M.Sc. Physics

SEM	Course Code	Course	Course Title	Ins.Hrs / Week	Credit	Marks		Total
						CIA	ESE	
I	20PPH1CC1	Core– I	Classical Dynamics and Relativity	6	5	25	75	100
	20PPH1CC2	Core – II	Mathematical Methods for Physicist	6	5	25	75	100
	20PPH1CC3	Core– III	Electronic Devices and Circuits	6	4	25	75	100
	20PPH1CC4P1	Core– IV	Advanced General Physics - I :Practicals	3	2	10	40	50
	20PPH1CC4P2		Advanced General Physics - II :Practicals	3	2	10	40	50
	20PPH1DE1	DSE – I #		6	4	25	75	100
			TOTAL	**30**	**22**			**500**
II	20PPH2CC5	Core– V	Advanced Mathematical Physics	6	5	25	75	100
	20PPH2CC6	Core– VI	Atomic and Molecular Spectroscopy	6	5	25	75	100
	20PPH2CC7	Core– VII	Electromagnetic Theory	6	4	25	75	100
	20PPH2CC8P1	Core– VIII	SolidStatePhysics :Practicals	3	2	10	40	50
	20PPH2CC8P2		Analog Electronics :Practicals	3	2	10	40	50
	20PPH2DE2	DSE – II #		6	4	25	75	100
			TOTAL	**30**	**22**			**500**
III	20PPH3CC9	Core– IX	Nuclear and Particle Physics	6	5	25	75	100
	20PPH3CC10	Core– X	Quantum Mechanics	6	5	25	75	100
	20PPH3CC11	Core– XI	Statistical Mechanics	6	4	25	75	100
	20PPH3CC12P1	Core– XII	Digital Electronics :Practicals	3	2	10	40	50
	20PPH3CC12P2		Numerical Programming in Physics: Practicals	3	2	10	40	50
	20PPH3DE3	DSE – III #		6	4	25	75	100
	20PPH3EC1	Extra Credit Course – I	Online Course (MOOC)	-	1*	-	-	-
			TOTAL	**30**	**22**			**500**
IV	20PPH4CC13	Core– XIII	Solid State Physics	6	5	25	75	100
	20PPH4CC14	Core– XIV	Electronic Communication	6	5	25	75	100
	20PPH4CC15P1	Core– XV	Microprocessor and Microcontroller :Practicals	3	3	10	40	50
	20PPH4CC15P2		Numerical Simulations in Physics :Practicals	3	2	10	40	50
	20PPH4DE4	DSE -IV #		6	4	25	75	100
	20PPH4PW	Project		6	5	-	100	100
	20PCNOC		Online Course (Compulsory)	-	1	-	-	-
	20PPH4EC2	Extra Credit Course – II	Physics for career examinations	-	5*	-	100	100*
			TOTAL	**30**	**24**			**500**
			GRAND TOTAL		**90**			**2000**

*Not considered for grand total and CGPA

Core Based Electives

SEMESTER	COURSE CODE	COURSE TITLE
I	20PPH1CE1A	Medical Physics and Ultrasonics
	20PPH1CE1B	Advanced Topics in Physics
II	20PPH2CE2A	Computational Physics
	20PPH2CE2B	Nanoscience and Technology
III	20PPH3CE3A	Microprocessor and Microcontroller
	20PPH3CE3B	Physics of Liquid Crystals
IV	20PPH4CE4A	Crystal Growth and Thin Films
	20PPH4CE4B	Fibre Optics and its Applications

Semester	Code	Course	Title of the Course	Hours	Credits	Max. marks	Internal marks	External marks
I	20PPH1CC1	Core – I	CLASSICAL DYNAMICS AND RELATIVITY	6	5	100	25	75

Course Outcomes :

1. Relate the underlying merits and demerits in the concept of Newton, Lagrangian, Hamilton and Hamilton-Jacobi theory.
2. Understand the need for action and angle variables and the applications of canonical transformation
3. Examine the normal modes of small oscillations and the dynamics of a rigid body
4. Debate the need for special theory of relativity and the Minkowski 4D-space
5. Construct mathematical modelsfor dynamical problems in the wide research area

Unit – I: Lagrangian Dynamics 18 hours

Constraints – generalized co-ordinates – principle of virtual work – D'Alembert'sprinciple – Lagrange's equation from the D' Alembert's principle – Newton's equation of motion from the Lagrange's equation- ##Superiority of Lagrangian mechanics over Newtonian approach##.

Derivation of Lagrange's equation from the Hamilton's principle – Applications: simple pendulum – Atwood's machine –motion under central force – series LC circuit

Unit – II: Hamiltonian Dynamics 18 hours

Generalized momentum and cyclic co-ordinates – Hamilton's equations – deduction of Hamilton's principle from the D'Alembert's principle – deduction of Hamilton's equation from the modified Hamilton's principle – Examples: Harmonic oscillator – ##Compound pendulum## — motion of a particle in a central force field - principle of least action-Jacobi's form and other forms of the principle of least action

Unit – III: Poisson's Brackets and Hamilton – Jacobi Theory 18 hours

Poisson's Bracket and its applications – canonical transformations – invariance of Poisson Bracket with respect to canonical transformations – Hamilton-Jacobi theory– solution of Harmonic oscillator problem using Hamilton-Jacobi theory– Action and Angle variables – Kepler's problem -– Hamilton's characteristic function for a conservative system.

Unit – IV: Small Oscillations and Rigid-body Dynamics 18 hours

General theory of small oscillations – Equation of motion for small oscillations – solution of eigen value equations – normal co-ordinates and normal frequencies of vibration – vibrations of a linear triatomic molecule.

Euler's angle – equation of motion of rigid body – Euler's equations – motion of a symmetric top under the action of gravity.

