J.J. COLLEGE OF ARTS AND SCIENCE (Autonomous)

DEPARTMENT OF PHYSICS

M.Sc. PHYSICS

Proposed Course Structure based on UGC - LOCF and TANSCHE

(Choice Based Credit System)

(Applicable for the candidates admitted from academic year 2022-2023 onwards)

Semester	Course Code	Title	Ins. Hrs/ Week	Credit	Exam Hrs	Marks		
						Int.	Ext.	Total
I	P1R2PHCC1	Mathematical Physics	6	5	3	25	75	100
	P1R2PHCC2	Classical Mechanics	6	5	3	25	75	100
	P1R2PHCC3	Electronics (Analog and Digital)	6	5	3	25	75	100
	P1R2PHCC4P	Major Practical-I	6	5	4	40	60	100
	P1R2PHDSE1:1/1:2	Discipline Specific elective-I (1:1/1:2)	6	3	3	25	75	100
			30	**23**				**500**
II	P2R2PHCC5	Electromagnetic Theory	5	5	3	25	75	100
	P2R2PHCC6	Quantum Mechanics	5	5	3	25	75	100
	P2R2PHCC7	Thermodynamics and Statistical Mechanics	5	5		25	75	100
	P2R2PHCC8	Microprocessor and Micro controller	5	5	3	25	75	100
	P2R2PHCC9P	Major Practical-II	6	5	4	40	60	100
	P2R2PHDSE(2:1/2:2	Discipline Specific elective-II (2:1/2:2)	4	3	3	25	75	100
			30	**28**				**600**

J.J. COLLEGE OF ARTS AND SCIENCE (Autonomous)

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M.Sc. PHYSICS

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III	P3R2PHCC10	Condensed Matter of Physics	6	5	3	25	75	100
	P3R1PHCC11	Nuclear and Particle Physics	6	5	3	25	75	100
	P3R2PHCC12	Spectroscopy	6	5	3	25	75	100
	P3R2PHCC13P	Major Practical–III	6	5	4	40	60	100
	P3R2PHSEC(1:1/1:2)	Skill Enhancement course - I (1:1/1:2)	6	3	3	25	75	100
			30	**23**				**500**
IV	P4R1PHCC14	Nano Science and Nano Technology	6	5	4	40	60	100
	P4R1PHGEC-1	Generic elective course-1	6	3	3	25	75	100
	Core Course–XV Project Work P4R2PHCC15PW	Dissertation 80 Marks [2 reviews– 20+20 =40marks Report Valuation =40 marks] Viva 20 Marks	18	8	***	***	***	100
		Total	**30**	**16**				**300**
		GRAND TOTAL		**90**				**1900**

CC- Core Course / AC – Allied Course /DSE – Discipline Specific Elective / SEC – Skill Enhancement Course / GEC – Generic Elective Course / AECC – Ability Enhancement Compulsory Course /P – Practical

Total Credit – 90 Total Marks –1900 Extension activities shall be outside the instruction hours.

Discipline Specific Elective Courses

Discipline Specific Elective - 1

1. Numerical methods in physics
2. Numerical methods and computational Physics

Discipline Specific Elective - 2

1. Crystal growth and Thin films
2. Thin Films Physics.

Skill Enhancement Courses

Skill Enhancement Course - 1

1. Non –Linear Optics
2. Medical Physics.

Generic Elective Courses (Offered by the Department)

1. Solar energy utilization.

TITLEOFTHECOURSE : MATHEMATICAL PHYSICS

CATEGORY : CORE COURSE

COURSECODE : P1R2PHCC1

NATUREOFSKILL : SKILL DEVELOPMENT

MARKS : CIA +EXTERNAL=25+75 =100 HOURS/WEEK :06

CREDITS : 05 TOTALINST.HOURS :96

COURSEOBJECTIVES:

C. obj – 1.To understand the concept in vector analysis

C. obj – 2.To develop knowledge in mathematical physics and its applications.

C. obj – 3.To develop expertise in mathematical techniques required in physics.

C. obj – 4.To enhance problem solving skills.

C. obj – 5.To enable students to formulate, interpret and draw inferences from mathematical solutions.

UNIT-I: VECTOR ANALYSIS AND VECTOR SPACES (Inst. Hrs : 20)

Concept of gradient, divergence and curl - Gauss's divergence theorem (Assignment), Green's theorem and Stoke's theorem (statement and proof) - Orthogonal curvilinear coordinates - Expression forgradient ,divergence,curl and Laplacianin cylindrical and spherical co-ordinates(Theory). Linearly dependent and independent sets of vectors-Inner product(problems)-Schmidt's orthogonalization process.

Unit II: Tensors and Matrix Theory (Inst. Hrs : 20)

Transformation of coordinates – Summation convention – Contravariant, covariant and mixed tensors – Rank of a tensor – Symmetric and antisymmetric tensors – contraction of tensor – Characteristic equation of a matrix – Eigen values and eigenvectors – Cayley - Hamilton theorem - Reduction of a matrix to diagonal form – Jacobi method – Sylvester's theorem.

Unit III: Complex Analysis (Inst. Hrs : 20)

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 -IV: Special Function (Inst. Hrs : 20)

Hermite differential equation – Generating functions – Hermite polynomials - Recurrence relations – Rodrigue's formula - Orthogonality: Laguerre differential equations – Generating functions - Laguerre polynomials - Recurrence relation - Rodrigue's formula – Orthogonality.

UNIT - V: GROUP THEORY (Inst. Hrs : 16)

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 -- D_3 as example

Books for Study

1. Mathematical Physics, B.D.Gupta,Vikas PublishingHousePvt.Ltd,1995.
2. Mathematical Physics, B.S.Rajput, 20thEdition,PragatiPrakashan,2008.
3. Mathematical Physics, H.K.DassandRama Verma,S.ChandandCompanyLtd,2010.
4. Mathematical physics,P.K.Chattopadhyay,WileyEasternLimited,1990.
5. Introduction to Mathematical physics,CharlieHarper,PrenticeHallofIndiaPvt.Ltd,1993.
6. Mathematical Physics, Sathyaprakash, sultan Chand &sons,Fifth revised enlarged edition,2006,New Delhi-110002.t

Books for Reference

1. Applied Mathematics for Engineers and Physicists,L.A.Pipesand L.R.Havevill, McGraw Hill Publications Co., 3rdEdition, 1971.
2. Theory and Problems of Laplace Transforms, Murray R.Spigel,Schaum's outline series, Mc Graw Hill, 1986.
3. Matrices and Tensors in Physics,A.W.Joshi,WileyEasternlimited,3rdEdition,1995.
4. Applied Mathematics for Engineers and Physicists, L.A. Pipesand L.R.Havevill,3rdEdition,McGrawHill, 1971.
5. Theory and problems of Laplace Transforms, Murray R.Spigel, International edition, McGraw Hill, 1986.

ONLINE RESOURCE

1.https://www.sultanchandandsons.com/book/141/mathematical-physics

2.https://infolearners.com/mathematical-physics-books-satya-prakash-pdf-download-2

COURSE OUTCOMES:

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

CO-1.Retrieve knowledge about the vector analysis and vector Space **–K1**

CO-2.Accomplish to study about Tensors and Matrices **–K3**

CO-3.Get to know the usage Complex analysis **–k6**

CO-4.Attain familiarity in Special Functions **-K4**

CO-5.Be informed about the Group Theory **-K3**

Relationship Matrix forCourse Outcome, Programme Outcomes and Programme Specific Outcomes

M.Sc. Physics – PSPH

Title of the Course: **MATHEMATICAL PHYSICS**						**Course Code: P1R2PHCC1**					
Course Outcomes (COs)	**Programme Outcomes (POs)**					**Programme Specific Outcomes (PSOs)**					**Mean Score of COs**
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	
CO1	3	3	2	2	3	3	3	2	2	3	2.6
CO2	3	3	3	2	2	3	3	1	2	2	2.4
CO3	2	3	3	2	2	3	3	3	2	2	2.5
CO4	3	3	2	2	3	3	3	3	2	2	2.5
CO5	3	2	2	3	3	3	3	2	3	2	2.6
	Mean Overall Score										**2.52**
	Result										**High**

TITLE OF THE COURSE : CLASSICAL MECHANICS

CATEGORY : CORE COURSE

COURSE CODE : P1R2PHCC2

NATURE OF SKILL : SKILL DEVELOPMENT

MARKS : CIA + EXTERNAL=25+75 HOURS/WEEK : 6

CREDITS : 5 TOTAL INST. HOURS: 96

COURSE OBJECTIVES:

The main objectives of this course are:

C obj-1. To acquire knowledge in solving the equation of motion using Lagrangian

C obj-2.To get essential qualities in generating functions & solving equation of motion by Hamilton's method

C-obj-3.To be expertise in Hamilton – Jacobi equation

C-obj-4. To obtain command over the kinematics of the rigid body through Euler equation

C-obj-5. To gain knowledge in central force field and relativity

UNIT-I: LAGRANGIANFORMULATION (InstHrs: 20)

Lagrangian formulation: System of particles-constraints and degrees of freedom-generalizedco-ordinates,forceandenergy-conservationlaws-conservationsoflinearandangular- momenta-symmetricproperties-homogeneityandisotropy-D'Alembertsprincipleofvirtual work(Seminar)-Lagrange's equation of motion- non-holonomic systems- applications of Lagrange equations of motion :free particle in space-Atwood'smachine.

UNIT–II: HAMILTON'SEQUATIONANDCANONICAL TRANSFORMATION (InstHrs: 19)

Calculusofvariation—principleofleastaction-Hamilton'sprinciple-Hamilton`sfunction-Lagrange's equation from Hamilton's principle-Hamilton's principle for non-holonomic system-variational principle- Hamilton's equations from variational principle-Legendre transformation and Hamilton's equation of motion. Cyclic co-ordinates and conservation theorem-Canonical transformations-Hamilton's canonical equations-Generatingfunctions(ICT)-Examples-Poissonbracketsanditsproperties.

UNIT-III: HAMILTON-JACOBI THEORY AND SMALL OSCILLATIONS (InstHrs: 19)

Hamilton-Jacobi equation for Hamilton's principle function(ICT)-Example: Harmonic oscillator problem-Hamilton's characteristic function-Action-angle variable-application to Kepler problem in action angle variables. Eigen value equation-Normal coordinates-Normal frequencies of vibration-vibrations of linear triatomic molecule.

UNIT-IV: KINEMATICSOFRIGIDBODY (InstHrs: 19)

Independent co-ordinates of rigid body-orthogonal transformation-properties of transformationmatrix-EulerangleandEuler'stheorem(Assignment)-infinitesimalrotation-Coriolisforce-angularmomentum and kinetic energy of motion about a point-moment of inertia tensor-Non-inertialframes and pseudo forces-Euler's equations of motion-torque free motion of a rigid body-heavysymmetricaltop.

UNIT-V: CENTRALFORCEPROBLEMANDTHEORY OFRELATIVITY (InstHrs: 19)

Reduction to the equivalent one body problem-Centre of mass-Equation of motion and firstintegral-classificationoforbits-Keplerproblem:Inverse-Squarelawofforce-Scatteringinacentralforcefield(Seminar)– transformationofscatteringtolaboratoryco-ordinates.Orbitsofartificial satellites, Virial theorem – Lorentz transformation, Relativistic Mechanics,RelativisticLagrangianandHamiltonianforaparticle,Spacetimeandenergy–Momentumvectors.

BOOKSFORSTUDY:

1. ClassicalMechanics-H.Goldstein,C.PooleandJ.Safko,PearsonEducationAsia,NewDelhi,ThirdEdition, 2002.
2. Classical Mechanics-G.Aruldhas, PHI Learning PrivateLimited,NewDelhi,2015.

BOOKSFORREFERENCE:

1. ClassicalMechanics-S.L.Gutpa,V.KumarandH.V.Sharma,PragatiPrakashan,Meerut,2016.
2. Classical Mechanics of Particles and Rigid Bodies -K.C. Gupta,NewAgeInternationalPublishers,NewDelhi,Thirdedition,2018.
3. ClassicalMechanics-N.C.RanaandP.J.Joag,TataMcGrawHill,NewDelhi,2015.

4. Classical Mechanics -J. C. Upadhaya, Himalaya Publishing HousePvt.Ltd,Bangalore,Secondedition,2017.
5. ClassicalMechanics,B.D.GuptaandSatyaPrakash,KederNathPublishers,Meerut,Revised Edition,2015.
6. Introduction to Classical Mechanics ,R.G.Takwale and P.S.Puranik, Tata Mc Graw Hill, New Delhi, 1989.

