**1**
CO_2	**2**	3	**1**	**2**	**2**	**1**	**2**	**2**
CO_3	**3**	1	**3**	**2**	**3**	**1**	**1**	**3**

CO_4	**3**	1	**1**	**2**	**3**	**3**	**2**	**1**
CO_5	**2**	3	**1**	**3**	**1**	**3**	**2**	**0**
Total	**13**	10	**8**	**10**	**11**	**11**	**9**	**7**
Scaled	**3**	2	**2**	**2**	**3**	**3**	**2**	**2**

3 – Strong: 2 – Medium: 1 – Low 1-5= 1, 6-10 = 2, 11-15= 3

COURSE CODE	COURSE NAME	L	T	P	C
YPH304	ADVANCED ELECTRONICS LAB	0	0	6	3

Course Outcome:

On the successful completion of the course, students will be able to			
		Domain	**Level**
CO_1	***Explain the concepts*** that are learnt in the lecture sessions and ***follow*** hands-on learning experience in the laboratory sessions.	Cognitive, psychometric	Understand ; Aff: Rec.;
CO_2	**Understand** the behaviour of electronic components and perform analysis and **design** of circuits by ICs etc.	Cognitive, psychometric	Understand and evaluating
CO_3	**Acquire** practical exposure on microprocessors, design and coding knowledge on 8085 & 86 family	Cognitive/ psychometric	Rem; Aff: Receive
CO_4	**Design** and **develop** the electronic instruments for advanced studies.	Cognitive/ psychometric	Understand; Aff: Receive
CO_5	***Manipulate*** and ***complete*** all the electronic experiments with advanced ***application*** knowledge.	Cognitive, psychometric	Applying ; evaluating

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. Micro controller – 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

COs	**PO_1**	**PO_2**	**PO_3**	**PO_4**	**PO_5**	**PO_6**	**PO_7**	**PO_8**
CO_1	**2**	**2**	**2**	**3**	**2**	**2**	**2**	**1**
CO_2	**2**	3	**1**	**2**	**2**	**1**	**2**	**2**

CO_3	**3**	1	**2**	**2**	**3**	**1**	**1**	**1**
CO_4	**3**	1	**1**	**2**	**3**	**2**	**2**	**1**
CO_5	**2**	3	**1**	**3**	**1**	**3**	**2**	**0**
Total	**12**	10	**7**	**12**	**11**	**9**	**9**	**5**
Scaled	**3**	2	**2**	**3**	**3**	**2**	**2**	**1**

3 – Strong: 2 – Medium: 1 – Low 1-5= 1, 6-10 = 2, 11-15= 3

COURSE CODE	COURSE NAME	L	T	P	C
YPH401	**SPECTROSCOPY**	**4**	**1**	**0**	**5**

Course Outcome:

On the successful completion of the course, students will be able to			
		Domain	**Level**
CO_1	**Understanding** the basics of electron spin and ***Explain*** the atom through atomic spectra	Cognitive	Understanding
CO_2	**Analyse** the behavior of the atom in the presence of the external field**; Acquire** the knowledge in quantum chemistry of molecules	Cognitive	Applying & Understanding
CO_3	***Analyze*** the rotating and vibrating diatomic molecules	Cognitive	Analyzing Understanding
CO_4	**Understand** the concept of Raman and electronic spectra and ***Explain*** Electronic Spectroscopic models	Cognitive	Understanding
CO_5	**Understand** the resonance spectra and ***Explain*** Basic principles of ESR	Cognitive	Understanding

Unit 1 : Atomic Spectra **9+3**

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 **9+3**

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 **9+3**

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 **9+3**

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 **9+3**

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).

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**	**2**	**2**	**1**	**3**	**2**	**1**
CO_2	**2**	3	**2**	**2**	**2**	**1**	**2**	**2**
CO_3	**3**	2	**3**	**2**	**3**	**1**	**1**	**1**
CO_4	**3**	1	**1**	**2**	**3**	**3**	**2**	**1**
CO_5	**2**	3	**1**	**3**	**2**	**3**	**2**	**1**
Total	**13**	11	**9**	**11**	**11**	**11**	**9**	**6**
Scaled	**3**	3	**2**	**3**	**3**	**3**	**2**	**2**

