DEPARTMENT OF PHYSICS

COURSE STRUCTURE & SYLLABI
(For the students admitted from year 2023-2024 onwards)

Programme : M.Sc. Physics

Since 1951

JAMAL MOHAMED COLLEGE (AUTONOMOUS)
Accredited with A++ Grade by NAAC (4th Cycle) with CGPA 3.69 out of 4.0
(Affiliated to Bharathidasan University)
TIRUCHIRAPPALLI – 620 020

M.SC. PHYSICS

Sem	Course Code	Course Category	Course Title	Ins. Hrs/ Week	Credit	Marks		Total
						CIA	ESE	
I	23PPH1CC1	Core - I	Classical Mechanics	6	5	25	75	100
	23PPH1CC2	Core - II	Mathematical Physics	6	5	25	75	100
	23PPH1CC3	Core - III	Electronic Devices and Circuits	6	5	25	75	100
	23PPH1CC4P1	Core - IV	Advanced General Physics - I - Practical	3	2	10	40	50
	23PPH1CC4P2		Advanced General Physics - II - Practical	3	2	10	40	50
	23PPH1DE1A/B	Discipline Specific Electives - I		6	4	25	75	100
			Total	**30**	**23**			**500**
II	23PPH2CC5	Core - V	Advanced Mathematical Physics	6	5	25	75	100
	23PPH2CC6	Core - VI	Molecular Spectroscopy	6	5	25	75	100
	23PPH2CC7	Core - VII	Electromagnetic Theory	6	5	25	75	100
	23PPH2CC8P1	Core - VIII	Condensed Matter Physics - Practical	3	2	10	40	50
	23PPH2CC8P2		Analog Electronics - Practical	3	2	10	40	50
	23PPH2DE2A/B	Discipline Specific Electives - II		6	4	25	75	100
	23PCN2CO	Community Outreach	JAMCROP	-	@	-	-	@
	@ Only grade will be given		**Total**	**30**	**23**			**500**
III	23PPH3CC9	Core - IX	Nuclear and Particle Physics	6	6	25	75	100
	23PPH3CC10	Core - X	Quantum Mechanics	6	5	25	75	100
	23PPH3CC11	Core - XI	Statistical Mechanics	6	5	25	75	100
	23PPH3CC12P1	Core - XII	Digital Electronics - Practical	3	2	10	40	50
	23PPH3CC12P2		Numerical Programming in Physics using Python - Practical	3	2	10	40	50
	23PPH3DE3A/B	Discipline Specific Electives - III		6	4	25	75	100
	23PPH3EC1	Extra Credit Course - I*	Online Course	-	*	-	-	-
			Total	**30**	**24**			**500**
IV	23PPH4CC13	Core - XIII	Condensed Matter Physics	6	6	25	75	100
	23PPH4CC14	Core - XIV	Electronic Communication	6	6	25	75	100
	23PPH4CC15P1	Core - XV	Microprocessor and Microcontroller - Practical	3	3	10	40	50
	23PPH4CC15P2		Numerical Simulations in Physics using Python - Practical	3	2	10	40	50
	23PPH4DE4A/B	Discipline Specific Electives - IV		6	4	25	75	100
	23PPH4PW	Project Work	Project Work	6	4	-	100	100
	23PCNOC	Mandatory online course**	Online Course	-	1	-	100	100
	23PPH4EC2	Extra Credit Course - II*	Online Course	-	*	-	-	-
	23PCN4EC3	Extra Credit Course – III+	Innovation and Intellectual Property Rights	-	+	-	-	-
	*** Programme Specific Online Course for Advanced Learners** **** Any Online Course for Enhancing Additional Skills** **+ Course for Enhancing IPR Skills**		**Total**	**30**	**26**			**600**
			Grand Total		**96**			**2100**

DISCIPLINE SPECIFIC ELECTIVES

Semester	Course Code	Course Title
I	23PPH1DE1A	Medical Physics and Ultrasonics
	23PPH1DE1B	Advanced Topics in Physics
II	23PPH2DE2A	Computations in Physics Using Python
	23PPH2DE2B	Nanoscience and Technology
III	23PPH3DE3A	Microprocessor and Microcontroller
	23PPH3DE3B	Nonlinear Optics
IV	23PPH4DE4A	Crystal Growth and Thin Films
	23PPH4DE4B	Fibre Optics and its Applications