Unit – V: Relativistic Mechanics 18 hours

Relativistic energy – relation between momentum and energy and conservation laws – transformation of momentum and energy – Force in relativistic mechanics – The Lagrangian and Hamiltonian of a particle in relativistic mechanics-Minkowski space and Lorentz transformations – ##World point and world line – Four vectors-Examples##.

self study portion

Book for study:

1. J.C. Updhaya, Classical Mechanics, Himalaya Publishing House, 2005

   Unit – I: Section 2.3 – 2.7, 2.8 (Examples:2, 3,7& 8), 2.11, 2.12
   Unit – II: Section 3.2, 3.5,3.7, 5.3, 5.5, 5.11
   Unit – III: Section 6.3,7.2, 7.6, 8.2,8.3,8.4,8.5
   Unit – IV: Section 9.2, 9.4 , 9.6, 10.3,10.7, 10.14
   Unit – V: Section 13.3, 13.5, 13.6, 13.7, 13.8, 13.11, 14.2, 14.3, 14.4, 14.5, 14.6

Books for reference:

1. H.Goldstain,Classical Mechanics, NarosaPublishing House, 2008
2. N.C.Rana and P.S.Joag,Classical Mechanics, Tata McGraw. Hill, 1991

Online Course Reference:

Unit – I: https://classcentral.com/course/swayam-theoritical-mechanics-14332

Online Reference:

www.physics.iisc.ernet.in

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

Semester	**Code**			**Title of the Paper**			**Hours**		**Credits**	
I	**20PPH1CC1**			**CLASSICAL DYNAMICS AND RELATIVITY**			**6**		**5**	
Course Outcomes (COs)	Programme Outcomes (POs)					Programme Specific Outcomes (PSOs)				
	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	✔	✔	✔	✔		✔	✔	✔	✔	
CO2	✔			✔		✔	✔	✔	✔	
CO3	✔	✔		✔		✔	✔	✔	✔	
CO4	✔			✔	✔	✔			✔	
CO5	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔
Number of Matches= 36, Relationship : High										

Preparedby:
Dr. R. Radhakrishnan

Checked by:
Dr. A. S. HajaHameed

Semester	Code	Course	Title of the Course	Hours	Credits	Max. marks	Internal marks	External marks
I	20PPH1CC2	Core – II	MATHEMATICAL METHODS FOR PHYSICISTS	6	5	100	25	75

Course Outcomes:

1. Orthogonal curvilinear coordinates, gradient, divergence,curl and Laplacian operators in these and their applications.
2. Basic concepts of linear vector spaces, orthogonalization process, matrices and matrix manipulations.
3. Tensors and their applications in the study of physical phenomena.
4. Concepts of complex analysis, Cauchy-Riemann condition, calculus of residues and evaluation of definite integrals.
5. Statistical tools and statistical distributions.

Unit – I: Vector Analysis **18 hours**

Gradient, divergence, curl, and Laplacian – Orthogonal curvilinear coordinate systems – spherical coordinate system and ##cylindrical coordinate system ## – Expression for gradient, divergence, curl and Laplacian – applications: Hydrodynamics – equation of continuity – Euler's equation of motion – The equation of heat flow in solids.

Unit – II: Linear Vector Space and Matrices **18 hours**

Linear Vector Space**:** definition – linear independence, basis and expansion theorem – inner product and unitary spaces - orthonormal set - Schwartz Inequality-Gram-Schmidt's orthogonalization process

Special types of matrices – transpose of a matrix – the conjugate transpose – Hermitian and skew-Hermitian matrices – orthogonal matrices – trace of a matrix – eigen values, eigen vectors – power of a matrix – matrices in physics.

Unit – III: Tensors **18 hours**

n-dimensional space – superscripts and subscripts – coordinate transformations – indicial and summation conventions – dummy and real indices – Kronecker delta symbol – scales, contravariant vectors and covariant vectors – tensors of higher ranks – algebraic operations of tensors – symmetric and anti symmetrictensors – applications – tensors in elasticity.

Unit – IV Complex Variables **18 hours**

The derivative of a complex function *f*(*z*) and its analyticity – Cauchy – Riemann conditions – harmonic functions- Cauchy's Integral theorem - Cauchy's Integral formula – Laurent's series – zeros of a complex function-evaluation of residues-Cauchy Residue theorem –evaluation of definite integrals of the form $\int_0^{2\pi} f(sin\theta, cos\theta)d\theta$ and $\int_{-\infty}^{+\infty} f(x)dx$

Unit – V: Probability and Statistics **18 hours**

Mathematical definition – binomial theorem of probability – measures of central tendency, averages – Karl Pearson's coefficient of correlation – standard deviation as the sum of distribution – Binomial distribution – Poisson's distribution – Normal distribution.

Books for Study:

1. Sathya Prakash, Sultan Chand & Sons, Mathematical Physics, New Delhi,2011
Unit – I: Section1.15, 1.19
Unit – II: Section 1.18, 2.5, 2.6, 2.7, 2.9, 2.10, 2.17, 2.18, 2.19, 2.31, 2.36, 2.37, 2.39

2. A.W. Joshi, Matrices and Tensors in Physics, New Age International, New Delhi,1995

Unit – III: Section 3.2, 3.3, 3.4, 3.5, 3.6, 3.7, 3.8, 3.9, 3.10, 3.11, 3.38
3. Charlie Harper, Introduction to Mathematical Physics, PHI,New Delhi,2006
Unit – IV: Section 6.10, 6.11, 6.14, 6.16, 6.20, 6.23, 6.24, 6.25
4. A.K.Ghatak, I.C. Goyal and S.J. Chua,Mathematical Physics,Macmillman India Ltd, New Delhi,1995
Unit – V: 12.2, 12.7, 12.10, 12.12, 12.13, 12.20, 12.21, 12.22

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

Semester	**Code**			**Title of the Paper**			**Hours**		**Credits**	
I	**20PPH1CC2**			**MATHEMATICAL METHODS FOR PHYSICISTS**			**6**		**5**	
Course Outcomes (COs)	Programme Outcomes (POs)					Programme Specific Outcomes (PSOs)				
	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	✓	✓	✓		✓	✓	✓	✓		
CO2	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
CO3	✓	✓		✓	✓	✓	✓	✓		
CO4	✓	✓		✓	✓	✓	✓	✓		
CO5	✓	✓		✓	✓	✓	✓	✓	✓	✓
Number of Matches= 40, Relationship : High										

Prepared by:
Dr. R. Raj Mohamed

Checked by:
Mr. A. Mohamed Saleem

Semester	Code	Course	Title of the Course	Hours	Credits	Max. marks	Internal marks	External marks
I	20PPH1CC3	Core – III	ELECTRONIC DEVICE AND CIRCUITS	6	4	100	25	75

Course Outcomes :

1. Acquiredthe basic principle and underlying concepts of electronic devices.
2. Gained a clear understanding of operations of electronic circuits.
3. The ability to design and analyze electronic circuits.
4. Learntthe applications of operational amplifier and IC 555and can demonstrate them timer.
5. Been motivated towards research in this field towardsthe applications according to the social needs.

Unit – I: IC Fabrication and GaAs devices **18 hours**

Introduction-advantages and limitations of ICs-classification of ICs-manufacturing process of monolithic ICs-monolithic diodes-resistors and capacitors-Gallium Arsenide devices-GaAs metal semiconductor-MESFET-of GaAs -depletion mode MESFET.