3 – Strong: 2 – Medium: 1 – Low 1-5= 1, 6-10 = 2, 11-15= 3

COURSE CODE	**COURSE NAME**	**L**	**T**	**P**	**C**
YPH402	**High Energy Physics**	**4**	**1**	**0**	**5**

Course Outcome:

On the successful completion of the course, students will be able to			
		Domain	**Level**
CO_1	**Recall** nuclear forces and **acquire** knowledge of nuclear interactions	Cognitive	Understanding Remembering
CO_2	***Distinguish*** and ***Demonstrate*** the various radioactivity decay of nucleus	Cognitive	Applying & Analyzing
CO_3	**Recall** the elementary particle and **Understand** the concept of particle interactions and fields	Cognitive	Remembering Analyzing
CO_4	**Remember** laws of expansion of universe and **Understand** the concept of cosmology	Cognitive	Remembering Understanding

CO_5	**Describe** scattering and **compare** the ideology of scattering of elementary particles	Cognitive	Remembering Evaluating

UNIT-I : Nuclear Interactions **9+3**

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 **9+3**

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 **9+3**

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 **9+3**

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 **9+3**

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

1. P.H.Perkins, , 1982, Introduction to high energy Physics, Addison – Wesley, London.
2. K.S. Krane, 1987, Introductory Nuclear Physics, Wiley, New York.
3. D. Griffiths, 1987, Introduction to Elementary Particle Physics, Harper and Row, New York.
4. R.R. Roy and B.P. Nigam, 1983, Nuclear Physics, New Age International, New Delhi.
5. Kaplan, 1989, Nuclear Physics, 2nd Edition, Narosa, New Delhi.
6. 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.

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**	**2**	**2**	**2**	**2**	**2**	**2**
CO_2	**2**	3	**2**	**2**	**2**	**3**	**2**	**2**
CO_3	**2**	2	**3**	**2**	**3**	**3**	**1**	**2**
CO_4	**3**	2	**1**	**2**	**3**	**3**	**2**	**1**
CO_5	**2**	3	**3**	**3**	**2**	**3**	**2**	**2**
Total	**12**	12	**11**	**11**	**12**	**14**	**9**	**9**
Scaled	**3**	3	**3**	**3**	**3**	**3**	**2**	**2**

3 – Strong: 2 – Medium: 1 – Low 1-5= 1, 6-10 = 2, 11-15= 3

COURSE CODE	**Elective Course – I**	**L**	**T**	**P**	**C**
YPH105A	**NUMERICAL METHODS IN PHYSICS**	**4**	**0**	**0**	**4**

Course Outcome:

On the successful completion of the course, students will be able to			
		Domain	**Level**
CO_1	**Identify** errors and **Measure** errors using General formula	Cognitive	Remembering Analyzing
CO_2	**Define** various iteration method and **Determine** the false position using these method.	Cognitive	Remembering Understanding
CO_3	**Find** the unequal intervals and **Applying** various interpolation formula	Cognitive	Analyzing Applying
CO_4	**Explain** numerical differentiation and integration and **Solve**	Cognitive	Applying &

	problems by Newton's forward, trapezoidal, Simpson's rule		Understanding
CO_5	**Explain** nth order ordinary differential equations and **apply** the knowledge to Solve the differential equation.	Cognitive	Understanding Applying

Unit I : FORMULA FOR ERRORS **8+2**

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 METHODS **8+2**

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 FORMULA **8+2**

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 **8+2**

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 : DIFFERENTIAL EQUATIONS **8+2**

Numerical Solutions of ordinary differential equations Nth order ordinary differential equations – Power series approximation – Point-wise 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.

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**	**1**	**2**	**3**	**1**	**0**	**1**
CO_2	**2**	2	**1**	**2**	**2**	**0**	**0**	**1**
CO_3	**2**	2	**1**	**2**	**2**	**0**	**3**	**2**
CO_4	**2**	2	**1**	**3**	**1**	**0**	**0**	**2**
CO_5	**2**	2	**1**	**3**	**0**	**2**	**0**	**2**
Total	**11**	10	**5**	**12**	**8**	**3**	**3**	**8**
Scaled	**3**	2	**1**	**3**	**2**	**1**	**1**	**2**

3 – Strong: 2 – Medium: 1 – Low 1-5= 1, 6-10 = 2, 11-15= 3

COURSE CODE	**Elective Course – II**	**L**	**T**	**P**	**C**
YPH105B	**GEOPHYSICS**	**4**	**0**	**0**	**4**

