DEPARTMENT OF PHYSICS

Board of studies minutes

CURRICULUM & SYLLABUS
FOR

M.Sc. – PHYSICS

I – VI SEMESTER (CURRICULUM)
I SEMESTER (SYLLABUS)
BOS Date 16.10.2015
22nd ACM 24.10.2015

(Based on Outcome Based Education)

REGULATIONS – 2015

PERIRAR MANIAMMAI UNIVERSITY

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 programmes 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 Physicsdiscipline 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 produceethical, 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

- **PO-1:** understand how scientific and mathematical knowledge continually evolve and that is subject to change.
- **PO-2:** identify and apply universal physical laws to the problem.
- **PO-3:** communicate effectively (written /oral) and work effectively as an individual or team.
- **PO-4:** understand the impact and ethics of scientific discoveries on influencing society locally and globally.

PO-5: work effectively in bringing multidisciplinary ideas to diverse professional environment.

PO-6: find, collect andassess scientific-based information - its relevance and reliability.

PO-7: design and perform experiments and thereby analyse and interpret data.

PO-8: use techniques, tools and skills necessary for emerging technologies.

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	3	2	0	0	1	1	3	2	**12**
Design / Development of solutions	2	1	0	1	2	3	3	2	**14**
Tool usage	1	1	1	2	1	2	3	3	**14**
Environment and sustainability	2	2	1	1	2	2	2	2	**14**
Ethics and Social responsibility	1	1	1	3	2	2	1	1	**12**
Effective communication	1	1	3	1	2	1	2	2	**13**
Individual and teamwork	2	2	1	2	2	2	2	1	**14**
Lifelong learning	3	2	1	1	2	2	2	2	**15**

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

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	Total
PEO-1	3	3	1	1	2	3	2	2	**17**
PEO-2	3	3	1	1	2	2	2	2	**16**
PEO-3	2	3	1	1	1	2	2	2	**14**
PEO-4	1	2	1	3	1	3	2	1	**14**

3 - Highly related 2 - Medium 1 - Low

PERIYAR MANIAMMAI UNIVERSITY

(Under Section 3 of UGC Act, 1956)

M.Sc. Physics – Curriculum (2015 onwards)

SEMESTER – I					
Subject Code	**Course Title**	**L**	**T**	**P**	**Credits**
YPH101 Core Course I	Mathematical Physics	3	1	0	4
YPH102 Core Course II	Classical Dynamics and Relativity	3	1	0	4
YPH103 Core Course III	Basic Electronics	3	1	0	4
YPH104 Core Course IV	Basic Practical (General & Electronics) - Lab	0	0	6	3
Elective Course I		3	0	0	3
	Total	**12**	**3**	**6**	**18**

SEMESTER – II					
Subject Code	**Course Title**	**L**	**T**	**P**	**Credits**
YPH201 Core Course V	Statistical Mechanics	3	1	0	4
YPH202 Core Course VI	Quantum Mechanics	3	1	0	4
YPH203 Core Course VII	Electromagnetic Theory	3	1	0	4
YPH204 Core Course VIII	Advanced General Experiments - Lab	0	0	6	3
Elective Course I		3	3	0	3
	Total	**12**	**3**	**6**	**18**

SEMESTER – III					
Subject Code	**Course Title**	**L**	**T**	**P**	**Credits**
YPH301 Core Course IX	Solid State Physics	3	1	0	4
YPH302 Core Course X	Special Electronics	3	1	0	4
YPH303 Core Course XI	Nuclear and Particle Physics	3	1	0	4
YPH304 Core Course XII	Advanced Electronics	0	0	6	3
Elective Course I		3	3	0	3
	Total	**12**	**3**	**6**	**18**

SEMESTER – IV					
Subject Code	**Course Title**	**L**	**T**	**P**	**Credits**
YPH401 Core Course XIII	Spectroscopy	3	1	0	4
YPH402 Core Course XIV	High Energy Physics	3	1	0	4
YPH403 Project	Project Work and Viva voce	-	-	20	10
	Total	**6**	**2**	**20**	**18**

18+18+18+18 = 72 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	12	12	12	8	44	61.11
	Lab	3	3	3	-	9	12.50
Elective		3	3	3	-	9	12.50
Project		-	-	-	10	10	13.88
Total		**18**	**18**	**18**	**18**	**72**	**100**

YPH101 MATHEMATICAL PHYSICS 3 1 0 4

Course Objectives:

To familiarize the students with the mathematical techniques that will be useful in understanding theoretical treatment in different courses taught in this class and for developing a strong background if they want to pursue research in theoretical physics.

Course Outcome:

At the end of the course students will be able to

- Master the basic elements of complex mathematical analysis
- Solve differential equations that are common in physical sciences
- Apply group theory and integral transforms to solve mathematical problems of interest in physics.