Unit –II: Solid State Devices **18 hours**

Construction, operation and V-I characteristics of special devices: tunnel diode – Gunn diode – MOSFET – Enhancement MOSFET- SCR – SCR half wave rectifier – SCR Full wave rectifier – TRIAC – DIAC – UJT – UJT relaxation oscillator

Unit – III: Operational Amplifiers **18 hours**

Instrumentation amplifier – Op-Amp circuits using diodes: half wave rectifier, full wave rectifier, peak detector, clipper and clamper circuits – sample and hold circuit – logarithmic and antilogarithmic amplifier.

Multipliers – dividers – differentiators – integrators –electronic analog computation: simulation of 2^{nd} order differential equation – simulation of transfer function

Unit – IV: Comparators, Waveform Generators and Filters **18 hours**

Comparators – Zero crossing detector – window detector – Schmitt trigger – astablemulti-vibrator – mono-stablemulti-vibrator – Triangular wave generator.

RC phase shift oscillator – Wien's bridge oscillator – function generator – RC active filters: first order low pass, high pass and band pass filters.

Unit – V: 555 Timer and Phase –Locked Loops (PLL) **18 hours**

Introduction – description and functional diagram of 555 timer – monostable operation – frequency divider – astable operation – Frequency Shift Keying(FSK) generator.

PLL Basic principle – analog phase detector – digital phase detector – voltage controlled oscillator (VCO) – PLL applications – frequency multiplication/division – frequency translation

Book for Study:

1. S Salivahanan, N Suersh Kumar & A Vallavaraj, Electronic Devices and Circuits, Tata McGraw-Hill Publishing Company Limited, New Delhi, Second Edition, 2009.
   Unit–I: Section 19.1,19.2,19.3,19.4,19.5
   Unit–II:Section 5.8, 8.3, 8.5, 8.7, 8.8, 17.2
2. D.Roy Choudhury and ShailB. Jain, Linear Integrated Circuits, New Age International Publishers, Third Edition
   Unit–III: Section 4.3, 4.6,4.6.1-4.6.5, 4.7 – 4.12
   Unit–IV: Section5.1,5.2,5.2.1,5.3,5.4-5.7, 7.2, 7.2.1,7.2.4,7.2.5
   Unit–V: Section8.1-8.3, 8.3.1,8.4,8.4.1,9.2,9.3.1,9.3.2,9.4,9.7,9.7.1,9.7.2

Book for reference

1. V.K. Mehta, Rohit Mehta, Principles of Electronics, Reprint 2016. S. Chand Publications.
2. Ramkant A. Gayakwad, Op- Amps and Linear Integrated Circuits, 4th Edition, Prentice Hall of India. 2015.

Online reference

1. https://nptel.ac.in/courses/117/107/117107095/
2. https://nptel.ac.in/content/storage2/courses/117104071/ui/Course_home-26.htm-

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

Semester	**Code**			**Title of the Paper**			**Hours**		**Credits**	
I	**20PPH1CC3**			**ELECTRONIC DEVICE AND CIRCUITS**			**6**		**5**	
Course Outcomes (COs)	Programme Outcomes (POs)					Programme Specific Outcomes (PSOs)				
	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	✓	✓		✓	✓	✓	✓	✓	✓	✓
CO2	✓	✓		✓		✓	✓		✓	✓
CO3	✓			✓		✓	✓	✓		✓
CO4	✓	✓	✓			✓	✓	✓		✓
CO5	✓	✓	✓	✓	✓	✓		✓	✓	
Number of Matches= 37, Relationship : High										

Prepared by:
Mr. S. Mohamed Ibrahim Sulaiman Sait

Checked by:
Mr. A. Mohamed Saleem

Semester	Code	Course	Title of the Course	Hours	Credits	Max. marks	Internal marks	External marks
I	20PPH1CC4P1	Core – IV	GENERAL PHYSICS	3	2	50	10	40

Course Outcomes:

1. The principles of elasticity and magnetism.
2. The concepts of Fourier Transforms and Fourier Decomposition of waves.
3. Handling of equipments finding their accuracy and precision.
4. Construction of circuits to perform as desired.
5. Observational skills and analysis using them.

1. Determination of q, n, σ by elliptical fringes method.
2. Magnetic Susceptibility of a Liquid - Guoy's Method.
3. e/m Magnetron.
4. Determination of the Dielectric Constant of a given specimen.
5. Fourier Analysis of Periodic Waveforms.
6. Determination of magnetic susceptibility by Quincke's method.
7. B-H Curve – Determination of the energy loss of a magnetic specimen.
8. Dielectric Constant using Radio Frequency Hartley Oscillator.

Semester	Code	Course	Title of the Course	Hours	Credits	Max. marks	Internal marks	External marks
I	20PPH1CC4P2	Core – IV	OPTICS AND HEAT PRACTICALS	3	2	50	10	40

Course Outcomes:

1. The principles of Optics, Thermal Physics, Polarization and spectrometry.
2. In handling of equipments finding their accuracy and precision.
3. Initial adjustments of the equipments.
4. Observational skills and analysis.
5. The application of the experimental skills developed to solve newer problems.

1. Hartmann's formula: Determination of wave lengths of spectral lines.
2. Ultrasonic Diffraction – Bulk modulus.
3. Charge of an electron by spectrometer.
4. "g" factor determination – ESR spectrometer.
5. Hollow Prism: Polarizability of liquids.
6. Determination of Stefan's constant.
7. Thermal conductivity and Lorentz number determination – Forbe's method.
8. Verification of Richardson – Dushmann equation: Thermionic work function.

Semester	Code	Course	Title of the Course	Hours	Credits	Max. marks	Internal marks	External marks
I	20PPH1DE1A	DSE – I	MEDICAL PHYSICS AND ULTRASONICS	6	4	100	25	75

Course Outcomes:

1. Learnt to measure the electrical signals from human body and analyze the recorded bio-potentialsignals.
2. The ability to develope a physiological assist device for monitoring and treatment proposes for society.
3. The ability to design and demonstrate a newer technology for laser based diagnostic methods and treatment.
4. Understood the conceptsof ultrasonic interferometery and to measure the acoustical parameters of liquids.
5. Learnt the applications of the ultrasonic instruments in industry.

Unit – I: Bio-potential Electrodes and Recorders 18 hours

Components of biomedical instrument system – electrodes – bio-potential recorder – characteristics of the recording system – electrical signals from the heart: electrocardiography (ECG) – electrical signals from brain: electroencephalogram (EEG) – electrical signal from muscles: electromyogram (EMG) – magnetic resonance imaging (MRI).

Unit – II: Physiological Assist Device and Operation Theatre Equipment 18 hours

Pacemaker – energy requirements to excite heart muscles – external and internal pacemaker – defibrillator – AC and DC defibrillators – renal function – dialysis –heamo-dialysis and peritoneal dialysis – peritoneal dialysis unit – ventilators- Microprocessor based ventilators – anesthesia machines– ## **e**lectro diagnostic/therapeutic stimulators ##.