Course Outcome:

On the successful completion of the course, students will be able to			
		Domain	**Level**
CO_1	**Recall** the basic laws of physics	Cognitive	Remembering
CO_2	**Understanding** properties of electrical and electromagnetic prospecting	Cognitive	Understanding
CO_3	**Understand** the concept of gravity and magnetic prospecting	Cognitive	Understanding
CO_4	**Understand** and **apply** the concept of seismic prospecting methods	Cognitive	Applying & Understanding
CO_5	**Apply** the concept of geophysics in disaster management.	Cognitive	Applying

UNIT I Introductions **8+2**

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

UNIT II Electrical & Electromagnetic Prospecting **8+2**

Electrical properties of rocks – Current flow in a homogeneous media – Electrode arrays - Current flow across layers of differing resistivity - Principles of electromagnetic- Electromagnetic 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 **8+2**

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 **8+2**

Propagation of Seismic Waves in Linear and Nonlinear medium, Wave-forms 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, Pinch-outs, Anticlines) - Applications of seismic methods in Hydrocarbon, Mining , Groundwater and Engineering studies. Mapping of Geological structures.

UNIT V Geo physical application in Disaster management **8+2**

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

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

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**	**2**	**2**	**1**	**3**	**2**	**3**

CO_2	**2**	1	**2**	**2**	**2**	**1**	**2**	**2**
CO_3	**3**	2	**3**	**2**	**3**	**1**	**1**	**1**
CO_4	**3**	1	**1**	**2**	**3**	**1**	**2**	**1**
CO_5	**2**	3	**1**	**3**	**2**	**3**	**2**	**2**
Total	**13**	9	**9**	**11**	**11**	**10**	**9**	**9**
Scaled	**3**	2	**2**	**3**	**3**	**2**	**2**	**2**

3 – Strong: 2 – Medium: 1 – Low 1-5= 1, 6-10 = 2, 11-15= 3

COURSE CODE	Elective Course – III	L	T	P	C
YPH105C	**Thin film Science and characterization Techniques**	**4**	**0**	**0**	**4**

Course Outcome:

On the successful completion of the course, students will be able to			
		Domain	**Level**
CO_1	**Acquire the knowledge of** the basics of thin films prepation methods	Cognitive	Understanding
CO_2	**Learn** verity of characterization techniques for thin film	Cognitive	Understanding
CO_3	**Understand** the growth and nucleation of thin films	Cognitive	Understanding
CO_4	**Comprehends** and **Distinguish** the mechanical and electrical properties of thin films	Cognitive	Understanding Analysing
CO_5	**Explain** the thin films in various applications	Cognitive	Understanding Applying

UNIT I: PREPARATION METHODS **8+2**

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 **8+2**

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 8+2

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 8+2

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 8+2

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).

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**	**2**	**2**	**1**	**1**	**2**	**3**
CO_2	**2**	3	**2**	**2**	**2**	**2**	**2**	**1**
CO_3	**3**	2	**3**	**2**	**3**	**1**	**1**	**1**

CO_4	**3**	1	**1**	**2**	**3**	**1**	**2**	**3**
CO_5	**2**	3	**1**	**3**	**2**	**1**	**2**	**3**
Total	**13**	11	**9**	**11**	**11**	**6**	**9**	**11**
Scaled	**3**	2	**2**	**3**	**3**	**2**	**2**	**3**

3 – Strong: 2 – Medium: 1 – Low 1-5= 1, 6-10 = 2, 11-15= 3

COURSE CODE	Elective Course–IV	L	T	P	C
YPH205A	LASER AND ITS APPLICATIONS	4	0	0	4

Course Outcome:

On the successful completion of the course, students will be able to			
		Domain	**Level**
CO_1	**Acquire the knowledge of** the basics of lasers	Cognitive	Understanding
CO_2	**Learn** various levels of laser	Cognitive	Understanding
CO_3	**Understand** the various production methods of laser	Cognitive	Understanding
CO_4	**Comprehends** and **Distinguish** the types of laser	Cognitive	Understanding Analyzing
CO_5	**Explain** the laser in various applications	Cognitive	Understanding Applying

UNIT I : Basics of laser **8+2**

Spontaneous emission, Stimulated emission, Population inversion, Fabry Perot etalon, table two mirror optical resonators, Longitudinal and transverse modes of laser cavity, Mode selection, Gain in a regenerative laser cavity.