Semester	Course Code	Course Category	Hours/ Week	Credits	Marks for Evaluation		
					CIA	ESE	Total
I	23PPH1CC1	CORE – I	6	5	25	75	100

Course Title	CLASSICAL MECHANICS

SYLLABUS		
Unit	**Contents**	**Hours**
I	**Lagrangian Dynamics**: 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 -Double pendulum – Atwood's machine –motion under Central Force – series LC circuit	**18**
II	**Two-Body Central Force Problem** Reduction of two-body central force problem to the equivalent one-body problem – Central Force and motion in a plane – Equations of motion under Central Force and first integrals – Differential equation for an orbit – *Inverse square law of force* – Kepler's laws of planetary motion and their deduction	**18**
III	**HamiltonianDynamics** Cyclic Coordinates – Hamilton's equations – Applications: Simple Pendulum – Compound Pendulum – Canonical transformations – Legendre transformations – Generating functions – fundamental properties of Poisson's brackets* – The Hamilton – Jacobi equation – solution of Harmonic oscillator problem by Hamilton – Jacobi method – Action and angle variables – Kepler's problem in Action – *Angles variables*	**18**
IV	**Small Oscillations and Rigid-body Dynamics** 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	**18**
V	**Stability analysis of Linear and Non Linear systems** Dynamical System: Linear and nonlinear systems – superposition principle – effects of nonlinearity – linear and nonlinear oscillators – *Autonomous and non-autonomous systems*– Equilibrium points and their classification – Stability analysis of damped cubic anharmonic oscillator – Bifurcation Scenario in Duffing Oscillator	**18**
VI	**Current Trends (For CIA only)** **Recent developments in classical dynamical systems:** Stochastic resonance - controlling of chaos - synchronization of chaos – chaotic signal masking – transmission of chaotic signals: analogue and digital	

……. Self Study

Text Book(s):

1. 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
2. M.Lakshmanan and S.Rajasekar: Nonlinear Dynamics:Integrability, Chaos and Patterns, Springer 2003
   Unit – V: Section 1.1, 1.2, 1.3, 1.4, 2.1, 2.2, 2.3, 2.4 3.1, 3.2 3.3, 3.4
   Unit VI : 9.2, 9.4 9.5

Reference Book(s):

1. H.Goldstain,Classical Mechanics, NarosaPublishing House,2005
2. N.C.Rana and P.S.Joag,Classical Mechanics, Tata McGraw. Hill, 1991
3.M.Lakshmanan and K. Murali Chaos in Nonlinear Oscillators: Controlling and Synchronization, World Scientific

Web Resource(s):

https://classcentral.com/course/swayam-theoritical-mechanics-14332
www.physics.iisc.ernet.in

Course Outcomes		
Upon successful completion of this course, the student will be able to:		
CO No.	**CO Statement**	**Cognitive Level (K-Level)**
CO1	Remembering the basic theory of Newtonian Mechanics and stimulating to think the need of new concepts	**K1**
CO2	Demonstrate the different methods and new ideas to overcome the limitations in the Newtonian mechanics. Analyse these methods and select an appropriate one to derive a mathematical model for a given physical system	**K2**
CO3	Applications of action and angle variables and canonical transformation	**K3**
CO4	Analyse the normal modes of small oscillations and the dynamics of a rigid body	**K4**
CO5	Debate the need of nonlinear studies and its recent developments. Create the circuit diagrams for dynamical problems in the wide research area	**K6**

Relationship Matrix:

Course Outcomes (COs)	**Programme Outcomes (POs)**					**Programme Specific Outcomes (PSOs)**					**Mean Score of COs**
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PSO1**	**PSO2**	**PSO3**	**PSO4**	**PSO5**	
CO1	**3**	3	**3**	**3**	**3**	**3**	**3**	**2**	**2**	**3**	2.8
CO2	**3**	**3**	**3**	**2**	**3**	**2**	**2**	**3**	**3**	**3**	2.7
CO3	**3**	**3**	**3**	**3**	**3**	**3**	**2**	**2**	**3**	**2**	2.7
CO3	**3**	**3**	**3**	**3**	**2**	**3**	**3**	**3**	**3**	**3**	2.9
CO5	**3**	**3**	**2**	**3**	**3**	**3**	**3**	**2**	**3**	**3**	2.8
										Mean Overall Score	**2.78**
										Correlation	**HIGH**