Unit – III: Laser Based Diagnostic Methods and Nuclear Therapy 18 hours

Laser based blood cell counter – laser doppler blood flow meter – principle and theory of fluorescence, reflectance and light scattering spectroscopy – laser based technique for cancer diagnosis: fluorescence and Raman Spectroscopy – photodynamic therapy of tumors – ## nuclear therapy: teletherapy (Co^{60}) – brachytherapy##.

Unit – IV:Ultrasonic Study of Liquid Mixtures and Solutions 18 hours

Ultrasonic study of molecular interactions– preparation of multi component liquid mixtures**:** mole fraction – weight fraction – volume fraction-measurement techniques: ultrasonic interferometer – continuous wave method – pulse echo overlap method – density – viscosity

Ultrasonic velocity in mixtures and solutions: free length theory – collision factor theory – Nomoto'srelation – acoustical parameters: adiabatic compressibility – acoustic impedance – intermolecular free length – molar volume – free volume – internal pressure.

Unit – V: IndustrialApplications of Ultrasound 18 hours

Classifications of ultrasonic applications: low frequency – high intensity applications:ultrasonic welding – ultrasonic cleaning – food industry – high frequency and low intensity application: level meters – thickness measurements– ultrasonic microscopy – acoustic holography (transmission acoustic holography)

Books for Study:

1. Dr.M.Arumugam, Biomedical Instrumentation, Second Edition, Anuradha Publications, Chennai, Reprint 2010.
   Unit I: Section 2.1 – 2.4, 4.1–4.2, 4.3, 4.3.1– 4.3.5, 4.4, 4.4.1–4..4.5, 4.5, 4.5.1–4.5, 10.10, 10.10.1, 10.10.3 –10.10.5, 10.10.8
   Unit II: Section 5.2, 5.2.1, 5.2.2,5.5, 5.5.1, 5.8.1–5.8.4, 6.8, 6.9,5,6.3

Unit III: Section 7.2, 6.10.3

2. Baldevraj, V.Rajendran and P.Palanichamy, Science and Technology of Ultrasonics, Narosa Publications, New Delhi.

Unit IV: Section 6.3, 6.4, 6.4.1 – 6.4.3, 6.5, 6.5.1–6.5.3, 6.7, 6.7.1–6.7.3, 6.8, 6.8.1–6.8.6)
Unit V: Section 5.2, 5.3, 5.3.1-5.3.2, 5.3.4, 5.4, 5.4.1-5.4.4)

Books for Reference:

1. John R. Cameron and James G.Skofronick, Medical Physics, John Wiley Interscience Publication, Canada.
2. S. Svanberg, Atomic & Molecular Spectroscopy (Basic aspects & Practical applications) – 4th Edition, 2007

Online References:

1. https://en.wikipedia.org/wiki/Laser-induced_fluorescence
2. https://www.google.com/search?biw=1366&bih=608&ei=C_djXaayF-Lez7sP-pKMwAU&q=lecture+notes+on+fluorescence%2C+reflectance%2C+light+scattering+and+photodynamic+therapy&oq=lecture+notes+on+fluorescence%2C+reflectance%2C+light+scattering+and+photodynamic+therapy&gs_l=psy-ab.12...0.0..133192...0.0..0.0.0.....0.....gws-wiz.FBc31MSRXnk&ved=0ahUKEwjm4-XC6aDkAhVi73MBHXoJA1gQ4dUDCAo
3. https://cancer.dartmouth.edu/radiation-oncology/teletherapy
4. https://www.mayoclinic.org/tests-procedures/brachytherapy/about/pac-20385159

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

Semester	**Code**			**Title of the Paper**			**Hours**		**Credits**	
I	**20PPH1DE1A**			**MEDICAL PHYSICS AND ULTRASONICS**			**6**		**4**	
Course Outcomes (COs)	Programme Outcomes (POs)					Programme Specific Outcomes (PSOs)				
	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	✓	✓		✓	✓	✓	✓	✓	✓	✓
CO2	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
CO3	✓	✓		✓		✓	✓	✓	✓	✓
CO4	✓	✓		✓		✓	✓	✓		
CO5	✓	✓				✓	✓	✓	✓	✓
Number of Matches= 37, Relationship : High										

Preparedby:
Dr. J. Ebenezar

Checked by:
Captain F. S. Muzammil

Semester	Code	Course	Title of the Course	Hours	Credits	Max. marks	Internal marks	External marks
I	20PPH1DE1B	DSE – I	ADVANCED TOPICS IN PHYSICS	6	4	100	25	75

Course Outcomes :

1. Explain the basic principles of Kerr and non- Kerr media and their underlying rules in recent research.
2. Compare the telescopes used in the astronomy.
3. Know the ideas needed to produce nonlinear waves like soliton.
4. Learn quantum theory for scattering.
5. Operatethe astronomical instruments in our lab.

Unit I: Quantum Theory of Scattering **18 hours**

Scattering: scattering cross section, scattering amplitude-scattering by a central potential: partial wave analysis, asymptotic solution, scattering amplitude, scattering cross section, optical theorem - scattering by an attractive square-well potential–Born approximation –scattering by screened Coulomb potential –##**validity of Born approximation**##.

Unit II: Molecular Orbital Theory **18 hours**

MO treatment of hydrogen molecule –hydrogen molecule: Heitler London theory –VB method of hydrogen molecule ion – sp,sp^2,sp^3hybridizations

Thomas-Fermi model of the atom –Hartree equation –Hartree-Fock equation.

Unit III:Non- linear Waves and Solitons **18 hours**

Linear dispersive and non-dispersive wave propagation-Non-liner dispersive system- John ScottRussel's water tank experiment- cnoidal and solitary wave solution of Korteweg-de vries (K-dV) equation- Fermi-Pasta Ulam(FPU) numerical experiments and recurrence phenomenon- ##**numerical experiments of Zabusky and Kruskal – birth of soliton**## –one soliton solution of the K-dV equation using the Hirota's method.

Unit IV: Optical Electronics **18 hours**

The electro-optic effect: the electro-optic effect in KDP crystal: longitudinal mode -transverse mode. acousto optic effect: Raman-Nath and Bragg regimes of diffractions –experimental set up to observe Raman-Nath diffraction – Raman-Nath acousto-optic modulator- Bragg modulator –##**acousto-optic spectrum analyser**##

Unit V: Astronomical Instruments **18 hours**

Optical telescope: main parts –general properties –special purpose telescope: astrograph-schmidt telescope –infrared telescope –solar telescope –photography techniques- standard spectrograph/scanner –##**characteristics of spectrograph**## –high resolution spectrograph: Echellespectrograph – Fabry-Perot etalon.