UNIT II : Modes of Laser **8+2**

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

UNIT III : Production of Laser **8+2**

Ammonia maser, Nitrogen laser, Carbon dioxide laser, Excimer laser, Dye laser, Ruby laser, Nd-YAG laser, Diode –pumped solid state lasers, Semiconductor lasers, High power laser systems.

UNIT IV : Laser Types **8+2**

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

UNIT V : Applications of Laser **8+2**

Ultra high resolution spectroscopy with lasers and its applications, Propagation of light in a medium with variable refractive index, Optical fibers, Light wave communication, Qualitative treatment of medical and engineering applications 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

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**	**2**	**2**	**1**	**1**	**2**	**3**
CO_2	**2**	3	**2**	**2**	**2**	**2**	**2**	**1**
CO_3	**3**	2	**3**	**2**	**3**	**1**	**1**	**1**
CO_4	**3**	1	**1**	**2**	**3**	**1**	**2**	**3**
CO_5	**2**	3	**1**	**3**	**2**	**1**	**2**	**3**
Total	**13**	11	**9**	**11**	**11**	**6**	**9**	**11**
Scaled	**3**	3	**2**	**3**	**3**	**2**	**`2**	**3**

3 – Strong: 2 – Medium: 1 – Low 1-5= 1, 6-10 = 2, 11-15= 3

COURSE CODE	**Elective Course – V**	**L**	**T**	**P**	**C**
YPH205B	**Nano Science**	**4**	**0**	**0**	**4**

Course Outcome:

On the successful completion of the course, students will be able to			
		Domain	**Level**
CO_1	**Acquire the knowledge of** Basic knowledge of Nanoscience and nanotechnology.	Cognitive	Understanding
CO_2	**Learn** verity of characterization techniques for nano	Cognitive	Understanding

	materials		
CO_3	**Understand** the fabrication of nanomaterials	Cognitive	Understanding
CO_4	**Comprehends** molecular electronics of nano materials	Cognitive	Understanding
CO_5	**Understand** the biological applications of nanomaterials	Cognitive	Understanding

Unit- I Introduction to Nanoscience **8+2**

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 Nano material characterizations **8+2**

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 Nano material fabrications **8+2**

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 **8+2**

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

Unit – V Nano Biology **8+2**

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.

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**	**2**	**2**	**1**	**1**	**2**	**3**
CO_2	**2**	3	**2**	**2**	**2**	**2**	**2**	**1**
CO_3	**3**	2	**3**	**2**	**3**	**1**	**1**	**1**
CO_4	**3**	1	**1**	**2**	**3**	**1**	**2**	**3**
CO_5	**2**	3	**1**	**3**	**2**	**1**	**2**	**3**
Total	**13**	11	**9**	**11**	**11**	**6**	**9**	**11**
Scaled	**3**	3	**2**	**3**	**3**	**2**	**2**	**3**

3 – Strong: 2 – Medium: 1 – Low 1-5= 1, 6-10 = 2, 11-15= 3

COURSE CODE	**Elective Course–VI**	**L**	**T**	**P**	**C**
YPH205C	**NON – DESTRUCTIVE TESTING TECHNOLOGY**	**4**	**0**	**0**	**4**

Course Outcome:

On the successful completion of the course, students will be able to			
		Domain	**Level**
CO_1	**Acquire the knowledge of** Visual testing and liquid penetration inspection of material.	Cognitive	Understanding
CO_2	**Learn** the generation of magnetic field and magnetic particle testing of material	Cognitive	Understanding
CO_3	**Understand** the basics radiographics and production	Cognitive	Understanding
CO_4	**Comprehends** and **Distinguish** the Radiographic inspection of material and testing of mathods	Cognitive	Understanding Analysing
CO_5	**Explain** the generation of ultrasonics and inspection of material	Cognitive	Understanding Applying

UNIT I SURFACE NDE TECHNIQUES – I **8+2**

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 **8+2**

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 **8+2**

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 **8+2**

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 **8+2**

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.