Mean Overall Score	**Correlation**
< 1.5	Low
≥ 1.5 and < 2.5	Medium
≥ 2.5	High

Course Coordinators: Dr. R. Radhakrishnan
Mr. S. Mohamed Ibrahim Sulaiman Sait

Semester	Course Code	Course Category	Hours/ Week	Credits	Marks for Evaluation		
					CIA	ESE	Total
I	23PPH1CC2	CORE – II	6	5	25	75	100

Course Title	MATHEMATICAL PHYSICS

SYLLABUS		
Unit	**Contents**	**Hours**
I	**Vector Analysis** Orthogonal curvilinear coordinates-Differential operators interms of Orthogonal curvilinear coordinates-Gradient, divergence, *curl and Laplacian* – Spherical polar coordinates and differential operators-Gradient, divergence, curl, and Laplacian -Cylindrical coordinates and differential operators Gradient, divergence, curl, and Laplacian – applications: – Euler's equation of motion – Bernoulli's equation	**18**
II	**Linear Vector Space and Matrices** Linear Vector Space**:** definition – linear independence of vectors and Dimensions, basis and expansion theorem – inner product and unitary spaces - orthonormal set - Schwartz Inequality-Gram-Schmidt's orthogonalization process -completeness Special types of matrices – transpose of a matrix – the conjugate transpose – Hermitian and skew-Hermitian matrices – orthogonal matrices – trace of a matrix – eigen values andeigen vectors – Characteristic equation of a matrix -Cayley-Hamilton theorem – power of a matrix – *matrices in physics*	**18**
III	**Tensors** 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 –Line element: metric tensor- Christoffel's 3 index symbols - Applications – tensors in dynamics of a particle-work energy	**18**
IV	**Complex Variables** Analytic function – Cauchy – Riemann differential equation-*Harmonic functions*- Cauchy's Integral formula –Taylor's series – Residues and their evaluation of residues-Cauchy Residue theorem –evaluation of improper definite integrals	**18**
V	**Probability, Statistics and theory of errors** Binomial theorem of probability –multinomial theorem of probability-Laplace-de-moivre limit theorem- measures of central tendency, averages-*measures of dispersion*-Karl Pearson's coefficient of correlation-theory of errors-most probable value and residual –Gaussian error curve	**18**

……. Self Study

Text Book :

1. SathyaPrakash, Sultan Chand & Sons, Mathematical Physics, 7th edition, New Delhi,2011
   Unit–I: Section 1.15 – 1.19
   Unit–II: Section 1.18,2.10,2.17,2.19,2.31,2.37,2.39
   Unit–III: Section 3.2-3.11, 3.16,3.20,3.38
   Unit–IV: Section 6.9-6.11, 6.14,6.16,6.20, 6.23-6.25
   Unit–V: Section 12.7-12.25

Reference Books

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

Web Resources:

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

Course Outcomes		
Upon successful completion of this course, the student will be able to:		
CO No.	**CO Statement**	**Cognitive Level (K-Level)**
CO1	Apply the concepts of linear vector spaces, orthogonalization process, matrices and matrix manipulations	**K3**
CO2	Make use of the concepts of complex analysis	**K3**
CO3	Analyze the orthogonal curvilinear coordinates, gradient, divergence,curl and Laplacian operators	**K4**
CO4	Prove the Cauchy-Riemann condition, calculus of residues and evaluation of definite integrals	**K5**
CO5	Develop the knowledge of the statistical tools and statistical distributions	**K6**

Relationship Matrix:

Course Outcomes (COs)	**Programme Outcomes (POs)**					**Programme Specific Outcomes (PSOs)**					**Mean Score of COs**
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PSO1**	**PSO2**	**PSO3**	**PSO4**	**PSO5**	
CO1	**3**	3	**3**	**2**	**2**	**2**	**1**	**2**	**2**	**2**	**2.2**
CO2	**2**	**3**	**3**	**2**	**2**	**2**	**1**	**3**	**3**	**2**	**2.3**
CO3	**2**	**2**	**2**	**3**	**3**	**2**	**3**	**3**	**2**	**2**	**2.4**
CO4	**2**	**3**	**2**	**3**	**2**	**1**	**2**	**3**	**2**	**3**	**2.3**
CO5	**2**	**3**	**3**	**3**	**3**	**3**	**2**	**1**	**2**	**2**	**2.4**
Mean Overall Score											**2.32**
Correlation											**Medium**