##---------- ##**Self study portion**

Text Books

1. G.Aruldhas, Molecular Structure and Spectroscopy
   Unit-I: Section 14.1-14.14
   Unit-II: Section 4.3,4.7,4.8,4.10
2. G.Aruldhas, Quantum mechanics,Second edition
   Unit II: Section 13.8,13.10
3. M. Lakshmanan and S. Rajasekar Nonlinear dynamics: Integrability, Chaos and Patterns,
   Unit-III: Section 11.2,11.3,11.6,11.7,12.2,12.4,12.5
4. K.Thyagarajan, Optical electronics by AjoyGhatak,

Unit-IV: Section 11.2,11.3,11.6,11.7,12.2,12.4,12.5

5. K.D.Abhyankar, Astrophysics, stars and Galaxies (unit 5)
   Unit-V: Section 19.2(a,b,d),19.3(a),19.4(a,b,c)

Books for Reference

1. B. H. Bransden and Joachain, Quantum Mechanics (2nd edition)
2. AjoyGhatak, K.Thyagarajan, Quantum mechanics and field theory
3. Michel Remosissenet, Waves called solitons, Concepts and experiments
4. AjoyGhatak, K.Thyagarajan,Contemporary Optics
5. A. Yariv,Opticalelectronics
6. Jayant Vishnu Narlikar,An Introduction to Cosmology

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

Semester	**Code**			**Title of the Paper**			**Hours**		**Credits**	
I	**20PPH1DE1B**			**ADVANCED TOPICS IN PHYSICS**			**6**		**4**	
Course Outcomes (COs)	Programme Outcomes (POs)					Programme Specific Outcomes (PSOs)				
	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	✓	✓	✓	✓	✓	✓	✓	✓	✓	
CO2	✓		✓			✓	✓	✓	✓	
CO3	✓				✓	✓	✓	✓		
CO4	✓		✓	✓		✓	✓	✓		
CO5	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Number of Matches= 36, Relationship : High										

Prepared by:
Dr. N. Peer Mohamed Sathik

Checked by:
Dr. A. S. Haja Hameed

Semester	Code	Course	Title of the Course	Hours	Credits	Max. marks	Internal marks	External marks
II	20PPH2CC5	Core – V	ADVANCED MATHEMATICAL PHYSICS	6	5	100	25	75

Course Outcomes :

1. Acquired knowledge of methods for solving partial differential equations and familiarized themselveswith separation of variables method.
2. Learnt the special functions like the Hermite polynomials, the Legendre polynomials, Bessel differential equations and their applications in various physical problems.
3. Learnt the Dirac delta function and its properties, which have applications in various branches of Physics
4. Understand the Fourier analysis of periodic functions and their applications in physical problems such as vibrating strings.
5. Gained the ability to apply group theory to Physics problems, which is a prerequisite fora deeper understanding of Crystallography, Particle Physics, Quantum mechanics and Energy bands in solids.

Unit – I: Partial Differential Equations (PDE) **18 hours**

Definitions – Method of separation of variables – Solution of one-dimensional wave equation – One dimensional heat conduction equation – Modes of an optical fiber – Transformation and classification of PDEs – Characteristic coordinates – Canonical forms of hyperbolic, parabolic and elliptic equations

Unit – II: Special Functions 18 hours

Legendre differential equation:generating function, Rodrigue's formula and orthogonal properties - Hermite differential equation – generating function – Rodrigue's formula – orthogonal properties – Bessel's differential equation – recurrence formula for $J_n(x)$

Unit – III: The Beta, Gamma, Dirac-Delta and Green's Functions 18 hours

Definition of Beta and Gamma functions –symmetry property of Beta function – transformation of Beta function – transformation of Gamma function–relation between Beta and Gamma functions

Dirac-Delta function – properties of delta function – three dimensional delta function – Green's function for one-dimensional case – application to boundary value problem –symmetry property of Green's function – Green's function for Poisson's equation and solution of Poisson's equation – Green's function for quantum mechanical scattering problem

Unit – IV: Fourier and Laplace Integral Transforms 18 hours

Fourier sine and cosine transforms of derivatives – Fourier transform functions of two and three variables – finite Fourier transforms – solution of boundary value problems (BVP).

Laplace Integral Transform: Solution of differential equations – ordinary differential equation (ODE) with constant coefficients – ODE with variable coefficients - solution of integral equations – solution of boundary value problems

Unit – V: Group Theory **18 hours**

Concept of a group – Abelian group – the cyclic group – the group multiplication table – Rearrangement theorem – Isomorphism and Homomorphism – the group of symmetry of an equilateral triangle – group of symmetry of a square – representation of groups – reducible and irreducible representations – Schur's Lemma I and II – The orthogonality theorem.

##Self study portion

Books for Study:

1. A.K. Ghatak, Mathematical Physics, IC Goyal& S.J. Chua, Mac Millan India Ltd., 1995.
   Unit – I : 15.2, 15.3, 15.6, 15.5, 15.6, 15.7
2. SatyaPrakash, Mathematical Physics, Sultan Chand and Sons, New Delhi, 2001.
   Unit – II: 4.1, 4.2, 4.4, 4.6, 4.7, 7.11, 7.12, 7.13, 7.14, 7.21, 7.25, 7.33,7.36, 7.37, 7.40
   Unit – III: 11.1, 11.2, 11.7, 11.8 – 11.10, 11.12, 11.13
3. SatyaPrakash, Mathematical Physics, Sultan Chand and Sons, New Delhi (2005).
   Unit – IV: 9.9 , 10.9, 10.11, 10.12,10.14,10.15,10.18
4. PichaiRamadevi and VarunDubey, Group Theory for Physicists: With Applications, Cambridge University Press, New York, 2019.
   Unit–V: 1.1-1.7, 2.2- 2.3, 3.3, 5.7.1

Books for Reference

1. Charlie Harper, Introduction to Mathematical Physics, PHI,New Delhi,2006.
2. P.K. Chattopadhyay, Mathematical Physics, New Age International,New Delhi,1990.