Unit I: VECTORS AND TENSORS

Vector analysis : Gradient –Divergence –Curl-second order derivatives – Gauss's theorem-Stoke's theorem-Green's theorem – Curvilinear coordinatesspherical polar-cylindrical coordinates. Tensor analysis : Cartesian tensors – law of transformation of first and second order tensors- addition, subtraction and multiplication (inner and outer product) of tensors –rank ,covariant, contravariant and mixed tensors- symmetric and antisymmetric tensors- Quotient law.

Unit 2 :Complex Analysis

Functions of complex variables – Differentiability -- Cauchy-Riemann conditions – Complex integration – Cauchy's integral theorem and integral formula – Taylor's and Laurent's series – Residues and singularities - Cauchy's residue theorem – Evaluation of definite integrals.

Unit 3: Differential equations and Special functions

Second order differential equations, Power Series method, Frobenius method, Bessel functions of first and second kind, Generating Function, Integral representation and recurrence relations and orthogonally, Legendre functions: Generating functions, recurrence relations and special properties, orthogonality, Associated Legendre functions: recurrence relations, parity and orthogonality, Hermite and Laguerre functions: Solution of Hermite and Lageurre differential equation, generating function and Recurrence relation.

Unit 4 FOURIER TRANSFORM, VECTOR SPACES AND GREEN FUNCTIONS

Fourier Transform: Fourier transform – sine and cosine transform – properties Faultung's theorem- application in heat conduction and spectroscopy. Vector spaces: Definition –Linear dependence-Linear independence of vectors- Linear spaces –Basis-change of basis – Inner

product space – Schmidt's orthogonalisation procedure – Schwartz's inequality – Hilbert spaces properties. Green's function: Definition and construction –symmetry propertiesexpression for Green's functions in terms of Eigen functions-Green's functions
for simple and second order operator.

Unit 5 Group Theory

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

Books for Study

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

Books for Reference

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

Mapping with Programme Outcomes

COs	PO_1	PO_2	PO_3	PO_4	PO_5	PO_6	PO_7	PO_8
CO_1	3	0	2	2	1	1	0	0
CO_2	2	0	1	2	2	2	0	2
CO_3	3	1	2	0	2	1	1	2
	8	1	5	4	5	4	1	4
Scaled to 1, 2, 3	3	1	2	2	2	1	1	2

3 – Strong: 2 – Medium: 1 – Low

YPH102 CLASSICAL DYNAMICS & RELATIVITY 3 1 0 4

Course Objectives:

To equip the students with the knowledge of Lagrangian and Hamiltonian principles, equations, canonical transformations and small oscillations, so that students may apply these equations and principles in modern physics research

Course outcome :

At the end of the course students will be able to

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

Unit I : Fundamental Principles and Lagrangian Formulation

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

Unit 2: Laguangian Formulation: Applications

a) Rigid Body Dynamies

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

b) Oscillatory Motion

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

Unit 3 : Hamilton's Formulation

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

Unit 4 : Nonlinear Dynamics

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

Unit 5 : Relativity

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

Books for study

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

Books for Reference

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

Mapping with Programme Outcomes

COs	**PO_1**	**PO_2**	**PO_3**	**PO_4**	**PO_5**	**PO_6**	**PO_7**	**PO_8**
CO_1	**3**	**0**	**2**	**1**	**2**	**1**	**1**	**0**
CO_2	**3**	2	**1**	**1**	**2**	**1**	**1**	**1**
CO_3	**3**	2	**1**	**0**	**2**	**1**	**1**	**1**
	9	4	**4**	**2**	**6**	**3**	**3**	**2**
Scaled to 1, 2, 3	**3**	2	**1**	**1**	**2**	**1**	**1**	**1**

YPH103 **BASIC ELECTRONICS** **3 1 0 4**

Course Objectives:

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

Course Outcome:

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

Understand the fundamentals of Semiconductor Device Physics

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

UNIT – 1 SEMICONDUCTOR DIODES

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

UNIT – 2 TRANSISTORS AND POWER SEMI-CONDUCTOR DEVICES

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

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

UNIT – 3 OPERATIONAL AMPLIFIER

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

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

Wien Bridge, phase shift oscillators and twin-T oscillators – triangular, saw-tooth and square wave generators-Schmitt’s trigger – sample and hold circuits – Voltage control oscillator – phase locked loops. Basic D to A conversion: weighted resistor DAC – Binary R-2R ladder DAC – Basic A to D conversion: counter type ADC – successive approximation converter – dual slope ADC.