ONLINE RESOURCE:

1. **https://en.wikipedia.org/wiki/Lagrangian_mechanics**
2. **http://go.microsoft.com/fwlink/p/?LinkId=255141**

COURSE OUTCOMES:

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

CO-1. Get to know Lagrangian formulation &its applications **– K3**

CO-2. Acquire knowledge in distinguishing Lagrangian & Hamilton formalisms and develop skill in canonical transformation **– K4**

CO-3. Gain understanding about Hamilton – Jacobi function and action angle variables**– K2**

CO-4. Come to know about Coriolis force and Euler's theorem **–K5**

CO-5. Be informed about scattering in central force field & relativistic Lagrangian and Hamiltonian **– K1**

Relationship Matrix forCourse Outcome, Programme Outcomes and Programme Specific Outcomes
M.Sc. Physics – PSPH

Title of the Course: CLASSICAL MECHANICS						**Course Code: P1R2PHCC2**					
Course Outcomes (COs)	**Programme Outcomes (POs)**					**Programme Specific Outcomes (PSOs)**					**Mean Score of COs**
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	
CO1	3	2	3	3	2	3	3	2	3	3	2.7
CO2	3	1	2	3	2	3	1	3	3	2	2.3
CO3	2	3	1	3	3	1	3	3	2	3	2.4
CO4	3	3	2	3	3	3	2	3	3	3	2.8
CO5	3	1	3	3	3	2	3	3	3	3	2.7
										Mean Overall Score	**2.58**
										Result	**High**

TITLE OF THE COURSE : ELECTRONICS (ANALOG AND DIGITAL)

CATEGORY : CORE COURSE

COURSE CODE : P1R2PHCC3

NATURE OF SKILL : EMPLOYABILITY

MARKS : CIA+EXTERNAL=25+75 =100 HOURS WEEK :06

CREDIT : 5 TOTAL INST HOURS:96

COURSE OBJECTIVES:

The main objectives of this course are

C obj-1. To Study the basic principle semiconductor devices.

C obj-2 To study the Operational Amplifier

C obj-3 To design and application of operational Amplifier.

C obj-4 To study the IC fabrication and 555Timer.

C obj-5 To Learn the circuit operation of sequential Circuits

Unit 1: Semiconductor Devices and Thyristors (Inst Hrs:20)

JFET- Structure and working – I -V Characteristics under different conditions – biasing circuits – CS amplifier design – AC analysis – MOSFET: Depletion and Enhancement type MOSFFT – UJT characteristics –UJT relaxation oscillator(ICT) – SCR characteristics – control circuits using SCR, DIAC and TRIAC Operation and Characteristic .

Unit – II Operational Amplifier (Inst Hrs:20)

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

Unit – III : Op-Amp Applications (Oscillators and Convertors) (Inst Hrs:20)

Wien bridge, phase shift 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(ICT): binary weighted resistor DAC – Binary R-2R ladder DAC – Basic A to D conversion: counter type ADC – successive approximation converter – dual slope ADC.

Unit – IV: IC Fabrication and Timer(Inst Hrs:20)

Basic monolithic ICs – epitaxial growth – masking –etching impurity diffusion-fabricating monolithic resistors, diodes, transistors, inductors and capacitors – Fabrication of BJT-FET - IC 555 timer (Assignment)– description of the functional diagram – mono stable operation – Astable operation.

Unit – V: Sequential Circuit Components (Inst Hrs:16)

Introduction to sequential circuits-Latches and Flip and Flop-SR latch-Timing problems and clocked latches-JK latch-Master slave latch- delay Flip Flop-T Flip Flop _ Flip Flop excitation requirements- Shift Registers(Assignment).

BOOKS FOR STUDY:

1. Electronic devices and circuits, S.Salaivahanan, N.Sureshkumar and A.Vallavaraj, Tata McGraw-Hill Publishing Company Lited, New Delhi.
2. Linear integrated circuits S.RoyChaudri, Shail Jain, , New age International (P)Limited, New Delhi.
3. Op-Amps &Linear integrated circuits, R.A.Gayakwad, Printice Hall India Pvt Ltd.(1999)

BOOK FOR REFERENCE:

1. Electronic device and circuits, G.K.Mittal, Printice Hall India PvtLTd(1999).
2. Principles of Electronics-V.K.Mehta, S.Chand and company,2016.
3. Electronics Devices and circuits-David A.Bell,4th Edition, Prentice Hall.2007.
4. Electronics devices and Circuits-David A.Bell,4th Edition, Prentice Hall.2007.

ONLINE RESOURCE:

https://www.elsevier.com/books/electronic-devices-and-circuits/pridham/978-0-08-203407-0

COURSE OUT COMES:

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

CO-1.Define the current and voltage characteristics of Special semiconductor device. -K1

CO-2. Describe the parameters of op-amp and design op-amp circuits.-K5,K6

CO-3. Acquire the knowledge of op-amp Applicatoin.-K3

CO 4. Design and analyze the fabrication of IC-K6 ,K4.

CO 5. Analyze the sequential circuits- ,K4.

Relationship Matrix for Course Outcome, Programme Outcomes and Programme Specific Outcomes

M.Sc. Physics – PSPH

Title of the Course: Electronics (Analog and Digital)						**Course Code: P1R2PHCC3**					
Course Outcomes (COs)	**Programme Outcomes (POs)**					**Programme Specific Outcomes (PSOs)**					**Mean Score of COs**
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	
CO1	3	3	2	2	3	3	2	3	3	2	2.5
CO2	3	2	2	3	2	3	3	3	2	1	2.4
CO3	3	3	2	2	2	3	3	3	2	2	2.5
CO4	3	2	3	2	2	3	3	2	2	2	2.4
CO5	3	2	2	3	3	3	3	2	3	2	2.6
	Mean Overall Score										**2.48**
	Result										**High**

TITLE OF THE COURSE : MAJORPRACTICAL- I (General & Electronics)

CATEGORY : CORE COURSE

COURSE CODE : PIR2PHCC4P

NATURE OF SKILL : SKILL DEVELOPMENT

MARKS : CIA + EXTERNAL =40+60 HOURS/WEEK : 06

CREDITS : 05 TOTAL INST. HOURS : 96

COURSE OBJECTIVES:

The main objectives of this course are **:**.

C. obj – 1.To understand the concept in bulk modulus.

C. obj – 2.To acquire knowledge in stefan's constant.

C. obj – 3.To study about the multivibrator circuit.

C. obj – 4.To study about the oscillator circuit.

C. obj – 5.To understand the basic concepts of semiconductor device.

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

A. General Experiments

1. Determination of q, n, b by elliptical fringes method
2. Determination of q, n, b by hyperbolic fringes method
3. Determination of bulk modulus of a liquid by ultrasonic wave propagation
4. Determination of Stefan's constant
5. Identification of prominent lines by spectrum photography – Copper spectrum
6. Identification of prominent lines by spectrum photography – Iron 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 Experiments

1. Design and study of Monostable Multivibrator
2. Design and study of Bistable Multivibrator
3. Design and study of Wein Bridge Oscillator (Op-amp)
4. Design and study of Phase Shift Oscillator (Op-amp)
5. Characteristics of JFET
6. Characteristics of UJT
7. Characteristics of LDR
8. FET amplifier - Common source
9. Hartley oscillator using Transistor
10. Colpitts oscillator using Transistor
11. Relaxation oscillator using UJT
12. Single stage amplifier using Transistor

BOOKSFOR REFERENCE:

1. A text book of practical Physics–M.N.Srinivasan and others–Sultan Chand &Sons, New Delhi.
2. Practical Physics, S. Somasundaram, V. Balachandran, S. Padmanathan, Apsara Publications, Tiruchirapalli

ON LINE RESOURCE:

1.https://iitg.ac.in/subhasht/ph511%20July-Dec-2015/Manual%20PH511.pdf

2.https://www.amazon.in/Practical-Approach-Analog-Digital-Electronics/dp/935030368

COURSE OUTCOME:

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

CO-1. Determine the bulk modulus of a liguid-K5.

CO-2. Acquire knowledge in Stefan"s constant- **K4**

CO-3. Design the multivibrator circuit-K5

CO-4. Explain the concepts of semiconductor device-K2

CO-5. Acquire the knowledge in amplifier circuit-K1.

Relationship Matrix for Course Outcome, Programme Outcomes and Programme Specific Outcomes

M.Sc. Physics – PSPH

Title of the Course :Major Practical-I						**Course Code:P1R2PHCC4P**					
Course Outcomes (COs)	**Programme Outcomes (POs)**					**Programme Specific Outcomes (PSOs)**					**Mean Score of COs**
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	
CO1	3	3	2	2	3	3	3	2	2	3	2.6
CO2	3	3	3	2	2	3	3	1	2	2	2.4
CO3	2	3	3	2	2	3	3	3	2	2	2.5
CO4	3	3	2	1	3	3	3	3	2	2	2.4
CO5	3	2	2	3	3	3	3	2	3	2	2.6
	Mean Overall Score										**2.5**
	Result										**High**

Discipline specific elective

TITLE OF THE COURSE : NUMERICAL METHODS IN PHYSICS

CATEGORY : DISCIPLINE SPECIFIC ELECTIVE

COURSE CODE : P1R2PHSEC1:1

NATURE OF SKILL : SKILLDEVELOPMENT

MARKS : CIA+EXTERNAL=25+75 HOURS WEEK :06

CREDIT : 3 TOTAL INST HOURS: 96

COURSE OBJECTIVES

The main objectives of this course are

C obj-1. To Acquire skill in Errors and measurements.

C obj-2 To understand the numerical solution for algebraic and transcendental equations.

C obj-3 To study the concept of linear Interpolation.

C obj-4 To understand the numerical differentiation andintergration.

C obj-5 To solve the numerical solution.

Unit 1:Errors and the measurements (**Inst Hrs:18)**

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

Unit 2: Numerical solution of algebraic and transcendental equations (**Inst Hrs:20)**

The iteration method – The method of false position – Newton – Raphson method – Convergence and rate of convergence -Newton – Raphson method. Simultaneous linear algebraic equations - Gauss elimination method(ICT) – Jordon's modification – Gauss–Seidel method of iteration .

Unit 3:Interpolation (**Inst Hrs:18)**

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 (Seminar)

Unit 4: Numerical differentiation and integration (**Inst Hrs:20)**

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

Unit 5: Numerical Solutions of ordinary differential equations (**Inst Hrs:20)**

Nth order ordinary differential equations – Power series approximation – Pointwise method – Solutions of Taylor series – Euler's method(Seminar) – Improved Euler's method – Runge-Kutta method – second and fourth order

Books for study

1. Introductory Methods of Numerical analysis – S.S. Sastry, Prentice – Hall of India, New Delhi (2003) 3rd Edition.
2. Numerical Methods in Science and Engineering – The National Publishing Co. Madras (2001).
3. Numerical Methods in C and C++, Veerarajan, S.Chand, New Delhi (2006).

Books for Reference :

1. Numerical Recipes in C, W.H. Press, B.P.Flannery, S.A.Teukolsky, W.T. Vetterling, Cambridge University (1996).
2. Monte Carlo : Basics, K.P.N. Murthy, ISRP, Kalpakkam, 2000.

ONLINE RESOURCE:

https://en.wikipedia.org/wiki/Numerical_analysis

https://www.umu.se/en/education/courses/numerical-methods-in-physics2/#:~:text=The%20numerical%20methods%20are%3A%20Fast,%2DStoer%2C%20Predictor%2DCorrector.

COURSE OUT COMES

On the success ful completion of the course the students will ab able to:

CO-1.acquire the knowledge to errors and measurment .-K1

CO-2.understand the problem in aigebraic and transcendentai equations -K2

CO-3. use physics principle to solvethe problem in numercicalpolation.-k3

CO-4.apply differentiation and intergration concept to solve physics problem.-K4

CO-5.to identify the problem in ordinary differentialequations.-K5.