Web Reference

1. https://freevideolectures.com/course/3536/selected-topics-in-mathematical-physics
2. https://www.perimeterinstitute.ca/video-library/collection/11/12-psi-mathematical-physics
3. http://mediacore.ictp.it/media/mathematical-methods-lecture-1-of-34

Online Course Reference

Unit V :https://swayam.gov.in/nd1_noc20_ph03/preview

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

Semester	**Code**			**Title of the Paper**		**Hours**			**Credits**	
II	**20PPH2CC5**			**ADVANCED MATHEMATICAL PHYSICS**		**6**			**5**	
Course Outcomes (COs)	Programme Outcomes (POs)					Programme Specific Outcomes (PSOs)				
	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	✓	✓	✓		✓	✓	✓		✓	✓
CO2	✓	✓	✓	✓	✓	✓		✓	✓	✓
CO3	✓	✓		✓			✓	✓		
CO4	✓	✓	✓			✓	✓	✓	✓	✓
CO5	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Number of Matches= 40, Relationship : High										

Prepared by: Checked by:

Dr. S. Shek Dhavud Dr. C. Hariharan

Semester	Code	Course	Title of the Course	Hours	Credits	Max. marks	Internal marks	External marks
II	**20PPH2CC6**	**Core – VI**	**ATOMIC AND MOLECULAR SPECTROSCOPY**	**6**	**5**	**100**	**25**	**75**

Course Outcomes :

1. Acquired the basic, principle and underlying quantum concepts of spectroscopy.
2. Familiarized to differentiate various types of spectra.
3. Learned the spectroscopic instrumentation
4. Understood the spectroscopic applications in allied fields.
5. Motivated towards research in spectroscopy

Unit – I : Rotation of Molecules **18 hours**

Classification of molecules –rotational spectra of rigid diatomic molecules – isotope effect in rotational spectra – non-rigid rotator – linear polyatomic molecules – microwave spectrometer – ##microwave oven##

Unit II: Infra-Red Spectroscopy **18 hours**

Molecular and fundamental vibrations - vibrational energy of a diatomic molecule – selection rules – vibrating diatomic molecule – diatomic vibrating rotator – rotation-vibration spectra of polyatomic molecules – ##finger print technique## – IR spectrometer - instrumentation – FTIR spectroscopy.

Unit – III : Raman Spectroscopy **18 hours**

Rotational Raman spectra - vibrational Raman spectra – Raman spectrometer – Hyper-Raman effect – stimulated Raman scattering – coherent anti-stokes Raman scattering (CARS)

Unit – IV : Electronic Spectroscopy **18 hours**

Vibrational coarse structure – vibrational analysis of band systems – Deslandres table - Franck-Condon principle – intensity of vibrational- electronic spectra – rotational fine structure of electronic-vibration spectra – dissociation energy and products – principle of electron spin resonance – Electron Spin Resonance spectrometer – electron density – density functional theory (DFT) – Kohn-Sham equations

Unit – V : Resonance Spectroscopy **18 hours**

Magnetic properties of nuclei – resonance condition – nuclear magnetic resonance imaging (NMRI) – nuclear magnetic resonance instrumentation – chemical shift – quadrupolar nucleus – principle of nuclear quadrupole resonance – transitions for non-axially symmetric systems – nuclear quadrupole resonance instrumentation

 # # Self study portion

Book for study:

1. G. Aruldhas, Molecular Structure and Spectroscopy, Second Edition, PHI Publishers.
   Unit -I:Section 6.1, 6.3, 6.4, 6.6, 6.8, 6.9, 6.10, 6.14
   Unit – II: Section7.1, 7.3, 7.4, 7.5, 7.11, 7.16, 7.18
   Unit-III: Section8.3, 8.4, 8.6, 15.5-15.8
   Unit –IV: Section9.2, 9.3, 9.6, 9.7, 9.9, 11.2, 11.3, 11.6
   Unit – V: Section10.1,10.2,10.3,10.8,10.19,12.1,12.2,12.4,12.5

Books for Reference:

1. Colin N. Banwell and Elaine M. McCash, Fundamentals of Molecular Spectroscopy, Fourth Edition, Tata McGraw-Hill Publishing Company Ltd, New Delhi, 2010.
2. Gurdeep R. Chatwal, Sham K. Anand, Spectroscopy- Atomic and Molecular, Himalaya PublishingHouse, Delhi, 2004.

Online Reference:

1. https://www.southampton.ac.uk/assets/centresresearch/documents/compchem/DFT_L6.pdf
2. e-PgPathshala,NME-ICT,paper10-M-15

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

Semester	**Code**			**Title of the Paper**			**Hours**		**Credits**
II	**20PPH2CC6**			**ATOMIC AND MOLECULAR SPECTROSCOPY**			**6**		**5**
Course Outcomes (COs)	Programme Outcomes (POs)					Programme Specific Outcomes (PSOs)				
	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	✓	✓		✓		✓	✓	✓	✓	✓
CO2	✓	✓		✓		✓	✓	✓		
CO3		✓			✓	✓	✓	✓		✓
CO4			✓	✓	✓	✓	✓	✓	✓	
CO5				✓	✓	✓	✓	✓		
Number of Matches= 32, Relationship : Moderate										

Prepared by:
Dr. M. Jamal Mohamed Jaffar

Checked by:
Dr. S. Prabhakaran

Semester	Code	Course	Title of the Course	Hours	Credits	Max. marks	Internal marks	External marks
II	20PPH2CC7	Core – VII	ELECTROMAGNETIC THEORY	6	4	100	25	75

Course Outcomes:

1. Acquired the basics, principles of electrostatics, magnetostatics and field theory.
2. Learnt the skills of problem solving in areas of electrostatics, magnetostatics and electromagnetism.
3. Understood the interactions of EM waves with different medium and acquired the knowledge of various modes of propagation of EM waves in wave guides using Maxwell's equations.
4. Analyzed the basic laws of reflection and refraction and understand the kinematic and dynamic properties. Understood the generations and radiations of EM waves and their applications.
5. Learnt the principles and applications of relativistic electrodynamics.

Unit–I: Electrostatics and Boundary value problems 18 hours

Gauss law - applications – field due to an infinite, straight, uniformly charged wire - Multipole expansion of charge distribution – method of separation of variables: cartesian coordinates – potential at a point between the plates of a parallel plate capacitor – spherical coordinates– potential at a point between the plates of a spherical capacitor – cylindrical coordinates - potential at a point due to a cylindrical capacitor

Unit–II:Magnetostatics 18 hours

Lorentz force law - Biot-Savart's law and its application -long straight wire – Ampere's circuital law and its application - toroidal solenoid – magnetic scalar and vector potential – magnetic boundary conditions for B and H between two media – magnetic intensity – magnetic susceptibility and permeability.

Unit–III:Field Equations and Potentials 18 hours

Maxwell's equations and their physical significance – continuity equation – displacement current – conservation law of energy: Poynting's theorem –Poynting's vector –electromagnetic potentials – gauge transformations: Lorentz gauge –Coulomb gauge – retarded potentials.

Unit–IV: Electromagnetic waves and their propagation 18 hours

Electromagnetic waves in free space – propagation of electromagnetic waves in dielectrics and in conductors - laws of reflection and refraction of electromagnetic waves: Kinematic and dynamic properties – Fresnel's law – Wave guide – rectangular wave guide – TM and TE modes – Multicavity klystron.