Mean Overall Score	**Correlation**
< 1.5	Low
≥ 1.5 and < 2.5	Medium
≥ 2.5	High

Course Coordinators: Dr.A. ISHAQ AHAMED
Dr.R. RAJ MUHAMED

Semester	Course Code	Course Category	Hours/ Week	Credits	Marks for Evaluation		
					CIA	ESE	Total
I	23PPH1CC3	CORE – III	6	5	25	75	100

Course Title	ELECTRONIC DEVICES AND CIRCUITS

SYLLABUS		
Unit	**Contents**	**Hours**
I	**SOLID STATE DEVICES** 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*	**18**
II	**OPERATIONAL AMPLIFIER APPLICATIONS** Instrumentation amplifier–Op-Amp circuits using diodes: Half-wave rectifier, Full-wave rectifier, *****Clipper and clamper circuits***** – Logarithmic and antilogarithmic amplifiers – Multipliers – Dividers – Differentiators – Integrators – Electronic analog computation: simulation of 2^{nd} order differential equation– Simulation of transfer function	**18**
III	**COMPARATORS, WAVEFORMGENERATORSANDFILTERS** Comparators–Applications of Comparators: Zerocrossingdetector–Windowdetector–Schmitttrigger–AstableMultivibrator–Monostable Multi-vibrator–Triangular wave generator – RC phase-shift oscillator–Wien's bridge oscillator–RC active filters: First-order low-pass, *High-pass* – Band-pass– Wide band-pass filter	**18**
IV	**555 TIMERANDPHASE–LOCKED LOOPS (PLL)** Description and functional diagram of 555 Timer - Monostable operation– Applications – Frequency divider – Astable operation – Applications – 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.	**18**
V	**OPTOELECTRONIC DEVICES** Construction and Characteristics of Optoelectronic devices: Photoconductive Cell- Photoconductive Sensors, Applications: Photodiode, Phototransistor **–** , Photovoltaic Cell - Solar Cell - Photovoltaic Sensors**–** Photoemissive Sensors **–** Vacuum Phototube**–**Gas-Filled Phototube – Photomultiplier – *Light Emitters **–** Light-Emitting Diode, Infrared Emitters*	**18**

……. Self Study

Text Books:

1.S.Salivahanan, N.SureshKumar, Electronic Devicesand Circuits, McGraw Hill Education Pvt., Limited, Chennai, Fourth Edition, 2019.

Unit–I: Section 5.8, 5.9, 7.10, 7.11, 8.3, 8.5, 8.7, 8.8, 17.2

Unit–V: Section 22.3 – 22.6.2

2. D. Roy Choudhury and Shail B.Jain, Linear Integrated Circuits, New Age International Publishers, Fourth Edition, 2015.

Unit–II: Section 4.3,4.6, 4.6.1 – 4.6.5,4.7–4.12

Unit–III: Section 5.1, 5.2 , 5.2.1, 5.3, 5.4 – 5.7,7.2,7.2.1,7.2.4,7.2.5

Unit–IV: Section 8.1– 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

Unit–VI :Section 1.6 – 1.8

Reference Books :

1. V.K. Mehta, Rohit Mehta, Principles of Electronics, S. Chand Publications, Reprint2016.
2. RamkantA.Gayakwad,Op-AmpsandLinearIntegratedCircuits,PrenticeHallofIndia, 4th Edition 2015.

Web Resources:

1. https://www.physics-and-radio-electronics.com/electronic-devices-and-circuits/semiconductor-diodes/tunneldiode-howitworks.html
2. https://www.tutorialspoint.com/linear_integrated_circuits_applications/linear_integrated_circuits_applications_rectifiers.htm#

Course Outcomes		
Upon successful completion of this course, the student will be able to:		
CO No.	**CO Statement**	**Cognitive Level (K-Level)**
CO1	Recall and Explain the basics of solid state devices and integrated circuits applications	K2
CO2	Utilize the applications of optoelectronics in modern gadgets	K3
CO3	Analyze the working of electronic analog computation using operation amplifier	K4
CO4	Influence on the various process of integrated circuit fabrication	K5
CO5	Construct the circuits of op-amp based rectifiers and waveform generators	K6