Relationship Matrix for Course Outcome, Programme Outcomes and Programme Specific Outcomes

M.Sc. Physics – PSPH

Title of the Course: Numerical Methods in Physics						**Course Code: P1R2PHSEC1:1**					
Course Outcomes (COs)	**Programme Outcomes (POs)**					**Programme Specific Outcomes (PSOs)**					**Mean Score of COs**
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	
CO1	3	3	2	2	2	3	2	2	2	3	2.4
CO2	3	3	3	2	1	3	3	1	2	2	2.3
CO3	2	3	2	2	2	3	3	3	2	2	2.4
CO4	3	3	2	1	3	3	3	3	2	2	2.4
CO5	3	2	2	3	3	3	3	2	2	2	2.5
	Mean Overall Score										**2.4**
	Result										**High**

TITLE OF THE COURSE : NUMERICAL METHODS AND COMPUTATIONAL PHYSICS

CATEGORY : DISCIPLINE SPECIFICELECTIVE

COURSE CODE : P1R2PHDSE1:2

NATURE OF SKILL : SKILLDEVELOPMENT

MARKS : CIA+EXTERNAL=25+75 HOURS WEEK : 06

CREDIT : 3 TOTAL INST HOURS : 96

COURSE OBJECTIVES

The main objectives of this course are

C obj-1. To understand the basic concept of the error and the measurements

C obj-2. To understand the numerical computations for algebraic, transcendental and linear simultaneous equations

C obj-3. To understand the concept of linear interpolation and curve fitting

C obj-4. To understand the numerical differentiation and integration

C obj-5. To understand the basic concept differential equations

UNIT -I: ERRORS AND THE MEASUREMENTS(Inst Hrs:19)

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

UNIT -II: NUMERICAL SOLUTION OF ALGEBRAIC AND TRANSCENDENTAL EQUATIONS (Inst Hrs:19)

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(Assignment) – C program for solution of linear equations.

UNIT -III: INTERPOLATION(Inst Hrs:19)

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 – C programming for Lagrange's interpolation(Seminar).

UNIT -IV: NUMERICAL DIFFERENTIATION AND INTEGRATION (Inst Hrs:20)

Newton's forward and backward difference formula to compute derivatives – Numerical integration : the trapezoidal rule, Simpson's rule(Assignment) – Extended Simpson's rule – C program to evaluate integrals using Simpson's and trapezoidal rules.

UNIT -V: NUMERICAL SOLUTIONS OF ORDINARY DIFFERENTIAL EQUATIONS (Inst Hrs:19)

Nth order ordinary differential equations – Power series approximation – Pointwise method – Solutions of Taylor series(Assignment) – Euler's method – Improved Euler's method – Runge-Kutta method – second and fourth order — C program for solving ordinary differential equations using RK and Eulers method.

Books for study

1.Introductory Methods of Numerical analysis – S.S. Sastry, Prentice – Hall of India, New Delhi (2003) 3rd Edition.

2.Numerical Methods in Science and Engineering – The National Publishing Co. Madras (2001).

3.Numerical Methods in C and C++, Veerarajan, S.Chand, New Delhi (2006).

Books for Reference :

1.1Numerical Recipes in C, W.H. Press, B.P.Flannery, S.A.Teukolsky, W.T. Vetterling, Cambridge University (1996).

2.Monte Carlo : Basics, K.P.N. Murthy, ISRP, Kalpakkam, 2000.

ON LINE RESOURCE:

https://en.wikipedia.org/wiki/Numerical_analysis

https://www.umu.se/en/education/courses/numerical-methods-in-physics2/#:~:text=The%20numerical%20methods%20are%3A%20Fast,%2DStoer%2C%20Predictor%2DCorrector

COURSE OUTCOME:

On completion of this course the students will be able to

CO-1. Use numerical methods to model physical systems on different length and time scales-K1.

CO-2.Critically select different numerical methods to solve different types of physical and technical problems - K5

CO-3.Describe different methods to compute the electron structure of solid materials -K2.

CO-4.Enable students to both broaden and deepen our understanding of physics by vastly increasing the range of mathematical calculations -K4.

CO-5.Acquired the knowledge of differential equation -K2.

Relationship Matrix for Course Outcome, Programme Outcomes and Programme Specific Outcomes

M.Sc. Physics – PSPH

Title of the Course:Numercical Methods and Coputational Physics						**Course Code:P1R2PHDSE1:2**					
Course Outcomes (COs)	**Programme Outcomes (POs)**					**Programme Specific Outcomes (PSOs)**					**Mean Score of COs**
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	
CO1	3	2	2	2	3	3	2	2	2	2	2.3
CO2	3	3	3	2	2	3	3	1	2	2	2.4
CO3	2	3	3	2	2	3	3	3	2	2	2.5
CO4	3	3	2	1	3	3	3	3	2	2	2.4
CO5	3	2	2	3	3	3	2	2	3	2	2.5
	Mean Overall Score										**2.42**
	Result										**High**

Title of the Course : ELECTROMAGNETIC THEORY

Category of the Course : Core Course

Course Code : P2R2PHCC5

Nature of the Skill : Skill Development

Marks : CIA : 25 + Ext: 75 = 100 Hrs / Week : 05

Credits : 5 Total Inst. Hrs : 80

COURSE OBJECTIVES

C. obj – 1. To develop theoretical knowledge in electromagnetism.

C. obj – 2. To develop skills on solving analytical problems in electromagnetism.

C. obj – 3. To give basics of defining the complete electromagnetic response of complex systems.

C. obj – 4.To understand the Gauss's law of electrostatics

C. obj – 5.To acquire the knowledge of EM waves in conductor and dielectric

UNIT -I: ELECTROSTATICS (Inst. Hrs : 16)

Coulomb's law- The electric field –Gauss's law - application of Gauss's law – curl of E - Poisson's equation and Laplace's equation – work and energy in electrostatics – energy of a point charge distribution – energy of continuous charge distribution – induced charges – capacitors.

Potentials: Laplace equation in one dimension and two dimensions – Dielectrics – induced dipoles – Gauss's Law in the presence of dielectrics (Assignment).

UNIT- II: MAGNETOSTATICS (Inst. Hrs : 16)

Lorentz force – magnetic fields – magnetic forces – currents – Biot-Savart Law – divergence and curl of B – Ampere's Law – Electromagnetic induction - comparison of magnetostatics and electrostatics – Magnetic vector potential (Assignment).

Magnetization: effect of magnetic field on atomic orbit – Ampere's Law in magnetized materials – ferromagnetism.

UNIT-III: **ELECTROMOTIVE FORCE(Inst. Hrs : 16)**

Ohm's Law – electromotive force – motional emf – Faraday's Law – induced electric field – inductance – energy in magnetic field – Maxwell's equation in free space and linear isotrophic media – continuity equation – Poynting theorem (ICT).

Electromagnetic waves in vacuum: Waves in one dimension – wave equation – sinusoidal waves – reflection and transmission – Polarization.

UNIT-IV: ELECTROMAGNETIC WAVES (Inst. Hrs : 16)

The wave equation for E and B – Monochromatic Plan waves – energy and momentum in electromagnetic waves – electromagnetic waves in matters –TE waves in rectangular wave guides – the co-axial transmission line.

Potentials: potentials and fields – scalar and vector potentials – Gauge transformation – Coulomb Gauge and Lorentz Gauge – Lorentz force law in potential form (ICT).

UNIT-V: APPLICATION OF ELECTROMAGNETIC WAVES (Inst. Hrs : 16)

Boundary conditions at the surface of discontinuity – Reflection and refraction of E.M waves at the interface of non – Conducting media – Kinematic and dynamic properties – Fresnel's equation – Electric field vector 'E' parallel to the plane of incidence and perpendicular to the plane of incidence – Brewster's law and degree of polarization (Seminar) – Total internal reflection.

BOOK FOR STUDY:

1. Introduction to Electrodynamics – David J. Griffiths, 4th Edition, Pearson.
2. Electromagnetic Theory and Electrodynamics, SathyaPrakash, KedarNath Ram Nath and Co, 2017.
3. Electromagnetics, B.B Laud, Wiley Eastern Company, 2000.
4. Fundamentals of Electromagnetic, WazedMiah, Tata Mc Graw Hill, 1980.
5. Basic Electromagnetics with Application, Narayanarao, (EEE) Prentice Hall, 1997.

BOOKS FOR REFERENCE:

1. Fundamentals of Electromagnetic Theory, Third edition, Narosa Publishing House, New Delhi – John R.Reitz, Frederick J Milford and Robert W.Christy, 1998.
2. Classical Electrodynamics – J.D. Jackson, II Edition, Wiley Eastern Limited, 1993.
3. Electromagnetic Fields and Waves – P.Lorrain and D.Corson.
4. Electromagnetics , B.B Laud, Wiley Eastern Company, 2000.

On line Resource Link:

1. https://drive.google.com/file/d/1-QQLBEpQz3jB7U_soJrtwKVXCS2rXAHD/view?usp=sharing

COURSE OUTCOME:

On completion of this course the students will be able to

CO .1.Understand the basics of Electrostatics - K2

CO. 2. Understand the basics of Magnetostatics - K2

CO. 3. Acquire knowledge on field equations and electromotive force - K1

CO. 4.Acquire the knowledge of the various modes of propagation of EM waves in waveguides - K1

CO. 5. Analyze the behaviour of EM waves in conducting surface through absorption, dispersion and reflection - K4

Relationship Matrix forCourse Outcome, Programme Outcomes and Programme Specific Outcomes

M.Sc. Physics – PSPH

Title of the Course: ELECTROMAGNETIC THEORY						**Course Code:P2R2PHCC5**					
Course Outcomes (COs)	**Programme Outcomes (POs)**					**Programme Specific Outcomes (PSOs)**					**Mean Score of COs**
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	
CO1	3	2	3	3	2	2	3	2	3	2	2.5
CO2	3	2	3	2	2	2	3	2	2	2	2.3
CO3	2	3	2	2	3	3	2	2	3	2	2.4
CO4	2	3	2	3	3	3	2	2	3	2	2.5
CO5	2	3	2	2	3	3	2	2	2	3	2.4
									Mean Overall Score		**2.42**
									Result		**High**

TITLE OF THE COURSE	**:**	**QUANTUM MECHANICS**
CATEGORY	**:**	**CORE COURSE**
COURSE CODE	**:**	**P2R2PHCC6**
NATURE OF SKILL	**:**	**SKILL DEVELOPMENT**
MARKS: CIA + EXTERNAL=25+75		**HOURS/WEEK : 05**
CREDITS: 05		**TOTAL INST. HOURS : 80**

COURSE OBJECTIVES:

The main objectives of this course are:

C obj-1. To study the fundamentals of wave mechanics.

C obj-2. To solve exactly soluble eigen value problems.

C-obj-3.To learn and acquire the knowledge of approximation method.

C-obj-4. To empathize the Scattering theory and Angular momentum concepts.

C-obj-5. To study the concepts of Relativistic Quantum mechanics.

UNIT-I:THE SCHRODINGER EQUATION AND OPERATOR FORMULATION

(InstHrs:16)

Matter waves- Equation of motion- Schrodinger equation for the free particle – physical interpretation of wave function-normalised and orthogonal wave functions-expansion theorem-admissibility conditions- stationary state solution of Schrodinger wave equation - expectation values-probability current density- Ehrenfertstheorem(ICT).

Operation formulation:

Linear operator– Adjoint and self adjoint operators–completeness-physical Interpretation of eigen value and eigen function-commutator-simultaneous eigen function-Heisenberg uncertainty relation

UNIT-II: EXACTLY SOLUBLE EIGENVALUE PROBLEMS (InstHrs : 16)

One dimensional linear harmonic oscillator-properties of stationary states-abstract operator method-Angular momentum operators-commutation relation-spherical symmetry systems(Seminar)-Particle in a central potential-radial wave function-Hydrogen atom: Solution of the radial equation-stationary state wave functions-bound states-the regidrotator:with free axis –in a fixed plane.

UNIT-III:APPROXIMATION METHODS (Inst Hrs:16)

Time independent perturbation theory: Non-degenerate and degenerate perturbation theories(first order only)-stark effect-WKB Approximation-LHO-Application to tunneling problem and quantization rules.Time dependent perturbation theory: Harmonic Perturbation-Transition probability-Fermi-Golden rule(Assignment).

UNIT-IV SCATTERING THEORY AND ANGULAR MOMENTUM (InstHrs : 16)

Scattering theory: Scattering cross section– Scatter.amplitude–Green function Approach–Partial wave analysis–Breit–Wigner formula–Born Approximation

Angular momentum: Angular momentum operators– commutation relations– Eigen values and Eigen functions of L and J – Angular momentum matrices–Spin angular momentum– Addition of angular momenta(Seminar) –Clebsch–Gordan coefficients (J=1 and J=2).

UNIT V RELATIVISTIC QUANTUM MECHANICS (InstHrs : 16)

Klein– Gordan equation for a free particle and in an electromagnetic field– Dirac equation for a free particle– Dirac matrices– Charge and Current densities– Negative energy States– Dirac Matrices– Plane waves solution–Spin of the Dirac particle– Spin–orbit interaction–Zitterbewegung –Spin Angular momentum–Spin orbit coupling(Assignment).