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**	**2**	**2**	**1**	**1**	**2**	**3**
CO_2	**2**	3	**2**	**2**	**2**	**2**	**2**	**1**
CO_3	**3**	2	**3**	**2**	**3**	**1**	**1**	**1**
CO_4	**3**	1	**1**	**2**	**1**	**1**	**2**	**3**
CO_5	**2**	3	**1**	**3**	**2**	**1**	**2**	**3**
Total	**13**	11	**9**	**11**	**9**	**6**	**9**	**15**
Scaled	**3**	3	**2**	**3**	**2**	**2**	**2**	**3**

3 – Strong: 2 – Medium: 1 – Low 1-5= 1, 6-10 = 2, 11-15= 3

COURSE CODE	Elective Course–VII	L	T	P	C
YPH305A	**CRYSTAL GROWTH AND CHARACTERIZATION TECHNIQUES**	**4**	**0**	**0**	**4**

Course Outcome:

On the successful completion of the course, students will be able to			
		Domain	**Level**
CO_1	**Acquire the knowledge of** the basics and different kinds of nucleations.	Cognitive	Understanding
CO_2	**Learn** the preparation of solution for crystal growth	Cognitive	Understanding
CO_3	**Understand** the various growth techniques	Cognitive	Understanding
CO_4	**Comprehends** melt growth techniques	Cognitive	Understanding
CO_5	**Explain** the verity of characterization techniques for crystals.	Cognitive	Understanding Applying

UNIT I NUCLEATION AND GROWTH **8+2**

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

UNIT II SOLUTION GROWTH TECHNIQUE **8+2**

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 **8+2**

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 **8+2**

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

UNIT V CHARACTERIZATION TECHNIQUE **8+2**

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).

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**	**2**	**2**	**1**	**1**	**2**	**3**
CO_2	**2**	3	**2**	**2**	**2**	**2**	**2**	**1**
CO_3	**3**	2	**3**	**2**	**3**	**1**	**1**	**1**
CO_4	**3**	1	**1**	**2**	**3**	**1**	**2**	**3**
CO_5	**2**	3	**1**	**3**	**2**	**1**	**2**	**3**
Total	**13**	11	**9**	**11**	**11**	**6**	**9**	**11**
Scaled	**1**	2	**2**	**2**	**2**	**2**	**2**	**3**

COURSE CODE	**Elective Course – VIII**	**L**	**T**	**P**	**C**

YPH305B	Automation Science and Techniques	4	0	0	4

Course Outcome:

On the successful completion of the course, students will be able to			
		Domain	**Level**
CO_1	**Know** the fundamental principles, design and operation of hydraulic and pneumatic machines,	Cognitive	Understanding
CO_2	**Learn** hydraulic system and components.	Cognitive	Understanding
CO_3	**Understand** the design of hydraulic circuits.	Cognitive	Understanding
CO_4	**Comprehends** the pneumatic systems and components	Cognitive	Understanding
CO_5	**Learn** the Applications of Fluid Power System in automation of Machine Tools and others Equipments.	Cognitive	Understanding Applying

UNIT I : FLUID POWER SYSTEMS AND FUNDAMENTALS 8+2

Introduction to fluid power, Advantages of fluid power, Application of fluid power system. Types of fluid power systems, Properties of hydraulic fluids – General types of fluids – Fluid power symbols. Basics of Hydraulics- Applications of Pascals Law- Laminar and Turbulent flow – Reynold's number – Darcy's equation – Losses in pipe, valves and fittings.

UNIT II : HYDRAULIC SYSTEM & COMPONENTS 8+2

Sources of Hydraulic Power: Pumping theory – Pump classification – Gear pump, Vane Pump, piston pump, construction and working of pumps – pump performance – Variable displacement pumps. Fluid Power Actuators: Linear hydraulic actuators – Types of hydraulic cylinders – Single acting, Double acting special cylinders like tanden, Rodless, Telescopic, Cushioning mechanism, Construction of double acting cylinder, Rotary actuators – Fluid motors, Gear, Vane and Piston motors.

UNIT III : DESIGN OF HYDRAULIC CIRCUITS 8+2

Construction of Control Components : Directional control valve – 3/2 way valve – 4/2 way valve – Shuttle valve – check valve – pressure control valve – pressure reducing valve, sequence valve, Flow control valve – Fixed and adjustable, electrical control solenoid valves, Relays, ladder diagram. Accumulators and Intensifiers: Types of accumulators – Accumulators circuits, sizing of accumulators, intensifier – Applications of Intensifier – Intensifier circuit.