Relationship Matrix

Course Outcomes (COs)	Programme Outcomes (POs)					Programme Specific Outcomes (PSOs)					Mean Score of COs
	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3	PSO4	PSO5	
CO1	2	2	1	3	2	2	3	1	2	3	2.1
CO2	2	3	1	2	3	2	3	2	3	2	2.3
CO3	2	3	2	3	2	1	3	2	1	3	2.2
CO4	3	2	3	2	1	3	2	3	2	3	2.4
CO5	3	2	3	3	2	3	2	2	3	1	2.4
										Mean Overall Score	2.28
										Correlation	Medium

Mean Overall Score	Correlation
< 1.5	Low
≥ 1.5 and < 2.5	Medium
≥ 2.5	High

Course Coordinators:

Dr. S. Shek Dhavud

Mr. S. Mohamed Ibrahim Sulaiman Sait

Semester	Course Code	Course Category	Hours/ Week	Credits	Marks for Evaluation		
					CIA	ESE	Total
I	23PPH1CC4P1	CORE – IV	3	2	10	40	50

Course Title	ADVANCED GENERAL PHYSICS - I - PRACTICAL

List of Experiments:

1. Determination of Young's, Rigidity modulus and Poission's ratio by hyperbolic fringes method.
2. Magneto resistance of a semiconductor.
3. Millikan's oil drop method – Charge of an electron.
4. Measurement of wavelength of monochromatic light using Fresnel's Biprism.
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. Measurement of wavelength of monochromatic light using Michelson's interferometer.

Books for Reference:

1.M.N. Srinivasan,S. Balasubramaniyan, R. Ranganathan, A text book of Practical Physics, S.Chand&Sons , Reprint 2010.
2.C.C. Ouseph, U.J. Rao& V. Vijayendran, Practical physics and electronics, S. Viswanathan, Pvt,Ltd, First Edition, 2007.

Web Reference:

www.physicstutoruials.org
www.sciencelearn.org.nz

Course Outcomes		
Upon successful completion of this course, the student will be able to:		
CO No.	**CO Statement**	**Cognitive Level (K-Level)**
CO1	Recall the basic principles of properties of , elasticity and magnetism	**K2**
CO2	Make practical skills essential for experimentation.	**K3**
CO3	Analyze experimental approaches to correlate with physics theory to develop practical understanding.	**K4**
CO4	evaluate the Fourier Transforms and Fourier Decomposition of waves	**K5**
CO5	create the ideas required for their higher studies	**K6**

Relationship Matrix:

Course Outcomes (COs)	Programme Outcomes (POs)					Programme Specific Outcomes (PSOs)					Mean Score of COs
	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3	PSO4	PSO5	
CO1	3	3	3	2	2	2	1	2	2	2	2.2
CO2	2	3	2	3	2	2	2	2	3	2	2.3
CO3	2	2	2	3	3	2	3	3	2	2	2.4
CO4	2	1	2	2	2	2	2	3	2	2	2.0
CO5	2	3	3	2	3	3	2	1	2	2	2.3
									Mean Overall Score		2.22
									Correlation		Medium

Mean Overall Score	Correlation
< 1.5	Low
≥ 1.5 and < 2.5	Medium
≥ 2.5	High

Course Coordinator: Dr. R. Raj Mohamed

Semester	Course Code	Course Category	Hours/ Week	Credits	Marks for Evaluation		
					CIA	ESE	Total
I	23PPH1CC4P2	CORE – IV	3	2	10	40	50

Course Title	ADVANCED GENERAL PHYSICS - II - PRACTICAL

List of Experiments:

1. Hartmann's formula: Determination of wavelength 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.

Books for Reference:

1.M.N. Srinivasan,S. Balasubramaniyan, R. Ranganathan, A text book of Practical Physics, S.Chand&Sons , Reprint 2010.
2.C.C. Ouseph, U.J. Rao& V. Vijayendran, Practical physics and electronics, S. Viswanathan, Pvt,Ltd, First Edition, 2007.