BOOKS FOR STUDY:

1. Quantum mechanics, SathyaPrakash, Kedarnathramnath& company, Meerut (2006).

2. Quantum mechanics, G.Aruldhas, Prientice Hall of india, new Delhi (2006).

3. Quantum Mechanics, V.K.Thankappan, Wiley–Eastern, Second Edition, New Delhi (1995)

BOOKS FOR REFERENCE:

1. Quantum Mechanics, V.Devanathan, Naroso Publishing House, (2011).

2. Quantum mechanic, L. Schiff Tata McGraw Hill, New Delhi, 1968.

3. A Text Book of Quantum Mechanic, P. M.Mathew and K. Venkatesan, Tata McGraw Hill, New Delhi, 1987.

4. Quantum Mechanics I: The Fundamentals, S. Rajasekar and R. Velusamy, CRC Press, 2015

5. Quantum Mechanics II: Advanced Topics, S. Rajasekar and R. Velusamy, CRC Press, 2015

ONLINE RESOURCE:

1.https://www.rpi.edu/dept/phys/Courses/phys410/lct8.pdf

2. https://www.hep.phy.cam.ac.uk/theory/webber/GFT/gft_handout2_06.pdf

COURSE OUTCOMES:

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

CO-1. Understand the concepts and principles of Quantum mechanics : The Schrodinger equation, the wave function and its physical interpretation, Stationary and non stationary, Time evolution and expectation values. **–K1**

CO-2. Apply principle of quantum mechanics to calculate observables on known wave functions **–K3**

CO-3. Grasp the concept of spin and angular momentum as well as their quantization and additionrules. **–K1**

CO-4. Explain physical properties of elementary particles (nucleons, atoms, molecules and solids) (bond structure) based on quantum mechanics. **–K2**

CO-5. To analysis the concept of Klein-Gordon equation. **–K4**

Relationship Matrix for Course Outcome, Programme Outcomes and Programme Specific Outcomes

M.Sc. Physics – PSPH

Title of the Course:Qunantum mechanics						**Course Code:P2R2PHCC6**					
Course Outcomes (COs)	**Programme Outcomes (POs)**					**Programme Specific Outcomes (PSOs)**					**Mean Score of COs**
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	
CO1	3	3	2	2	2	3	3	1	2	2	2.3
CO2	3	3	3	2	3	3	3	2	3	2	2.7
CO3	2	3	2	2	2	3	2	3	3	2	2.4
CO4	3	3	3	3	2	3	3	2	3	3	2.8
CO5	2	3	3	3	2	3	3	2	2	2	2.6
										Mean Overall Score	**2.56**
										Result	**High**

TITLE OF THE COURSE : THERMODYNAMICSANDSTATISTICAL MECHANICS

CATEGORY : CORE COURSE

COURSE CODE : P2R2PHCC7

NATURE OF SKILL : SKILL DEVELOPMENT

MARKS : CIA + EXTERNAL=25+75 HOURS/WEEK : 5

CREDITS : 5 TOTAL INST. HOURS: 80

COURSE OBJECTIVES:

The main objectives of this course are:

C obj-1. To know the basic concepts of thermodynamics

C obj-2. To perceive knowledge in ensembles and partition function

C-obj-3.To gain skill in distribution functions

C-obj-4. To obtain command over transport phenomena & non-equilibrium processes

C-obj-5. To recognize the basics of heat capacity of gases and concept of phase transitions

UNIT- I: THERMODYNAMICS, MICROSTATES AND MACROSTATES (InstHrs : 16)

Basic postulates of thermodynamics – Phase space and ensembles – Fundamental relations and definition of intensive variables – Intensive variables in the entropic formulation – Equations of state – Euler relation, densities - Gibbs-Duhem relation for entropy - Thermodynamic potentials(ICT)– Maxwell relations – Thermodynamic relations – Microstates and macro states – Ideal gas – Microstate and macro state in classical systems – Microstate and macro state in quantum systems– Density of states and volume occupied by a quantum state

UNIT-II: MICROCANONICAL,CANONICALANDGRANDCANONICAL ENSEMBLES (InstHrs: 16)

Microcanonical distribution function – Two level system in microcanonical ensemble – Gibbs paradox and correct formula for entropy – The canonical distribution function – Contact with thermodynamics - Partition function and free energy of an ideal gas –The grand partition function – Relation between grand canonical and canonical partition functions (Assignment) – One-orbital partition function

UNIT-III:BOSE-EINSTEIN,FERMI-DIRACANDMAXWELL-BOLTZMANN DISTRIBUTIONS (InstHrs: 16)

Bose-Einstein and Fermi-Dirac distributions – Thermodynamic quantities – Non-interacting Bose gas and thermodynamic relations – Chemical potential of bosons – The principle of detailed balance – Number density of photons and Bose condensation - Thermodynamic relations for non-interacting Fermi gas – Fermi gas at zero and low temperature – Fermi energy and Fermi momentum - Maxwell-Boltzmann distribution law for microstates in a classical gas(Seminar) - Physical interpretation of the classical limit – Fluctuations in different ensembles

UNIT-IV: TRANSPORT AND NON-EQUILIBRIUM PROCESSES (InstHrs: 16)

Derivation of Boltzmann transport equation for change of states without and with collisions – Boltzmann equation for quantum statistics – Equilibrium distribution in Boltzmann equation – Transport processes; One speed and one dimension - All speeds and all directions - Conserved properties - Distribution of molecular velocities – Equipartition and Virial theorems (ICT)– Random walk - Brownian motion - Non-equilibrium process; Joule-Thompson process - Free expansion and mixing - Thermal conduction - The heat equation.

UNIT-V: HEAT CAPACITIES, ISING MODEL AND PHASE TRANSITIONS (InstHrs: 16)

Heat capacities of heteronuclear diatomic gas – Heat capacities of homonuclear diatomic gas – Heat capacity of Bose gas –One-dimensional Ising model and its solution by variational method– Exact solution for one-dimensional Ising model - Phase transitions and criterion for phase transitions – Classification of phase transitions by order and by symmetry – Phase diagrams for pure systems – Clausius-Clapeyron equation (Seminar)– Gibbs phase rule

BOOKS FOR REFERENCE:

1. Fundamentals of Statistical and Thermal Physics Paper back, Reif, Sarat Book Distributors (2010).
2. Fundamentals of Statistical Mechanics Paperback, B.B. Laud, New Age International Private Limited, Jan 2012.
3. Elementary Statistical Physics, C.Kittel, John Wiley & Sons, 2004.
4. Statistical and Thermal Physics, F.Reif, McGraw Hill, Fifth Edition, 2010.
5. Statistical Mechanics, Gupta & Kumar, 20th Edition, Pragati Prakashan, Meerut, 2003.

6. Statistical Mechanics, B.K.Agarwal and M.Eisner, Second Edition, NewAge International Private Limited, Delhi, 2016.
7. Statistical Mechanics and Properties of Matter (Theory and Applications), E.S.R.Gopal, Ellis Horwood Ltd, 1974.

ONLINE RESOURCE:

1. **https://faculty.uca.edu/saddison/Thermal2003/ThermodynamicPotentials.pdf**
2. **http://go.microsoft.com/fwlink/p/?LinkId=255141**

COURSE OUTCOMES:

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

CO-1. Get to know the basics of thermodynamic systems and thermodynamic potentials **– K1**

CO-2. Acquire knowledge in distinguishing ensemble **– K4**

CO-3.Gain understanding about classical & quantum statistical distribution functions **– K6**

CO-4.Come to know transport processes and derive Boltzmann theorems **–K5**

CO-5. Be informed about phase transitions in Ising model and its criterion **– K3**

Relationship Matrix for Course Outcome, Programme Outcomes and Programme Specific Outcomes

M.Sc. Physics – PSPH

Thermodynamics and Statistical Mechanics						**Course Code: P2R2PHCC7**					
Course Outcomes (COs)	**Programme Outcomes (POs)**					**Programme Specific Outcomes (PSOs)**					**Mean Score of COs**
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	
CO1	3	3	3	2	3	3	1	3	3	3	2.7
CO2	3	2	3	3	2	3	2	3	3	3	2.7
CO3	3	1	3	3	3	2	3	3	3	2	2.6
CO4	3	2	1	3	3	2	3	3	2	3	2.5
CO5	3	3	2	3	3	3	3	2	3	3	2.8
	Mean Overall Score										**2.66**
	Result										**High**

TITLE OF THE COURSE : MICROPROCESSOR AND MICROCONTROLLER

CATEGORY : CORE COURSE

COURSE CODE : P2R2PHCC8

NATURE OF SKILL : EMPLOYABILITY

MARKS:CIA+EXTERNAL=25+75 HOURS WEEK :05

CREDIT :5 TOTAL INST HOURS: 80

COURSE OBJECTIVES

The main objectives of this course are

C obj-1. To understand the Microprocessor Archicture and Microcontroller architecture.

C obj-2. To understand the assembly language program of the micro processor

C obj-3. To understand the Microcontroller architecture.

C obj-4 To understand the hardware components and software programming instructions of INTEL 8086 microprocessors and 8051 microcontroller

C obj-5.To Know the concept of interfacing and peripheral devices.

Unit 1:8086 Microprocessor Architecture (Inst Hrs:16)

Organization of 8086 microprocessor-Memory organization - Register structure-Addressing modes in 8086-Pin configuration 8086 microprocesso(ICT)r-Minimum mode configuration-Maximum mode configuration-internal interrupts-External interrupts-Exception handling in 8086

Unit 2:Instruction set and programming(8086) (Inst Hrs:16)

Data transfer – Arithmetic - Branch Loop - Flag manipulation - Logical shift and rotate instructions. Programme in 8086-Addition – subtraction – multiplication – division - Choosing the biggest and smallest from a list - Arranging a list of numbers in ascending and descending order-. Time delay-Character manipulation(Assignment).

Unit3: Microcontroller 8051 (Inst Hrs:16)

Overview of 8051 family-pin description of 8051(ICT) -Registers-Program counter - Romspace-RAM SPACE, Stack, PSW, SFR, Addressing modes-Jump call instruction - Arithmetic and Logic instruction - BIT instruction.

Unit4: Microcontroller SFRS and PROG (**Inst Hrs:16)**

Basics of Serial communication-RS232 connections and ICSMAX 232-8051serial communication register(ICT) - Serial communication programmes – Interrupt - Interrupt reg - Internal and External interrupt programming.

Unit5: Microprocessor and Microcontroller Application (**Inst Hrs:16)**

Microprocessor interfacing and application - Programmable Peripheral interface Intel 8255 measurement of frequency, voltage current, measurement of temp, microprocessor based. - Micro Controller based Interfacing and application(Asssignment): Interfacing steeper motor, keyboard and DAC.

Books for Study

1. Introduction to Microprocessor 8086 by Aditya P Mathur.
2. Micro Controller and Embedded System by Muhammed Ali Mazidi – 8052

Book for Reference

1. Micro processor 8086 by Raffikuzman.
2. Micro processor and Interfacing by Douglas V. Hall (1998 13th Edition).
3. The 8051 Micro Controller Architecture, Programming & Application (2nd Edition) by Kenneth J ayala.