UNIT IV : PNEUMATIC SYSTEMS AND COMPONENTS 8+2

Pneumatic Components: Properties of air – Compressors – Filter, Regulator, Lubricator Unit – Air control valves, Quick exhaust valves, pneumatic actuators. Fluid Power Circuit Design, Speed control circuits, synchronizing circuit, Penumo hydraulic circuit, Sequential circuit design for simple applications using cascade method.

UNIT V DESIGN OF FLUIDIC CIRCUITS WITH SENSORS 8+2

Servo systems – Hydro Mechanical servo systems, Electro hydraulic servo systems and proportional valves. Fluidics – Introduction to fluidic devices, simple circuits, Introduction to

Electro Hydraulic Pneumatic logic circuits, ladder diagrams, PLC applications in fluid power control. Fluid power circuits; failure and troubleshooting.

TEXT BOOKS:

1. Anthony Esposito, "Fluid Power with Applications", Pearson Education 2005.
2. Majumdar S.R., "Oil Hydraulics Systems- Principles and Maintenance", Tata McGraw-Hill, 2001.

REFERENCES:

1. Srinivasan.R, "Hydraulic and Pneumatic controls", Vijay Nicole, 2006.
2. Shanmugasundaram.K, "Hydraulic and Pneumatic controls", Chand & Co, 2006.
3. Majumdar S.R., "Pneumatic systems – Principles and maintenance", Tata McGraw Hill, 1995
4. Anthony Lal, "Oil hydraulics in the service of industry", Allied publishers, 1982.
5. Harry L. Stevart D.B, "Practical guide to fluid power", Taraoeala sons and Port Ltd. Broadey, 1976.
7. Michael J, Prinches and Ashby J. G, "Power Hydraulics", Prentice Hall, 1989.
8. Dudelyt, A. Pease and John T. Pippenger, "Basic Fluid Power", Prentice Hall, 1987.

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**	**2**	**2**	**1**	**1**	**2**	**3**
CO_2	**2**	3	**2**	**2**	**2**	**2**	**2**	**1**
CO_3	**3**	2	**3**	**2**	**3**	**1**	**1**	**1**
CO_4	**3**	1	**1**	**2**	**3**	**1**	**2**	**3**
CO_5	**2**	3	**1**	**3**	**2**	**1**	**2**	**3**
Total	**13**	11	**10**	**11**	**11**	**6**	**9**	**8**
Marks	**3**	3	**2**	**3**	**3**	**2**	**2**	**2**

3 – Strong: 2 – Medium: 1 – Low 1-5= 1, 6-10 = 2, 11-15= 3

COURSE CODE	**Elective Course – IX**	**L**	**T**	**P**	**C**
YPH305C	**RESEARCH METHODOLOGY**	**4**	**0**	**0**	**4**

Course Outcome:

On the successful completion of the course, students will be able to			
		Domain	**Level**
CO_1	**Acquire the knowledge of** an advance exposure about the research	Cognitive	Understanding

CO_2	**Learn** and **Familiarize** the art and style of writing a research report.	Cognitive	Understanding Analysing
CO_3	**Develop** acquaintance with intensive techniques and skills of research process.	Cognitive	Understanding
CO_4	**Explain** the computer applications	Cognitive	Understanding
CO_5	**Comprehends** the patent laws and how to get patents.	Cognitive	Understanding Applying

UNIT I Introduction – Selection of Research Problem 8+2

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 8+2

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 8+2

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 8+2

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 8+2

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)
5. Anderson, Theses & Assignment writing, Prentice Hall (1998)

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**	**2**	**2**	**1**	**1**	**2**	**3**
CO_2	**2**	3	**2**	**2**	**2**	**2**	**2**	**1**
CO_3	**3**	2	**3**	**2**	**3**	**1**	**1**	**1**
CO_4	**3**	1	**1**	**2**	**3**	**1**	**2**	**3**
CO_5	**2**	3	**1**	**3**	**2**	**1**	**2**	**3**
Total	**13**	11	**9**	**15**	**11**	**6**	**9**	**11**
Scaled	**3**	3	**2**	**3**	**3**	**2**	**2**	**3**

3 – Strong: 2 – Medium: 1 – Low 1-5= 1, 6-10 = 2, 11-15= 3