Web References:

www.physicstutoruials.org
www.sciencelearn.org.nz

Course Outcomes		
Upon successful completion of this course, the student will be able to:		
CO No.	**CO Statement**	**Cognitive Level (K-Level)**
CO1	Recall the basic principles Optics, Thermal Physics, Polarization and spectrometry	**K2**
CO2	Make practical skills essential for experimentation.	**K3**
CO3	Analyze initial adjustments of the equipments.	**K4**
CO4	evaluate application of the experimental skills developed to solve newer problems	**K5**
CO5	create the ideas to establish new experiments	**K6**

Relationship Matrix:

Course Outcomes (COs)	Programme Outcomes (POs)					Programme Specific Outcomes (PSOs)					Mean Score of COs
	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3	PSO4	PSO5	
CO1	**3**	3	**3**	**2**	**2**	**2**	**1**	**2**	**2**	**2**	**2.2**
CO2	**2**	**3**	**2**	**3**	**2**	**2**	**2**	**2**	**3**	**2**	**2.3**
CO3	**2**	**2**	**2**	**3**	**3**	**2**	**3**	**3**	**2**	**2**	**2.4**
CO4	**2**	**2**	**2**	**2**	**2**	**2**	**1**	**3**	**3**	**3**	**2.2**
CO5	**2**	**3**	**3**	**2**	**3**	**3**	**2**	**1**	**2**	**2**	**2.3**
Mean Overall Score											**2.28**
Correlation											**Medium**

Mean Overall Score	Correlation
< 1.5	Low
≥ 1.5 and < 2.5	Medium
≥ 2.5	High

Course Coordinator: Dr. A. Ishaq Ahamed

Semester	Course Code	Course Category	Hours/ Week	Credits	Marks for Evaluation		
					CIA	ESE	Total
I	23PPH1DE1A	DISCIPLINE SPECIFIC ELECTIVES – I	6	4	25	75	100

Course Title	MEDICAL PHYSICS AND ULTRASONICS

SYLLABUS

Unit	Contents	Hours
I	**Bio-potential Electrodes and Recorders** Components of biomedical instrument system – Electrodes – Bio-potential recorder – Characteristics of the recording system – Electrical signals from the heart: Electrocardiography (ECG) – Phonocardiography recording set-up – Electrical signal from muscles: Electromyogram (EMG) – Electrooculogram − *Magnetic Resonance Imaging (MRI): Principle and instrumentation*	18
II	**Physiological Assist Devices and Operation Theatre Equipments** Pacemaker – Defibrillator – AC and DC defibrillators – Dialysis − Hemodialysis and peritoneal dialysis − Comparison of hemodialysis and peritoneal dialysis − Short-wave diathermy − Microwave diathermy – Ultrasonic diathermy – *Anesthesia machines* – Digital pH meter − vitro oximetry − *Electro diagnostic/therapeutic stimulators *	18
III	**Laser Based Diagnostic Methods and Nuclear Therapy** Laser based blood cell counter – Laser doppler blood flow meter – Principle and theory of fluorescence – Tumor tissue diagnosis methods: Laser-induced fluorescence spectroscopy – Diffused reflectance spectroscopy – Light scattering spectroscopy – *Raman spectroscopy* – Photodynamic therapy of tumors – Nuclear therapy: Teletherapy (Co^{60}) –Brachytherapy	18
IV	**Ultrasonic Testing** Classification of Ultrasonic Non-Destructive Testing – *Ultrasonic Testing* – Advantages – Disadvantages − Classification of Ultrasonic Testing: Pulse Echo − Contact testing − Through transmission – Immersion − Pitch-Catch or Tandom – Different types of techniques in Pulse Echo Method – Flaw Detector – Application of Flaw Detectors: A and B scans and thickness gauging	18
V	**Underwater Acoustics** Fundamentals of Underwater Acoustics: Physical and Chemical properties – Sound properties – Boundaries – Biological organisms – Classification of instruments: Salinity, temperature and depth measurements – Flow measurements – Sound velocity –SONAR – *Multibeam Sonar *– Applications: Depth of Sea – Fisheries – Acoustic Exploration for Mining	18

……. Self Study

Text Book(s):

1. Dr.M.Arumugam, Biomedical Instrumentation, Second Edition, Anuradha Publications, Chennai, Reprint 2017.
2. A.G. Patil, Medical Electronics, First Edition, Excel books, New Delhi, 2003.
3. S. Schoenberg, Atomic and Molecular Spectroscopy: Basic Aspects and Practical Applications, Fourth Edition, Springer (India) Private limited, New Delhi. 2017.
4. Baldevraj, V.Rajendran and P.Palanichamy, Science and Technology of Ultrasonics, Second reprint, Narosa Publications, New Delhi., 2009.