ONLNE RESOURCE

https://www.slideshare.net/gokulvlsi/microprocessor-microcontroller-notes

COURSE OUT COMES

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

CO-1.explain the microprocessor Architecture **–K2**

CO-2.write Assembly language programme for the 8086 **-K2**

CO-3. under stand the Microcontroller Architecture **-K1**

CO-4. implement the Peripheral devices. **-K4**

CO-5.apply Interfacing device to microprocessor and Microcontroller **-K3**

Relationship Matrix for Course Outcome, Programme Outcomes and Programme Specific Outcomes

M.Sc. Physics – PSPH

Title of the Course: MICROPROCESSOR AND MICROCONTROLLER						**Course Code: P2R2PHCC8**					
Course Outcomes (COs)	**Programme Outcomes (POs)**					**Programme Specific Outcomes (PSOs)**					**Mean Score of COs**
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	
CO1	3	3	2	3	2	3	3	3	3	2	2.7
CO2	3	2	2	3	2	3	3	2	3	2	2.5
CO3	3	3	2	2	3	3	3	2	3	2	2.6
CO4	3	3	2	2	3	3	3	3	2	2	2.6
CO5	3	3	2	3	2	3	3	3	2	1	2.5
	Mean Overall Score										**2.58**
	Result										**High**

TITLE OF THE COURSE : MAJORPRACTICAL-II

CATEGORY : CORE COURSE

COURSE CODE : P2R2PHCC9P

NATURE OF SKILL : SKILL DEVELOPMENT

MARKS: CIA + EXTERNAL =40+60 HOURS/WEEK : 06

CREDITS: 05 TOTAL INST. HOURS : 96

COURSE OBJECTIVES:

The main objectives of this course are **:**

C. obj - 1. To understand the concepts of microprocessor..

C. obj - 2. To develop programming skill in microprocessor.

C. obj – 3. To understand the concept of interfacing

C. obj – 4. To understand the concept of computational method in C- language.

C. obj – 5. To acquire knowledge about C-language.

(Choosing minimum of six experiments from each part)

A. Microprocessor Practical

1. 8 - bit addition, subtraction, multiplication and division using 8085/Z80.
2. Conversion from decimal to octal and hexa systems.
3. Conversion from Octal, Hexa to Decimal systems.
4. Sum of series
5. Data transfer
6. Table of square
7. ASCII to decimal conversion
8. Decimal to ASCII conversion
9. Display of names
10. Study of Seven Segment Display
11. Study of DAC interfacing (DAC 0900).
12. Study of ADC interfacing (ADC 0809).
13. Study of timer interfacing (IC 8253).
14. Traffic control system using microprocessor.

15. Generation of square, triangular, saw-tooth staircase and sine waves using DAC 0800.

16. Control of stepper motor using microprocessor.

B. Computer practical's (C- Language)

1. Roots of algebraic equations – Newton – Raphson method
2. Least - squares curve fitting – straight-line fit
3. Least – squares curve fitting – Exponential fit.
4. Solution of simultaneous linear algebraic equations-Gauss elimination method
5. Interpolation – Lagrange method
6. Numerical integration – Composite trapezoidal rule
7. Numerical integration – Composite Simpson's rule
8. Numerical differentiation – Euler method
9. Solution of ordinary differential equations – Runge – Kutta second order method
10. Solution of ordinary differential equations – Runge – Kutta fourth order method

BOOKS FOR REFERENCE:

1. A text book of practical Physics–M.N.Srinivasan and others–Sultan Chand &Sons, New Delhi.
2. Practical Physics, S. Somasundaram, V. Balachandran, S. Padmanathan, Apsara Publications, Tiruchirapalli

ON LINE RESOURCE:

1.https://www.pdfdrive.com/microprocessor-8086-lab-manual-e33574949.htm

2.https://www.jnec.org/labmanuals/eep/se/sem2/SY%20P2%20NMP%20Lab%20manual.pdf

COURSE OUTCOME:

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

CO-1.Retrieve the knowledge about microprocessor **-K1.**

CO-2.write Assembly language programme for the 8086 **-K2**

CO-3.Apply Interfacing device to microprocessor **- K3**

CO-4. Acquire the knowledge in c-language **-K1**

CO-5.Develop a writing skill in c-programming **-K5.**

Relationship Matrix for Course Outcome, Programme Outcomes and Programme Specific Outcomes

M.Sc. Physics – PSPH

Title of the Course: Major Practical-II						**Course Code:P2R2PHCC9P**					
Course Outcomes (COs)	**Programme Outcomes (POs)**					**Programme Specific Outcomes (PSOs)**					**Mean Score of COs**
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	
CO1	3	3	2	2	3	3	3	2	2	3	2.6
CO2	3	3	3	2	2	3	3	1	2	2	2.4
CO3	2	3	3	2	2	3	3	3	2	2	2.5
CO4	3	3	2	1	3	3	3	3	2	2	2.4
CO5	3	2	2	3	3	3	3	2	3	2	2.6
	Mean Overall Score										**2.5**
	Result										**High**

TITLEOFTHECOURSE : CRYSTAL GROWTH AND THIN FILM PHYSICS

CATEGORY : DISCIPLINESPECIFIC ELECTIVE

COURSECODE : P2PHDSE 2: 1

NATUREOFSKILL : EMPOLYABILITY

MARKS :CIA +EXTERNAL=25+75 HOURS/WEEK :04

CREDITS :03 TOTALINST.HOURS:64

COURSE OBJECTIVES:

The main objectives of this course are:

C obj-1. The students will learn the crystal growth mechanisms and techniques.

C obj-2.To study the various thin film deposition techniques and its analysis.

C obj-3.Acquire knowledge about applications of thin films.

Understand the various methods of thin films preparations

Understand the various technique of characterizations

UNIT-I: NUCLEATION AND CRYSTAL GROWTH (Inst.Hrs:14)

Nucleation - Different kinds of nucleation - Concept of formation of critical nucleus- Classical theory of nucleation - Spherical and cylindrical nucleus - Low temperature solution growth: Solution - Solubility and super solubility - Expression of super saturation -Mier's T-C diagram - Growth Kinetics of Thin Films - Thin Film Structure- Crystal System and Symmetry(ICT).

UNIT-II: GEL AND SOLUTION GROWTH TECHNIQUES (Inst.Hrs:14)

Constant temperature bath and crystallizer -Seed preparation and mounting - Slow cooling and solvent evaporation methods.

Principle - Various types - Structure of gel - Importance of gel - Experimental procedure - Chemical reaction method - Single and double diffusion method - Chemical reduction method - Complex and decomplexion method(Seminar) - Advantages of gel method.

UNIT-III: MELT AND VAPOUR GROWTH TECHNIQUES (Inst.Hrs:12)

Melt technique: Bridgman technique - Basic process - Various crucibles design - Thermal consideration - Vertical Bridgman technique - Czochralskitechnique (Assignment)- Experimental arrangement - Growthprocess.

Vapour technique: Physical vapour deposition - Chemical vapour deposition (CVD) - Chemical Vapour Transport.

UNIT-IV: THIN FILM DEPOSITION TECHNIQUES (InstHrs:12)

Thin Films - Introduction to Vacuum Technology - Deposition Techniques - Physical Methods - Resistive Heating, Electron Beam Gun, Laser Gun Evaporation and Flash Evaporations, Sputtering - Reactive Sputtering, Radio-Frequency Sputtering - Chemical Methods - Spray Pyrolysis -Electro deposition - Sol-gel technique (Seminar).

UNIT-V: CHARACTERIZATION TECHNIQUE (InstHrs:12)

X-ray Diffraction (XRD) - Powder and single crystal - Fourier transform Infrared analysis (FT-IR) - Elemental dispersive X-ray analysis (EDAX) - Transmission electron microscopy (TEM) andScanning Electron Microscopy (SEM) - UV-VIS-NIR Spectrometer - Chemical Etching - Vickers Micro hardness - Photoluminescence spectroscopy (PL).

BOOKS FOR STUDY:

1. I.V. Markov, Crystal Growth for Beginners: Fundamentals of Nucleation, Crystal Growth and Epitaxy, (2004) 2nd edition.
2. P. Santhanaragavan and P. Ramasamy, Crystal Growth Process and Methods (KRU Publications, Kumbakonam, 2001).
3. A. Goswami, Thin Film Fundamentals (New Age International (P) Limited, New Delhi, 2008).
4. H.H. Willard, L.L. Meritt, J.A. Dean, F.A. Sette, Instrumental Methods of Analysis (CBS Publishers, New Delhi, 1986).
5. S. Zhang, L. Li and A. Kumar, Materials Characterization Techniques (CRC Press, Bota Racon, 2009).

BOOKS FOR REFERENCE:

1. J. C. Brice, Crystal Growth Process (John Wiley and Sons, New York, 1986).
2. M. Ohring, Materials Science of Thin Films (Academic Press, Boston, 2002) 2nd edition.

3. E. N. Kaufmann, Characterization of Materials, Volume-I (John Wiley, New Jersey,2012).

4. H.H. Willard, L.L. Merritt, J.A. Dean, F.A. Settle, CBS, Publishers and Distributors, NewDelhi.

ONLINERESOURCE:

1. https://www.msm.cam.ac.uk/research/research-disciplines/crystal-growth-and-thin-films

COURSE OUTCOMES:

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

CO-1.Understand the nucleation and kinetics of crystal growth and technique. **-K1**

CO-2.Knowledge about modern crystal growth technique. **-K3**

CO-3.Acquire knowledge about physical properties of crystals. **-K5**

CO-4.Understand the thin film deposition techniques, film growth and structure. **-K4**

CO-5.Knowledge about thin film analysis, electrical, optical and magnetic properties. **-K2**

Relationship Matrix for Course Outcome, Programme Outcomes and Programme Specific Outcomes

M.Sc. Physics – PSPH

Title of the Course:Crystal Growth and Thin film						**Course Code:P2R2PHDSE1:1**					
Course Outcomes (COs)	**Programme Outcomes (POs)**					**Programme Specific Outcomes (PSOs)**					**Mean Score of COs**
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	
CO1	3	3	2	2	2	3	3	2	2	3	2.5
CO2	3	3	3	2	2	3	3	1	2	2	2.4
CO3	2	2	3	2	2	3	3	3	2	2	2.4
CO4	3	3	2	1	3	3	3	3	2	2	2.4
CO5	3	2	2	3	3	3	3	2	2	2	2.5
	Mean Overall Score										**2.44**
	Result										**High**

TITLEOFTHECOURSE : THIN FILM PHYSICS

CATEGORY : DISCIPLINESPECIFIC ELECTIVE

COURSECODE : P2R2PHDSE 2:2

NATUREOFSKILL : EMPOLYABILITY

MARKS:CIA +EXTERNAL=25+75 HOURS/WEEK : 04

CREDITS: 03 TOTALINST.HOURS: 64

COURSE OBJECTIVES:

The main objectives of this course are:

C obj-1. To understand the basic concepts of thin films technology.

C obj-2. To acquire the knowledge about thin film coating methods, its characterization methods and its applications.

C obj-3.To gain knowledge in determining the thickness of films

C obj-4. To explain the electric, electronic, magnetic, and structural behaviour of functional materials, the experimental methods used to investigate their functionality,

C obj-5.the mathematical and computational techniques used to model their properties.

UNIT-I: PREPARATION OF THIN FILM (Inst.Hrs:14)

Nature of Thin Film-Deposition Technology-Distribution of Deposit-Resistance Heating-Thermal Evaporation (ICT) -Flash Evaporation.

UNIT-II: DEPOSITION TECHNIQUES (Inst.Hrs:14)

Electron Beam Method- Cathodic Sputtering-Glow Discharge Sputtering- Low Pressure Sputtering-Reactive Sputtering-RF Sputtering-Chemical Vapour Deposition (Seminar)-Chemical Deposition.

UNIT-III: FILM THICKNESS AND ITS CONTROL (Inst.Hrs:12)

Mass Methods-Optical Method-Photometry-Ellipsometry-Interferometry- Other Methods-Substrate Cleaning-Microscopic Defect and Dislocation- Edge Dislocation-Screw Dislocation-Boundary Defect (Seminar)-Stress Effect-Removal of Defect-Defect and Energy State.

UNIT-IV: THIN FILM ANALYSIS (InstHrs:12)

Electron Diffraction Technique- High Energy Electron Diffraction-Low Energy Electron Diffraction-Electron Microscopy-Scanning Electron Microscopy-X Ray Photoelectron Spectroscopy (ICT) -MassSpectroscopy- Thermodynamics of Nucleation-Nucleation Theories-Film Growth-Incorporation of Defects, Impurities etc. in Film-Deposition Parameters and Grain Size.

UNIT-V: THIN FILM GROWTH PROCESS (InstHrs:12)

Epitaxy-Thin Film Structure-Substrate Effect-Epitaxial Deposit-Twinning and Multi twinning-Phase Transition-Dissociations-Film Thickness Effect- Crystal Growth Process (Seminar).