Unit–V: Relativistic Electrodynamics 18 hours

Einstein's postulates of special theory of relativity – #concept of four vectors – covariance of electrodynamic equations – Maxwell's equations in four vector – Transformations of electromagnetic fields – Four vector form of Lorentz equation – Lagrangian and Hamiltonian force equations for a relativistic charged particle.

--- ## Self study portions

Books for Study:

1. K.K. Chopra and G.C. Agarwal, Electromagnetic Theory, Fifth Edition,K. Nath& Co., Meerut.
   Unit -I: Section1.3, Ex: 3(a), 1.4, 2.2(A), 2.2(B), 2.3 (A), 2.3(B),2.4(A), 2.4(B)
   Unit -II: Section3.2,3.3, 3.2(B), 3.2(C), 3.3, 3.3(C), 3.5, 3.6, 3.10 (a), 3.10(b)
   Unit -III: Section 3(A), 4.1, 4.2, 4.4,4.5, 4.7, 4.9, 4.10, 4.11, 8.1
   Unit -IV: Section 5.1, 5.2, 5.4, 6.2, 6.2 (A), 6.2 (B), 6.3, 6.8,

2. N. Ghosh, Electromagnetic theory and wave propagation, Section Edition, Narosa publishers, New Delhi.
   Unit V: Section 17.1, 17.2, 17.3, 17.4, 17.5, 17.6, 17.7.

Book for reference

1. David J. Griffiths, Introduction to Electrodynamics (3rd edition), Prentice-Hall of India.
2. J.D. Jackson, Classical Electrodynamics, (3rd edition), John-Wiley, New York.

Online Resources:

1. http://www.kau.edu.sa/GetFile.aspx?id=158642&fn=EMNotes.pdf
2. https://web.njit.edu/~vitaly/121/notes121.pdf
3. http://www.clerkmaxwellfoundation.org/html/electromagnetic_theory.html
4. https://www.electrical4u.com/electromagnetic-theory/
5. https://lecturenotes.in/subject/77/electromagnetic-theory-emt
6. https://ocw.mit.edu/courses/physics/8-311-electromagnetic-theory-spring-2004/
7. https://www.classcentral.com/course/swayam-electromagnetic-theory-5223
8. https://nptel.ac.in/courses/115/101/115101005/electromagnetictheory.

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

Semester	**Code**			**Title of the Paper**			**Hours**		**Credits**
II	**20PPH2CC7**			**ELECTROMAGNETIC THEORY**			**6**		**4**
Course Outcomes (COs)	Programme Outcomes (POs)					Programme Specific Outcomes (PSOs)				
	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	✓	✓		✓		✓	✓	✓	✓	✓
CO2	✓	✓		✓	✓	✓	✓	✓	✓	
CO3	✓	✓	✓			✓	✓	✓		✓
CO4	✓	✓	✓	✓		✓	✓	✓	✓	
CO5	✓	✓	✓	✓	✓	✓	✓	✓	✓	
Number of Matches= 40, Relationship : High										

Prepared by:
Dr. S. Abbas Manthri

Checked by:
Dr. C. Hariharan

Semester	Code	Course	Title of the Course	Hours	Credits	Max. marks	Internal marks	External marks
II	20PPH2CC8P1	Core – VIII	SOLID STATE PHYSICS PRACTICALS	3	2	50	10	40

Course Outcomes:

1. The principles of Solid State Physics.
2. Initial adjustments of CRO, sensitive balance etc.
3. Experimental skills.
4. Methods of analysis.
5. Apply the skills developed to future problems.

1. Determination of q, n, σ by Hyperbolic fringes method.
2. Characteristics of LDR.
3. Determination of Planck's constant.
4. Hystersis Loop Tracer.
5. Band gap energy – Four Probe method.
6. Determination of carrier concentration and Hall coefficients in semiconductors.
7. e/m Helical method.
8. Determination of magnetic susceptibility of anhydrous sample – Guoy's method.

Semester	Code	Course	Title of the Course	Hours	Credits	Max. marks	Internal marks	External marks
II	20PPH2CC8P2	Core – VIII	ANALOG ELECTRONICS PRACTICALS	3	2	50	10	40

Course Outcomes:

1. The principles of Analog Electronics.
2. Identification of components and their tolerances.
3. Principles of design and construction of electronic circuits.
4. Measuring output using CRO, ammeters, voltmeters etc.
5. Troubleshoot deficiencies and rectify problems that may occur.

1. Op – Amp characteristics.
2. Astable Multivibrator using 555 timer.
3. Analog Comparator.
4. Wien's Bridge Oscillator.
5. Characteristics and UJT Relaxation Oscillator.
6. D/A converter – Binary Weighted and R - 2R Ladder Method.
7. Monostable Multivibrator using 555 timer.
8. Low Pass, High Pass and Band Pass Filters.

Semester	Code	Course	Title of the Course	Hours	Credits	Max. marks	Internal marks	External marks
II	20PPH2DE2A	DSE – II	COMPUTATIONAL PHYSICS	6	4	100	25	75

Course Outcomes:

1. Acquired the basic knowledge and familiarise computational methods of physics problem solving techniques
2. The capacity of solving problems of type polynomial, simultaneous, linear one dimensional equations and numerical Integration
3. Theablity to construct the mathematical models of the physical problems
4. Learnt to numerically simulate problems in physics using the mathematical models so constructed
5. Been motivated towards research by the understanding gained by mathematical modeling and numerical simulations

Unit- I : Overview of C Language **18 hours**

Operators :arithmetic, relational, logical, assignment, increment and decrement, conditional and bitwise operators - formatted I/P and O/P functions - `scanf ()`&`printf()` functions, format specifiers. **Decision making statements:**`if`, `if-else`, `switch`,`go-to`, `break` and `continue` statements, **Loop constructs:** syntax and flow charts for `for loop`, `while loop`, `do-while loop`. **## One–dimensional and two dimensional arrays: declaration and initializing of arrays##**

UNIT –II SolvingPolynomialandSimultaneous Linear Equations **18 hours**

Polynomial Equations: Newton-Raphson's Algorithm for solving polynomial equations-convergence of Newton-Raphsonmethod-Limitations of Newton-Raphson'smethod-C-Program for implementing Newton-Raphsonmethod.

Direct Solution of Simultaneous Linear Equations: Basic Gauss Elimination method-Gauss Elimination with Pivoting-C-program to implement Gauss elimination Method – problems.

UNIT –IIIOrdinary Differential Equations andNumerical Integration : **18 hours**

Order and Degree of ODE's- Euler's Method –Runge-Kutte Fourth Order Method-**##Systems of Differential Equations##** -C Program to implement RK4 Method for a first order differential equation.

Numerical Integration: Trapezoidal rule, Simpson's 1/3 rule –C program to evaluate integrals usingTrapezoidal and Simpson's 1/3 rules- problems.