UNIT	BOOK	SECTION NO.
I	1	2.3, 2.4, 4.1, 4.2, 4.2.1, 4.3, 4.3.1, 4.3.3, 4.3.7, 4.5, 4.5.1, 4.6, 10.10, 10.10.8
	2	3.3.1, 3.3.2, 6.3.1
II	1	5.2, 5.5, 5.5.1, 5.8.2−5.8.4, 6.3−6.5, 6.9, 6.14.1, 6.15
III	1	7.2, 6.10.3
	3	10.5.3, 10.5.4, 10.5.2
IV	4	7.2, 7.3, 7.4, 7.4.1−7.4.5, 7.5, 7.5.1−7.5.2, 7.6, 7.6.1−7.6.2, 7.8, 7.8.1
V	4	10.2, 10.2.1−10.2.4, 10.4, 10.4.2, 10.4.3, 10.4.5, 10.4.7, 10.4.7 (iii), 10.5

Reference Book(s):
1. John R. Cameron and James G.Skofronick, Medical Physics, John Wiley Interscience Publication, Canada.
Web Resource(s):
1. https://www.digimat.in/nptel/courses/video/108105091/L03.html 2. https://en.wikipedia.org/wiki/Anaesthetic_machine 3. https://digimat.in/nptel/courses/video/103103211/L06.html 4. https://www.digimat.in/nptel/courses/video/113106070/L16.html 5. https://en.wikipedia.org/wiki/Sonar

Course Outcomes		
Upon successful completion of this course, the student will be able to:		
CO No.	**CO Statement**	**Cognitive Level (K-Level)**
CO1	Identify the electrical signals from human body and analyze the recorded bio- Potential signals such as ECG, EMG, MRI and physiological Assist Device	**K3**
CO2	Classify different types of the Non-destructive testing, pulse echo method, Salinity, temperature and depth measurements	**K4**
CO3	Analyse the concepts of underwater acoustics and physical and chemical properties of liquids	**K4**
CO4	Design and demonstrate a newer technology for laser based diagnostic methods and treatment	**K4**
CO5	Develop a physiological assist device for monitoring and treatment proposes for society	**K6**

Relationship Matrix:

Course Outcomes (COs)	**Programme Outcomes (POs)**					**Programme Specific Outcomes (PSOs)**					**Mean Score of COs**
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PSO1**	**PSO2**	**PSO3**	**PSO4**	**PSO5**	
CO1	**3**	2	**0**	**3**	**2**	**3**	**2**	**3**	**2**	**2**	2.2
CO2	**2**	**2**	**2**	**2**	**3**	**3**	**3**	**2**	**2**	**2**	2.3
CO3	**2**	**2**	**0**	**2**	**0**	**3**	**2**	**2**	**3**	**3**	1.9
CO4	**3**	**2**	**2**	**2**	**1**	**3**	**3**	**2**	**1**	**2**	2.1
CO5	**2**	**3**	**1**	**0**	**2**	**2**	**3**	**2**	**3**	**2**	2.0
										Mean Overall Score	**2.10**
										Correlation	**Medium**

Mean Overall Score	**Correlation**
< 1.5	Low
≥ 1.5 and < 2.5	Medium
≥ 2.5	High

Course Coordinators:
Dr. M. Jamal Mohamed Jaffar
Dr. J. Ebenezar

Semester	Course Code	Course Category	Hours/ Week	Credits	Marks for Evaluation		
					CIA	ESE	Total
I	23PPH1DE1B	DISCIPLINE SPECIFIC ELECTIVES – I	6	4	25	75	100

Course Title	ADVANCED TOPICS IN PHYSICS

SYLLABUS

Unit	Contents	Hours
I	**Quantum Theory of Scattering** 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*.	18
II	**Molecular Orbital Theory** 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*****	18
III	**Non- linear Waves and Solitons** 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	18
IV	**Optical Electronics** The electro-optic effect: the electro-optic effect in KDP crystal: longitudinal mode -transverse mode. Acousto- optic effect: Raman-Nath and Bragg'sregimes of diffractions – experimental set up to observe Raman-Nath diffraction – Raman-Nath acousto-optic modulator- Bragg's modulator –*****acousto-optic spectrum analyser*****	18
V	**Astronomical Instruments** 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*****	18

……. Self Study

Text Book :

1. G.Aruldhas, Molecular Structure and Spectroscopy , Eastern Economy Edition , II Edition **,** 2018 Unit-I: Section 14.1-14.14