BOOKS FOR STUDY:

1. Thin Film Fundamentals, A. Goswami-New Age International-New Delhi.

BOOKS FOR REFERENCE:

1. Thin Film Phenomena-K.L. Chopra.
2. Handbook of Thin Film Technology-L.T. Meissel& R. Glang-McGraw Hill.

ONLINERESOURCE:

1. https://static.ifp.tuwien.ac.at/homepages/Personen/duenne_schichten_alt/pdf/t_p_ds_contents_cover.pdf

COURSE OUTCOMES:

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

CO-1.Apply the knowledge of basic principles of materials science in thin film technology.**-K1**

CO-2.Use various techniques to synthesis thin films of desired characteristics. **-K3**

CO-3.Understand the formation of thin filmmechanism. **-K5**

CO-4.Make application of thin films for devices fabrication. **-K4**

CO-5.Acquire skills required for entrepreneurship or jobs in the field of thin films. **-K2**

Relationship Matrix for Course Outcome, Programme Outcomes and Programme Specific Outcomes

M.Sc. Physics – PSPH

Title of the Course:Thin Film Physics						**Course Code:P2**R2PHDSE2:2					
Course Outcomes (COs)	**Programme Outcomes (POs)**					**Programme Specific Outcomes (PSOs)**					**Mean Score of Cos**
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	
CO1	3	3	2	2	3	3	3	2	2	3	2.6
CO2	3	3	3	2	2	3	3	1	2	2	2.4
CO3	2	3	3	2	2	3	3	3	2	2	2.5
CO4	3	3	2	2	3	3	3	3	2	2	2.5
CO5	3	2	2	3	3	3	3	2	3	2	2.6
	Mean Overall Score										**2.52**
	Result										**High**

THE COURSE : CONDENSED MATTER OF PHYSICS

CATEGORY : CORE COURSE

COURSE CODE : P3R2PHCC10

NATURE OF SKILL : SKILL DEVELOPMENT

MARKS : CIA + EXTERNAL=25+75 HOURS/WEEK : 06

CREDITS: 05 TOTAL INST. HOURS : 96

COURSE OBJECTIVES

The main objectives of this course are:

C Obj -1 To study the different structure of crystalline solids.

C Obj -2 To gain knowledge about carrier movement, lattice vibration and thermal property in solids.

C Obj -3 To understand the concepts of Free Electron and Band Theory of Solids.

C Obj -4 To study the different types of magnetism in solids.

C Obj -5 To study super conductivity and its applications.

UNIT – I: CRYSTAL PHYSICS (InstHrs: 20)

Crystals - Crystal lattice and translation vectors - Types of lattices (2D & 3D) - Point group – Space groups - Lattice direction and planes - Simple crystal structures - Close packed and loose packed structures - Structure of Diamond, Zinc Blend and Sodium chloride (Seminar)- X-ray diffraction - X-ray diffraction methods (Laue's method, Power crystal method) - Reciprocal lattice and its Properties - Imperfections in crystals - Point defects - line defects.

UNIT–II: SEMICONDUCTORS, LATTICE VIBRATIONS AND THERMAL PROPERTY

(InstHrs: 19)

Intrinsic and Extrinsic semiconductors (Seminar)- General study of carrier movement - Fermi level and conductivity – Lattice vibrations - One dimensional Monatomic lattice and

diatomic lattice - Phonons - Phonon momentum - Lattice heat capacity - Classical theory (Dulong and Petit Law) - Einstein theory - Debye's model - Density modes.

UNIT – III: FREE ELECTRON THEORY AND BAND THEORY OF SOLIDS

(InstHrs: 19)

Drude - Lorentz's classical theory of free electron gas – Relation between thermal and electrical conductivity (Wiedemann-Franz Law) – Free electron Gas in a 1-D - Free electron Gas in a 3-D- Application of free electron gas model – Bloch theorem – Kronig-Penny model (ICT) – effective mass of electron.

UNIT – IV: DIELECTRICS AND MAGNETISM IN SOLIDS (InstHrs: 19)

Polarization and Susceptibility – Local field - Dielectric constant and Polarizability (Clausius-Mosotti Equation) - Sources of Polarizability - Ferro electricity - Classical and Quantum theory of Dia and Para magnetism - Weiss theory of ferromagnetism (ICT) – Hund's rules- Concepts of Domains – Antiferromagnetism – Ferrimagnetism- Piezo electricity – Phenomenological approach to Piezoelectric effects – Piezoelectric parameters and their measurements – Piezoelectric materials.

UNIT – V: SUPERCONDUCTIVITY (InstHrs: 19)

Introduction – The Meissner effect (Assignment) – Soft and hard superconductors – Thermo dynamical and optical properties – Type -I and Type-II superconductors - London equations – BCS theory- Quantum tunneling-Josephson tunneling- Theory of DC Josephson effect – Theory of AC Josephson effect- High Tc super conductors – SQUIDS – Applications of super conductors.

BOOKS FOR STUDY

1. Introduction to Solid State Physic, C. Kittel, Wiley Eastern, New Delhi, 2008.
2. Solid State Physics, A. J. Dekker, McMillan, Madras, 1971.
3. Solid State Physics, S. O. Pillai, New Age International (P) Ltd, Revised 6th Edition, 2008.
4. Solid State Physics, Gupta and Kumar, K.Nath& Co, Meerut, 2011.

BOOKS FOR REFERENCE

1. An Introduction to X-ray Crystallography, M. M. Woolfson, Cambridge University Press, Cambridge, 1991.
2. Solid State Physics N. W. Ashcrof and N. D. Mermin, Holt, Rinehart and Winston, Philadelphia.
3. Solid State Physics J. S. Blakemore, Cambridge University Press, Cambridge, 1985.

ONLINE RESOURCES

http://www4.hcmut.edu.vn/~huynhqlinh/project/Minhhoa3/Nhieuxa/Nx2/www.matter.org.uk/diffraction/x-ray/laue_method.htm

https://winnerscience.com/london-equations-in-superconductors-derivation-and-

COURSE OUTCOMES

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

CO-1	Classify crystal structures and their defects	**-K2**
CO-2	Compare classical and quantum theories of lattice heat capacity	**-K4**
C0-3	Apply free electron gas model	**-K3**
CO-4	Distinguish different types of magnetism in solids	**-K4**
CO-5	Elaborate the applications of superconductors	**- K6**

Relationship Matrix for Course Outcome, Programme Outcomes and Programme Specific Outcomes

M.Sc. Physics – PSPH

Title of the Course: Condensed of Matter Physics						**Course Code: P3R2PHCC10**					
Course Outcomes (COs)	**Programme Outcomes (POs)**					**Programme Specific Outcomes (PSOs)**					**Mean Score of COs**
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	
CO1	3	3	2	2	3	3	3	2	2	3	2.6
CO2	3	3	3	2	2	3	3	1	2	2	2.4
CO3	2	3	3	2	2	3	3	3	2	2	2.5
CO4	3	3	2	1	3	3	3	3	2	2	2.4
CO5	3	2	2	3	3	3	3	2	3	2	2.6
										Mean Overall Score	**2.5**
										Result	**High**

TITLE OF THE COURSE : NUCLEARANDPARTICLE PHYSICS

CATEGORY : CORE COURSE

COURSECODE : P3R1PHCC11

NATUREOFSKILL : SKILLDEVELOPMENT

MARKS: CIA +EXTERNAL=25+75 HOURS/WEEK : 06

CREDITS: 05 TOTAL INST. HOURS : 96

COURSE OBJECTIVES:

The main objectives of this course are:

C obj-1.To understand the characteristics of nucleus forces

C obj-2. Gain knowledge in different types of nuclear models

C-obj-3.Acquire skill for deducing expression for Q-value

C-obj-4.Develop skill in Fermi& G.T Selection rules

C-obj-5.Analyze the interaction betweenelementary particles

UNIT I:NUCLEARFORCES (Inst Hrs.20)

Characteristics of Nucleus Forces – Exchange forces and tensor forces – charge independence-Spin dependence of Nucleus Forces - Meson theory of nuclear forces- Ground state of deuteron(Seminar)-Nucleon-nucleon scattering singlet and triplet parameters – Nucleon-Nucleon scattering: Cross-section, Differential Cross-section, Scattering Cross-sections – magnetic moment- Quadrupolemoment–Sand Dstateadmixtures-Effectiverangetheoryofn-pscatteringatlow energies.

UNIT II: NUCLEARMODELS (InstHrs: 14)

Binding energy & mass defect – Weizacker's formula – mass parabola - Liquid drop model(ICT)– - Bohr -Wheeler theory of fission- Activation energy for fission- Shell model-Spin –Orbit coupling-Spins of nuclei- Magnetic moments – Schmidt lines- Electric quadrupole moments - Collective model of Bohr and Mottelson: Nuclear vibration – Nuclear rotation – Nelson model.

UNIT III:NUCLEARREACTIONS (Inst. Hrs: 20)

Nuclear reaction - Q- value– Nuclear reaction cross section – Direct Nuclear Reactions: Knockout reaction, Pick-up reaction, Stripping reaction – Compound nucleus theory – Formation –Disintegrationenergylevels–PartialwaveanalysisofNuclearreactioncross-section-Resonance

Scattering and Reaction cross-section (Breit-Wigner dispersion formula) –Scattering matrix-Reciprocity theorem(Assignment)– –Breit-Wigner one level formula–Resonance scattering–Absorption cross section at high energy.

UNITIV:RADIOACTIVEDECAYS (InstHrs: 20)

Alpha decay - Beta decay –Energy release in beta decay – Fermi theory of beta decay – Shape of the beta spectrum(Seminar) – decay rate Fermi-Curie plot – Fermi & G.T Selection rules – Comparatives half - lives and forbidden decays- Gama decay - Multipoleradation – Angular momentum and parity selection rules –Internal conversion– Nuclear isomerism.

UNITI V:ELEMENTRYPARTICLEPHYSICS (InstHrs: 22)

Classification of elementary particles- Types of interaction between elementary particles– Hadronsandleptons–Symmetryandconservationlaws–Strangenessandassociateproduction - CPT theorem – classification of hadrons(Assignment)– Quark model – Isospin multiples - SU(2)-SU(3)multiplets- Gell-Mann - Okubo mass formula for octet and decuplet hadrons– Phenomenology of weak interaction hadrons and leptons - Universal Fermi interaction – Elementary concepts of weak interactions.

TEXT BOOKS:

1. IntroductoryNuclearPhysics,K.Krane,Wiley,NewYork,1987.
2. Nuclear Physics, V.Devanathan,Narosa Publishing house.
3. Nuclear Physics, D.C.Tayal, Himalaya Publishing House Pvt., Ltd.,Vedition,2018.

REFERENCE:

1. IntroductiontoElementaryParticles,D.Griffiths,IntroductiontoElementaryParticles (WileyInternational,NewYork,1987).

ONLINE RESOURCE:

https://www.nuclear-power.com/nuclear-power/fission/liquid-drop-model/

COURSE OUTCOMES:

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

CO-1.Gain knowledge in Nucleon scattering **-K2**

CO-2.Obtain art of using Weizacker's formula **-K3**

CO-3. Attain familiarity in Nuclear Reactions **-K4**

CO-4.Catch on the Fermi theory of beta decay **-K5**

CO-5. Figure out the Quark model **-K4**

Relationship Matrix for Course Outcome, Programme Outcomes and Programme Specific Outcomes

M.Sc. Physics – PSPH

Title of the Course: NUCLEARANDPARTICLE PHYSICS						**Course Code: P3R1PHCC11**					
Course Outcomes (COs)	**Programme Outcomes (POs)**					**Programme Specific Outcomes (PSOs)**					**Mean Score of COs**
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	
CO1	3	2	2	3	1	3	2	2	3	3	2.4
CO2	3	1	3	2	3	3	3	2	2	2	2.4
CO3	3	3	2	1	3	3	3	1	2	2	2.3
CO4	3	3	2	2	1	3	2	2	2	3	2.3
CO5	3	2	3	3	1	2	3	2	3	2	2.5
	Mean Overall Score										**2.38**
	Result										**High**

Title of the Course : SPECTROSCOPY

Category of the Course : Core Course

Course Code : P3R2PHCC12

Nature of the Skill : Skill Development

Marks : CIA : 25 + Ext: 75 = 100 **Hrs / Week : 06**

Credits : 5 **Total Inst. Hrs : 96**

COURSE OBJECTIVES:

The main objectives of this course are:

C. obj - 1. Learn and understand the concept of Molecular spectroscopy

C. obj - 2. The concept of FT-IR is well understood

C. obj - 3. The concepts of Raman Spectroscopy is well understood

C. obj - 4. learn and understand the concepts of NMR and ESR spectroscopy

C. obj - 5. The concepts of Mossbauer spectroscopy is understood

UNIT-I: MICROWAVE SPECTROSCOPY (Inst. Hr : 20)

Rotation of Molecules – Rigid Rotor (Diatomic Molecules) – Expression for the Rotational Constant - Intensity of Spectral Lines – Effect of Isotopic Substitution - Molecular Parameters (Bond Length, Bond Angle, Dipole Moment) from Rotation Spectra – Techniques and Instrumentation.