UNIT - IV Curve Fitting: **18 hours**

Interpolation and Regression: Interpolation of tabulated data and well defined functions- Lagrange's interpolation formula for polynomial functions-C program for implementing Lagrange's interpolation formula- Curve Fitting of linear equations: Linear Least Squares Regression method- **##Fitting of Transcedental Equations,##** C-Program for implementing Linear Least Square Fit – Problems.

Unit-V: Matrix Operations, Evaluation of Special Functions **18 hours**

Matrix Operations: Determinant of a matrix, characteristic polynomial of a matrix-determination of the largest eigen value and the corresponding eigen vector of a matrix using power method. C-programs to implement these.

Special Functions: Analytic expressions for Legendre, Laguerre and Hermite polynomial functions-C-programs to implement these.

Books for Study

1. E. Balagurusamy, Programming in ANSI C, Tata Mc-Graw Hill, New Delhi, Sixth Edition, 2012.
Unit- I:Section 3.2 to 3.9, 5.2 to 6.4,7.1 to 7.6

2. E. Balagurusamy, Numerical Methods, Tata Mc-Graw Hill, New Delhi, Second Edition, 1999.
Unit- II: Section 6.8, 7.4
Unit-III: Section 11.13, 12.3, 12.4, 13.3, 13.6
Unit- IV: Section 9.1,9.4,10.1,10.3
3. Suresh Chandra, Computer Applications in C, Narosa, PublishingHouse,NewDelhi,
Second Edition, 2006
Unit -V: Section6.1,6.2,6.4,10.2,10.5,10.7,11.1 to 11.6

Books forreference

1. K.R. Venugopal and S.R. Prasad, Mastering C, Tata Mc-Graw Hill, New Delhi, ThirdEdition,2007
2. Steven C. Chapra, NumericalMethods for Engineers,Tata Mc-Graw Hill, New Delhi, Seventh Edition,2016.

Online reference :

1. https://khanacadamy.zendesk.com

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

Semester	**Code**			**Title of the Paper**			**Hours**		**Credits**	
II	**20PPH2DE2A**			**COMPUTATIONAL PHYSICS**			**6**		**4**	
Course Outcomes (COs)	Programme Outcomes (POs)					Programme Specific Outcomes (PSOs)				
	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
CO2	✓			✓	✓	✓	✓	✓		
CO3	✓	✓		✓		✓	✓	✓	✓	
CO4	✓			✓		✓	✓	✓		
CO5			✓	✓		✓	✓	✓	✓	✓
Number of Matches= 35, Relationship : High										

Prepared by:
Capt. F. S. Muzammil

Checked by:
Dr. R. Raj Muhamed

Semester	Code	Course	Title of the Course	Hours	Credits	Max. marks	Internal marks	External marks
II	**20PPH2DE2B**	**DSE – II**	**NANOSCIENCE AND THCHNOLOGY**	**6**	**4**	**100**	**25**	**75**

Course Outcomes:

1. Acquiredthe basic principles and fundamental concepts of nanotechnology
2. The ablity to evaluate nanostructures in quantum mechanical approaches
3. Learnt the importance of nanotechnology in various fields
4. The capacity to convey their views on the implication of nano sciences for the society
5. Been motivated towards research in Nanotechnology

Unit-I: Nanomaterials 18 hours

Introduction to materials – solid materials and their strength – perspective of length – nanoscience and nanotechnology – nanostructures in nature – quantum structures – quantum confinement - surface effect of nanomaterials – prime materials – carbonnano structure – oxides: zinc oxide – aluminium oxide – copper oxide

Unit-II: Growth techniques of Nanomaterials 18 hours

Nano materials synthesis –physical approaches: arc discharge method – laser ablation – high energy ball milling – chemical vapour deposition (CVD) – plasma synthesis method – electro deposition chemical approaches: hydrothermal synthesis – Reverse Miller – Sol–gel synthesis – microwave method – co–precipitation method

Unit-III: Properties of Nanomaterials 18 hours

Mechanical properties of nanomaterials – optical properties ofnanomaterials – applications of optical properties of nanomaterials – electrical properties – dielectric materials and properties – magnetic properties of materials – supermagnetism – electrochemical process – chemical sensing properties

Unit-IV: Characterization Tools of Nanomaterials 18 hours

X – ray diffraction – the powder method: determination of grain size using X – rays - line broadening studies – electron microscopy – principles of electron microscopy – Scanning electron Microscope (SEM) – energy dispersive X–ray analysis (EDX) – Transmission electron microscope (TEM) – spectroscopy techniques: absorption spectroscopy – **##photoluminescence##** – Fourier Transform infrared spectroscopy – Raman spectroscopy

Unit-V: Applications of Nanomaterials 18 hours

Nanomaterials in medicine –nanomaterials in energy sector – ##n**anomaterials in next – generation computer technology##** - nanomaterials in communication sector –nanomaterials in food – nanomaterials in fabric industry – nanometarials in automobiles – nanomaterials in ceramics industry

Books for Study:

1. M.A. Shah Tokeer Ahmad ,Principles of Nano Science and Nanotechnology, Narosa
   Unit-I : Section 1.1, 1.2, 1.3, 1.4, 1.5, 1.6, 1.7, 1.8, 1.9, 1.10, 1.11
   Unit-II: Section2.2, 2.3, 2.4
   Unit-III: Section6.2, 6.3, 6.4, 6.5, 6.6, 6.7, 6.8
   Unit-IV: Section4.3, 4.6, 3.3, 3.5, 3.6, 5.5, 5.6, 5.7, 5.8
   Unit-V: Section7.2, 7.3, 7.8, 7.9, 7.11, 7.12

Books for Reference:

1. K.K. Chattobpadhyay, Introduction to Nano Science and Technology, PHI, New Delhi.
2. S. Shanmugam, Nano Technology - MJP Publishers

Web reference:

1. http://www.trynano.org/
2. https://www.nanowerk.com/111
3. https://www.nanotec.org.uk/report/chapter2.pdf

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

Semester	**Code**			**Title of the Paper**			**Hours**			**Credits**
II	**20PPH2DE2B**			**NANOSCIENCE AND THCHNOLOGY**			**6**			**4**
Course Outcomes (COs)	Programme Outcomes (POs)					Programme Specific Outcomes (PSOs)				
	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔
CO2	✔	✔		✔		✔	✔	✔	✔	
CO3	✔		✔	✔	✔	✔	✔	✔	✔	
CO4			✔		✔					✔
CO5	✔			✔		✔				✔
Number of Matches= 32, Relationship : Moderate										

Prepared by:
Mr. I. Mansur Basha

Checked by:
Dr. C. Hariharan