UNIT – 5 IC FABRICATIONS AND IC TIMER

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

Books for study

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

Books for Reference

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

Mapping with Programme Outcomes

COs	**PO_1**	**PO_2**	**PO_3**	**PO_4**	**PO_5**	**PO_6**	**PO_7**	**PO_8**
CO_1	**3**	**0**	**2**	**1**	**2**	**1**	**2**	**0**
CO_2	**3**	2	**1**	**1**	**2**	**1**	**2**	**1**
CO_3	**3**	2	**1**	**1**	**2**	**1**	**2**	**1**
	9	4	**4**	**3**	**6**	**3**	**6**	**2**
Scaled to 1, 2, 3	**3**	2	**1**	**1**	**2**	**1**	**2**	**1**

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

General Lab

Course Objectives:

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

Course Outcome:

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

Any fifteen Experiments

(Choosing a minimum of six experiments from each part)

A. General Experiments

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

B. Electronics Lab

Course Objectives:

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

Course Outcome:

At the end of the course,

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

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

24 Common source amplifier using FET

25 Common drain amplifier using FET

26 Relaxation oscillator using UJT (or) Op-amp

27. Active 2nd order filter circuits
28. Construction of an Instrumentation amplifier

Mapping with Programme Outcomes

COs	PO_1	PO_2	PO_3	PO_4	PO_5	PO_6	PO_7	PO_8
CO_1	3	0	1	1	2	1	2	3
CO_2	2	2	1	1	0	0	2	3
CO_3	2	2	1	1	2	1	2	3
CO4	3	2	1	1	1	2	0	2
	7	4	3	3	4	2	6	9
Scaled to 1, 2, 3	3	2	1	1	2	1	2	3

YPH105A **NUMERICAL METHODS IN PHYSICS** **3 0 0 3**

Course Objectives:

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

Course Outcome:

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

Unit I

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

Unit II

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

Unit III

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

Unit IV

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

Unit V

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

Books for study

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

Books for Reference

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

Mapping with Programme Outcomes

COs	**PO_1**	**PO_2**	**PO_3**	**PO_4**	**PO_5**	**PO_6**	**PO_7**	**PO_8**
CO_1	**3**	**1**	**2**	**2**	**1**	**1**	**1**	**2**
	3	1	**2**	**2**	**1**	**1**	**1**	**2**
Scaled to 1, 2, 3	**3**	1	**2**	**2**	**1**	**1**	**1**	**2**

YPH105B **GEOPHYSICS** **3 0 0 3**

UNIT I Introductions

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

UNIT II Electrical & Electromagnetic Prospecting

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

UNIT III Gravity and Magnetic prospecting

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

UNIT IV Seismic Prospecting Methods

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

UNIT V Geo physical application in Disaster management

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

Books for study

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

YPH105C **Thin Film Science and Characterization Techniques** **3 0 0 3**

Course Objectives:

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

Course Outcome:

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

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

UNIT I: PREPARATION METHODS

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

UNIT II: THICKNESS MEASUREMENT AND MONITORING

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

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

UNIT III: THERMODYNAMICS AND KINETICS OF THIN FILM FORMATION

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

UNIT IV: MECHANICAL & ELECTRICAL PROPERTIES OF FILMS

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

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

UNIT V: APPLICATIONS

Micro and optoelectronic devices, quantum dots, Data storage, corrosion and wear coatings – Polymer films, MEMS, optical applications –Applications in electronics–electric contacts, connections and resistors, capacitors and inductances – Applications of ferromagnetic and superconducting films – active electronic elements, micro acoustic elements using surface waves–integrated circuits–thin films in optoelectronics and integrated optics.

REFERENCES:

1. M.Ohring, „The Materials Science of Thin Films‟, Academic Press, 2nd edition(2001).

2. Zexian Cao, „Thin film growth - Physics, materials science and applications‟, Woodhead .

3. Publishing Limited, (2011).

4. H.Bubert and H.Jenett, „Surface and Thin Film Analysis – Principles, Instrumentations, Applications‟, Wiley – VCH Verlag GmbH (2002).

5. Krishna Seshan, „Handbook of Thin-Film Deposition Processes and Techniques‟, Noyes Publications & William Andrew Publishing, 2nd edition(2002).

Mapping with Programme Outcomes

COs	**PO_1**	**PO_2**	**PO_3**	**PO_4**	**PO_5**	**PO_6**	**PO_7**	**PO_8**
CO_1	**3**	**0**	**2**	**2**	**2**	**2**	**1**	**1**
CO_2	**3**	2	**1**	**2**	**2**	**1**	**1**	**1**
CO3	**2**	2	**1**	**1**	**1**	**1**	**2**	**1**
	8	4	**4**	**5**	**5**	**4**	**4**	**3**
Scaled to 1, 2, 3	**3**	2	**2**	**2**	**2**	**2**	**2**	**1**