UNIT II: INFRARED SPECTROSCOPY

Vibrational energy of a diatomic molecule- Infrared selection rules-Vibrating diatomic molecule-Diatomic vibrating rotator- Vibrations of polyatomic molecules-Fermi resonance-Rotation vibration spectra of polyatomic molecules-Normal modes of vibration in crystal-Interpretation of vibrational spectra-Group frequencies-IR spectrophotometer-Instrumentation-Sample handling techniques-Fourier Transform Infrared spectroscopy-Applications

UNIT III: RAMAN SPECTROSCOPY

Introduction-Theory of Raman scattering-Rotational Raman spectra-Vibrational Raman spectra-Mutual Exclusion principle-Raman spectrometer-Sample handling techniques-Polarization of Raman scattered light-Structure determination using IR and Raman spectroscopy-Raman investigation of phase transitions-Resonance Raman scattering-Nonlinear Raman phenomena-Preliminaries-Hyper Raman effect-Stimulated Raman scattering-Inverse Raman effect-Coherent Anti-Stokes Raman scattering .

UNIT IV: NUCLEAR MAGNETIC AND ELECTRON SPIN RESONANCE SPECTROSCOPY

Basic principles – Quantum theory of NMR - magnetic resonance – relaxation processes – chemical shifts – spin-spin coupling - Spectra and molecular structure – Fourier Transform NMR –Instrumentation – Applications.

Basic principles – Quantum theory - g-factor – Nuclear Interaction and Hyperfine structure – Relaxation effects - Hyperfine interaction – line widths – ESR spectrometer – Instrumentation – applications.

UNIT V: MOSSBAUER SPECTROSCOPY

Mossbauer effect: Principle of Mossbauer spectroscopy – recoilless emission and absorption - hyperfine interaction - chemical isomer shift - magnetic hyperfine and electric quadruple interactions – ` Instrumentation – applications.

BOOKS FOR REFERENCE:

1. Colin N. Banwell, Elaine M. McCash, Fundamentals of Molecular Spectroscopy (Fourth Edition), Tata McGraw-Hill Publishing Company Ltd, 1995.

2. J.D. Graybeal, Molecular Spectroscopy, McGraw-Hill, New York, 1988.

3. Hollas, Michael, Modern Spectroscopy (Fourth Edition) John Wiley, New York, 2004.

4. R.P Straughen, S.Walker, Spectroscopy Vols.I,II and III, Chapman & Hall, London, 1976.

On Line Resource Link:

1.https://drive.google.com/file/d/1mUhjPY47kNp6CaGO0LeVrbS2magVwlZN/view?usp=sharing

Course Outcomes:

Oncompletionofthecoursethestudentswillhave:

CO. 1.Understand the aspects of rotational spectroscopy and its techniques **– K2**

CO. 2.Understand the theory and principles of vibrational spectroscopy and. its techniques. **– K2**

CO. 3.Comprehend the basics of Raman and their instrumentation techniques **– K4**

CO. 4.Understand the physics behind NMR and ESR spectroscopy and its instrumentation. **– K2**

CO. 5.Understand Mossbauer spectroscopic techniques and hyperfine spectral lines **– K2**

Relationship Matrix for Course Outcome, Programme Outcomes and Programme Specific Outcomes

M.Sc. Physics – PSPH

Title of the Course: SPECTROSCOPY						**Course Code:P3R2PHCC12**					
Course Outcomes (COs)	**Programme Outcomes (POs)**					**Programme Specific Outcomes (PSOs)**					**Mean Score of COs**
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	
CO1	3	2	3	2	3	2	2	2	2	3	2.4
CO2	3	2	3	2	3	3	2	2	2	2	2.4
CO3	2	2	2	2	2	2	2	3	2	3	2.2
CO4	3	2	2	3	3	2	3	2	2	2	2.4
CO5	3	3	2	3	2	3	2	2	2	2	2.4
	Mean Overall Score										**2.36**
	Result										**High**

TITLE OF THE COUSE	**:**	**MAJORPRACTICAL- III (General & Electronics)**
CATEGORY	**:**	**CORE COURSE**
COURSE CODE	**:**	**P3R2PHCC13P**
NATURE OF SKILL	**:**	**SKILL DEVELOPMENT**

MARKS : CIA + EXTERNAL =40+60 =100		**HOURS/WEEK**	**: 06**
CREDITS : 05		**TOTAL INST. HOURS**	**: 96**

COURSE OBJECTIVES:

The main objectives of this course are **:**

C. obj - 1. To understand the concepts of resistivity and Hall coefficients.

C. obj - 2.To Study the Magnetic susceptibility and Dielectric constant.

C. obj – 3. To Study the concept of refractive index of liquid.

C. obj – 4.To learn the concepts of basic gates.

C. obj – 5. To acquire knowledge about memory circuit.

Any fifteen Experiments (choosing a minimum of eight experiments from each part)

A. General Experiments

1. Four probe method – Determination of resistivity of powdered samples.
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. Charge of an electron by spectrometer.
9. Polarizability of liquids by finding the refractive indices at different wavelengths.
10. Determination of wavelength of monochromatic source using Biprism.
11. Determination of specific rotatory power of a liquid using Polarimeter.
12. Rydberg's constant using spectrometer.
13. Forbe's method of determining thermal conductivity.
14. Determination of dielectric loss using CRO.

15. Particle size determination using He-Ne Laser.
16. Laser diode characteristics.

B. Electronics Experiments

1. Logic gates – Universality of NAND gates Using IC's
2. Logic gates – Universality of NOR gates Using IC's
3. Verification of Demorgans theorems and Boolean Expressions
4. Construction of dual regulated power supply
5. Digital to analog converter - R-2R method and Weighted method
6. Study the function of multiplexer and demultiplexer
7. Study the function of decoder and encoder
8. Flip flops
9. Half adder and Full adder (using only NAND & NOR gates)
10. Half subtractor and Full Subtractor (using only NAND & NOR gates)
11. Digital comparator using XOR and NAND gates
12. BCD to seven segment display
13. Study of counter using IC 7490 (0-9 and 00-99)
14. Measurement of Resistance using AC Wheatstone bridge

REFERENCE BOOKS:

1. Atextbookof practicalPhysics–M.N.Srinivasanandothers–Sultan Chand&Sons, NewDelhi.

2. Practical Physics, S. Somasundaram, V. Balachandran, S. Padmanathan, Apsara Publications, Tiruchirapalli

ON LINE RESOURCE:

1.https://iitg.ac.in/subhasht/ph511%20July-Dec-2015/Manual%20PH511.pdf

2.https://www.amazon.in/Practical-Approach-Analog-Digital-Electronics/dp/935030368

COURSE OUTCOMES:

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

CO-1. Acquire the Knowledge in the fundamentals of resistivity **-K1**

CO-2 Understand the Dielectric constant . **-K2**

CO-3. Determine the refractive index of liquid **-K5**

CO-4. Simplify the Demorgans theorem **-K4**

CO-5. Construct the sequential circuit **-K3**

Relationship Matrix for Course Outcome, Programme Outcomes and Programme Specific Outcomes

M.Sc. Physics – PSPH

Title of the Course:Major Practical-III						**Course Code:P3**R2PHCC13P					
Course Outcomes (COs)	**Programme Outcomes (POs)**					**Programme Specific Outcomes (PSOs)**					**Mean Score of COs**
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	
CO1	3	3	2	2	3	2	3	2	2	2	2.4
CO2	3	3	3	2	2	3	3	1	2	2	2.4
CO3	2	3	3	2	2	3	3	3	2	2	2.5
CO4	3	3	2	1	3	3	3	3	2	2	2.4
CO5	3	2	2	3	3	3	2	2	3	2	2.5
	Mean Overall Score										**2.44**
	Result										**High**

Skill Enhancement Course

TITLE OF THE COURSE : NON LINEAR OPTICS

CATEGORY : SKILL ENHANCEMENT COURSE

COURSE CODE : P3R2PHSEC 1:1

NATURE OF SKILL : SKILL DEVELOPMENT

MARKS : CIA+EXTERNAL=25+75 **HOURS WEEK : 06**

CREDIT : 3 **TOTAL INST HOURS : 96**

COURSE OBJECTIVES:

The main objectives of this course are

C obj-1. To understand the different types of Lasers

C obj-2 To Acquie the skill in fibre optics

C obj-3 To study the different harmonic generations

C obj-4 To study the Fiber optical communication systems

C obj-5 To study the Non linear optical materials

Unit 1: Lasers **(Inst Hrs:18)**

Gas lasers – He-Ne, Az + ion lasers – Solid state lasers – Ruby – Nd- YAG, Ti Sapphire – Organic dye laser – Rhoda mine(ICT) – Semiconductor lasers – Diode laser, Ga-As laser

Unit 2: Fiber Optics **(Inst Hrs:18)**

Step – Graded index fibers – wave propagation – Fiber modes – Single and multimode fibers – Numerical aperture – Dispersion – Fiber bandwidth – Fiber loss(seminar) –Scattering, Absorption, Bending ,Leaky mode and mode couplings losses- Attenuation coefficient – Material absorption.

Unit 3: Introduction to Nonlinear Optics **(Inst Hrs:20)**

Wave propagation in an anisotropic crystal – Polarization response of materials to light – Harmonic generation – Second harmonic generation(ICT) – Sum and difference frequency generation – Phase matching – Third harmonic generation – disability – self focusing

Unit 4: Multiphoton Processes **(Inst Hrs:20)**

Two photon process – Theory and experiment – Three photon process Parametric generation of light – Oscillator – Amplifier – Stimulated Raman scattering – Intensity dependent refractive index optical Kerr effect(seminar) – photorefractive- electron optic effec**ts**

Unit 5: Nonlinear Optical Materials **(Inst Hrs:20)**

Basic requirements – In organics – Borates – Organics – Urea, Nitro aniline – Semi organics – Thio urea complex – X-ray diffraction – FT-IR - FT-NMR(Assignment)- Second harmonic generation – Laser induced surface damage threshold.

Books for Study

1. Nonlinear Optics, Robert W. Boyd, 2nd Edn., Academic Press, New York, 2003
2. Laser Fundamentals, William T. Silvast, Cambridge University Press, Cambridge 2003

Books for Reference

1. Lasers and Nonlinear Optics,B.B. Laud, 2nd Edn. New Age International (P) Ltd., New Delhi, 1991
2. Fiber-Optics Communication Systems, Govind P. Agarwal, ,3rd Edn. John Wiley & Sons, Singapore 2003
3. Nonlinear Optics – Basic Concepts D.L. Mills, Springer, Berlin 1998.

ON LINE RESOUECE

https://www.brown.edu/research/labs/mittleman/sites/brown.edu.research.labs.mittleman/files/uploads/lecture35_0.pdf

https://www.brown.edu/research/labs/mittleman/sites/brown.edu.research.labs.mittleman/files/uploads/lecture35_0.pdf

COURSE OUT COMES

On the successful completion of the course the students will ab able to:

CO-1. Explain the basic principles and operation of a laser.-K2

CO-2.List the different types of Fiber-K1

CO-3. Understand the Non linear optics-k2

CO-4. Evaluate the Multiphoton processes-K4

CO-5. Analyze the Non linear optical materials-K4.

Relationship Matrix for Course Outcome, Programme Outcomes and Programme Specific Outcomes

M.Sc. Physics – PSPH

Title of the Course:Non linear Opticss						**Course Code:P3**R2PHSEC1:1					
Course Outcomes (COs)	**Programme Outcomes (POs)**					**Programme Specific Outcomes (PSOs)**					**Mean Score of COs**
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	
CO1	3	3	2	2	3	3	3	1	2	3	2.5
CO2	3	3	3	2	2	3	3	1	2	2	2.4
CO3	2	3	3	2	2	3	3	3	2	2	2.5
CO4	3	3	2	1	3	3	3	3	2	2	2.4
CO5	3	2	2	3	3	3	3	2	2	2	2.5
	Mean Overall Score										**2.46**
	Result										**High**

TITLE OF THE COURSE : MEDICAL PHYSICS

CATEGORY : SKILL ENHANCEMENT COURSE

COURSE CODE : P3R2PHSEC1:2

NATURE OF SKILL : EMPLOYABILITY

MARKS : CIA+EXTERNAL=25+75 HOURS WEEK : 06

CREDIT :3 TOTAL INST HOURS: 96

COURSE OBJECTIVES

The main objectives of this course are

C obj-1. To understand the general concepts in radiation and its interaction and dose measurement.

C obj-2 To Understand physics principle involved Medical physics

C obj-3. To apply the physics concepts in clinical trials.

C obj-4 To educate scientifically the principles of radiation and its effect in the medical field

C obj-5 To emphasize the significance of various medical techniques and therapy

UNIT – I (Inst Hrs:18)

Basic concepts in Radiation Dosimetry: Definitions of Dosimetric Quantities-units and relationship between DQ- linear energy transfer- tissue weighting factor-charged particle equilibrium-biological effects of radiation(ICT).

UNIT –II (Inst Hrs:18)

Interaction of gamma rays and X-rays with matter: Introduction- typesof interaction with matter(Assignment) – over all interaction of photons with matter.

UNIT – III (Inst Hrs:20)

Treatment planning in radiation therapy- photon beam treatment planning-electron beam treatment planning(seminar).

UNIT – IV (Inst Hrs:20)

Image-Guided radiation therapy: Introduction – Rationale of IGRT- current available IG techniques(ICT) – traditional IGRT technologies –real time tracking systems – image registration and correction strategies – image guided Adaptive treatment (IG-ART) - management of respiratory motion.

UNIT –V **(Inst Hrs:20)**

Magnetic Resonance Imaging (MRI): MRI – contrasts in MRI – Physiological and functional MRI – MRI safety – future MRI applications. CT and MRI Radiotherapy: CT based treatment simulation and planning – MRI in Radiotherapy(Assignment).

BOOKS FOR STUDY:

1. Introduction to Medical Physics – Muhammad Maqbool – Springer International Publishing (2017).

2.Medical Physics-John R Cameron and jamesG,Skofronick, John Wiley and Sons-Interscience Oublications,1978.

BOOKS FOR REFERENCE:

1. Attix FH (1986) An introduction to radiological physics and radiation dosimetry, Wiley.
2. Hendee WR, Ritenour ER (2002) Medical imaging physics, 4th edn. Wiley-Liss. xix, New York

ONLNE RESOURCE

https://www.routledge.com/Introduction-to-Medical-Physics/Keevil-Padovani-Tabakov-Greener-Lewis/p/book/9781498744799

COURSE OUT COME

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

CO-1 Understand basic concepts of Radiation. **–K2**

CO-2.Explain the types of Interaction. **-K2**

CO-3.Analyze the different radiation therapy **-K4**

CO-4.Explain the radiation therapy **-K2**

CO-5.Apply the various technique in MRI **-K3**

Relationship Matrix for Course Outcome, Programme Outcomes and Programme Specific Outcomes

M.Sc. Physics – PSPH

Title of the Course :Medical Physics						**Course Code:P3R2PHCC1:2**					
Course Outcomes (COs)	**Programme Outcomes (POs)**					**Programme Specific Outcomes (PSOs)**					**Mean Score of COs**
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	
CO1	3	3	2	2	3	3	3	2	2	3	2.6
CO2	3	3	3	2	2	3	3	2	2	2	2.5
CO3	2	3	3	2	2	3	3	3	2	2	2.5
CO4	3	3	2	1	3	3	3	3	2	2	2.4
CO5	3	2	2	3	3	3	3	2	3	2	2.6
	Mean Overall Score										**2.52**
	Result										**High**

TITLEOFTHECOURSE : NANOSCIENCE AND NANOTECHOLOGY

CATEGORY : CORE COURSE

COURSECODE : P4R2PHCC14

NATURE OF SKILL : EMPOLYABILITY

MARKS : CIA +EXTERNAL=25+75 HOURS/WEEK : 06

CREDITS : 05 TOTAL INST.HOURS : 96

COURSE OBJECTIVES:

The main objectives of this course are:

C obj-1. To study the applications of nanomaterials.

C obj-2. To understand the fundamentals, nucleation and kinetics of nanoparticles.

C obj-3. To learn the nanoscience and nanotechnology.

C obj-4.To get to know about properties of nanomatedrials

C obj-5.To acquire knowledge in various applications of nano materials

UNIT-I: BACKGROUND TO NANOTECHNOLOGY (Inst. Hrs:20)

Scientific revolution- Atomic structures-Molecular and atomic size- Bohr radius - Emergence of Nanotechnology - Challenges in Nanotechnology (Assignment) - Carbon age - New form of carbon (from Graphene sheet to CNT).

UNIT-II: NUCLEATION (Inst. Hrs:20)

Influence of nucleation rate on the size of the crystals- macroscopic to microscopic crystals and nano crystals - large surface to volume ratio, top-down and bottom-up approaches-self-assembly process (Assignment)-grain boundary volume in nanocrystals-defects in nanocrystals-surface effects on the properties.

UNIT-III: TYPES OF NANOSTRUCTURES (InstHrs:20)

Definition of a Nano system - Types of Nanocrystals-One Dimensional (1D)-Two Dimensional (2D) -Three Dimensional (3D) nanostructured materials - Quantum dots (ICT)-Quantum wire- Core/Shell structures.

UNIT-IV: NANOMATERIALS AND PROPERTIES (InstHrs:20)

Carbon Nanotubes (CNT) - Metals (Au, Ag) - Metal oxides (TiO2, ZnO) - Semiconductors (Si, Ge,) - Ceramics and Composites - Dilute magnetic semiconductor- Biological system - DNA and RNA - Lipids - Size dependent properties (ICT)- Mechanical, Physical and Chemical properties.

UNIT-V: APPLICATIONS OF NANOMATERIALS (InstHrs:16)

Molecular electronics and nanoelectronics - Quantum electronic devices - CNT based transistor and Field Emission Display (Seminar) - Biological applications - Biochemical sensor - Membrane based water purification.

BOOKS FOR STUDY:

1. Nanostructured Materials and Nanotechnology -Hari Singh Nalwa, Academic Press, 2002.
2. Nanotechnology: Basic science and Emerging technologies, M. Wilson, K. Kannangara, G. Smith, M. Simmons, B. Raguse, Overseas Press India Pvt Ltd., New Delhi, First Edition, 2005.
3. The chemistry of nanomaterials: Synthesis, properties and applications, C.N.R.Rao, A.Muller, A.K.Cheetham (Eds), Wiley VCH VerlagGmbh&Co, Weinheim, 2004.
4. Nanoscale Materials Science, Kenneth J. Klabunde (Eds), John Wiley & Sons, InC, 2001.
5. Nanofabrication towards biomedical applications, C.S.S.R.Kumar, J.Hormes, C.Leuschner, VCH Verlag GmbH & Co, Weinheim, 2004.

BOOKS FOR REFERENCE:

1. Organic and Inorganic Nanostructures, A. Nabok- Artech House, 2005.
2. Nanoscience: "Nanotechnologies and Nanophysics", C. Dupas, P.Houdy, M. Lahmani, Springer-Verlag Berlin Heidelberg, 2007.
3. Introduction to Nanotechnology, Charles P. Poole, Frank J Owens, Wiley- Interscience.
4. Nanosystem Characterization Tools in the Life Sciences edited by Challa Kumar.
5. Naostructures and Nanomaterials: Synthesis, properties and applications, G. Cao, Imperical College Press, 2004.
6. Nano Electronics and information Technology,W. Rainer, Wiley, 2003.
7. Nano systems, K.E.Drexler, Wiley, 1992.

ONLINERESOURCE:

1. **https://web.pdx.edu/~pmoeck/phy381/intro-nanotech.pdf**

COURSE OUTCOMES:

Onthesuccessfulcompletionof thecoursethestudentswillbeableto:

CO-1Define the fundamentals of nanoscience and nanotechnology . **-K1**

CO-2. Knowledge about synthesis of nanomaterials. **-K3**

CO-3. Acquire knowledge about nanoscale and devices. **-K5**

CO-4. Understand the properties of nanomaterials. **-K4**

CO-5. Understand the physical and chemical synthesis methods of nanomaterial. **-K2**

Relationship Matrix for Course Outcome, Programme Outcomes and Programme Specific Outcomes

M.Sc. Physics – PSPH

Title of the Course : Nano Science and Nano Technology						**Course Code:P4R2PHCC14**					
Course Outcomes (COs)	**Programme Outcomes (POs)**					**Programme Specific Outcomes (PSOs)**					**Mean Score of COs**
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	
CO1	3	3	2	2	3	3	3	2	2	3	2.6
CO2	3	3	3	2	2	3	3	1	2	2	2.4
CO3	2	3	3	2	2	3	3	3	2	2	2.5
CO4	3	3	2	1	3	3	3	3	2	2	2.4
CO5	3	2	2	3	3	3	3	2	3	2	2.6
	Mean Overall Score										**2.5**
	Result										**High**

Generic Elective Courses (Offered by the Department)

TITLE OF THE COURSE : SOLAR ENERGY UTILIZATION

CATEGORY : GENERIC ELECTIVE COURSE

COURSE CODE : P4R2PHGEC1

NATURE OF SKILL : EMPLOYABILITY

MARKS:CIA+EXTERNAL=25+75 HOURS WEEK : 06

CREDIT : 3 TOTAL INST HOURS : 96

COURSE OBJECTIVES

The main objectives of this course are

C obj-1. To understand the general concepts in Heat transfer and radiation.

C obj-2 To Understand the basis principle of solarcollecter.

C obj-3. To Know the various types of Solas Heater.

C obj-4 T.o educate scientifically the principles of Solarenergyconversion.

C obj-5 To emphasize the significance of Nanomaterials

UNIT I: HEAT TRANSFER & RADIATION ANALYSIS (Inst Hrs:18)

Conduction, Convection and Radiation – Solar Radiation at the earth's surface - Determination of solar time – Solar energy measuring instruments.

UNIT II: SOLAR COLLECTORS (Inst Hrs:18)

Physical principles of conversion of solar radiation into heat flat plate collectors - General characteristics – Focusing collector systems – Thermal performance evaluation of optical loss.

UNIT III: SOLAR HEATERS (Inst Hrs:18)

Types of solar water heater - Solar heating system – Collectors and storage tanks – Solar ponds – Solar cooling systems.

UNIT IV: SOLAR ENERGY CONVERSION (Inst Hrs:18)

Photo Voltaic principles – Types of solar cells – Crystalline silicon/amorphous silicon and Thermo - electric conversion - process flow of silicon solar cells- different approaches on the process- texturization, diffusion, Antireflective coatings, metallization.

UNIT V: NANOMATERIALS IN FUEL CELL APPLICATIONS (Inst Hrs:18)

Use of nanostructures and nanomaterials in fuel cell technology - high and low temperature fuel cells, cathode and anode reactions, fuel cell catalysts, electrolytes, ceramic catalysts. Use of nano technology in hydrogen production andstorage.

BOOKS FOR STUDY:

1. Solar energyutilization -G.D. Rai –Khanna publishers – Delhi 1987.
2. Solar energy – principles of thermal collection & storage – S.P. Sukhatme, TMH Delhi 1984.
3. MaheshwarSharon,MadhuriSharon, Carbon"Nano formsandApplications", McGraw-Hill,2010.

BOOKS FOR REFERENCE:

1. Solar Energy – An Introduction to Physic s – R.H.Romer,W.H.Freeman.(1976)

ONLINE RESOURCE

https://solareis.anl.gov/guide/solar/index.cfm

COURSE OUT COMES

On the successful completion of the course the students will ab able to:

CO-1.understand basic concepts of Radiation. **–K2**

CO-2 apply the Physics Principle of conversion solar radiation **-K3**

CO-3.explain the types of Solar Heater. **-K2**

CO-4.demonstrate the Solar Energy conversion **-K2**

CO-5.apply the Nanomaterials in Fuel cell Applications. **-K3**

Relationship Matrix for Course Outcome, Programme Outcomes and Programme Specific Outcomes

M.Sc. Physics – PSPH

Title of the Course : Solar Energy Utilization						**Course Code:P4R2PHCCGEC1**					
Course Outcomes (COs)	**Programme Outcomes (POs)**					**Programme Specific Outcomes (PSOs)**					**Mean Score of COs**
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	
CO1	3	3	2	2	3	3	3	2	2	3	2.6
CO2	3	3	3	2	2	3	3	1	2	2	2.4
CO3	2	3	3	2	2	3	3	3	2	2	2.5
CO4	3	3	2	1	3	3	3	3	2	2	2.4
CO5	3	2	2	3	3	3	3	2	3	2	2.6
	Mean Overall Score										**2.5**
	Result										**High**

TITLEOFTHECOURSE : PROJECT WORK

CATEGORY : CORE COURSE

COURSECODE : P4R2PHCC15PW

NATUREOFSKILL : SKILL DEVELOPMENT

MARKS : CIA +EXTERNAL=40+60 = 100 HOURS/WEEK : 18

CREDITS : 18 TOTALINST.HOURS : 96