Unit-II: Section 4.3,4.7,4.8,4.10

2. G.Aruldhas, Quantum mechanics, Eastern Economy Edition Second edition, 2014

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, Tata McGraw-Hill Publishing Company Ltd, New Delhi, 2010 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 Tata McGraw-Hill Publishing Company Ltd, New Delhi, 2015Unit-V: Section 19.2(a,b,d),19.3(a),19.4(a,b,c)

Reference Books
1. 1. B. H. Bransden and Joachain, Quantum Mechanics , Wily Edition (2nd edition) 2008 2. AjoyGhatak, K.Thyagarajan, Quantum mechanics and field theory Wily Edition ,2018 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
Web Resources:
1.https://www.southampton.ac.uk/assets/centresresearch/documents/compchem/DFT_L6.pdf 2. e-PgPathshala,NME-ICT,paper10-M-15

Course Outcomes		
Upon successful completion of this course, the student will be able to:		
CO No.	**CO Statement**	**Cognitive Level (K-Level)**
CO1	explain the basic principles of Kerr and non- Kerr media and their underlying rules in recent research	**K2**
CO2	Solve the quantum theory problems for scattering.	**K3**
CO3	compare the telescopes used in the astronomy	**K4**
CO4	evaluate the ideas needed to produce nonlinear waves like soliton	**K5**
CO5	Develop the knowledge and operate the astronomical instruments in our lab	**K6**

Relationship Matrix:

Course Outcomes (COs)	**Programme Outcomes (POs)**					**Programme Specific Outcomes (PSOs)**					**Mean Score of COs**
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PSO1**	**PSO2**	**PSO3**	**PSO4**	**PSO5**	
CO1	**3**	3	**3**	**2**	**2**	**2**	**1**	**1**	**2**	**1**	**2.0**
CO2	**2**	**3**	**2**	**3**	**2**	**1**	**2**	**2**	**3**	**2**	**2.2**
CO3	**2**	**2**	**2**	**3**	**3**	**2**	**2**	**3**	**1**	**2**	**2.2**
CO4	**2**	**1**	**2**	**2**	**2**	**2**	**2**	**3**	**2**	**2**	**2.0**
CO5	**2**	**3**	**3**	**2**	**3**	**3**	**2**	**1**	**2**	**1**	**2.2**
Mean Overall Score											**2.12**
Correlation											**Medium**

Mean Overall Score	**Correlation**
< 1.5	Low
≥ 1.5 and < 2.5	Medium
≥ 2.5	High

Course Coordinators:

Dr. S. ABBAS MANTHIRI
Dr. V. KALYANA VALLI

Semester	Course Code	Course Category	Hours/ Week	Credits	Marks for Evaluation		
					CIA	ESE	Total
II	23PPH2CC5	CORE - V	6	5	25	75	100

Course Title	ADVANCED MATHEMATICAL PHYSICS

SYLLABUS		
Unit	**Contents**	**Hours**
I	**Partial Differential Equations (**PDE) Definitions – Method of separation of variables – Solution of one-dimensional wave equation – One dimensional heat conduction equation — General solution of the cylindrical wave equation – Modes of an optical fiber-Transformation and classification of PDEs – *Characteristic coordinates* – Canonical forms of hyperbolic, parabolic and elliptic equations	**18**
II	**Special Functions** Legendre differential equation and Legendre functions – Generating function of Legendre Polynomial – Orthogonal properties of Legendre Polynomials- Recurrence formula for $P_n(x)$ Bessel's differential equation – Recurrence formula for $J_n(x)$- Jacobi series-Hermite differential equation and Hermite Polynomials – Generating function of Hermite Polynomials – Recurrence formula for Hermite Polynomials – *Orthogonal properties of Hermite Polynomials*	**18**
III	**The Beta, Gamma, Dirac-Delta, Green's Functions** 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	**18**
IV	**Fourier and Laplace Integral Transforms** 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** Evaluation of definite integrals-Solution of differential equations – ordinary differential equation (ODE) with constant coefficients – ODE with variable coefficients - solution of integral equations – solution of boundary value problem	**18**
V	**Group Theory** 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- The character of a representation	**18**
VI	**Current Trends (For CIA only)** **Self-Study for Enrichment:** Exact differential –Sylvester's theorem— Elementary ideas in Lie Groups and Lie Algebras –Simple applications of Fourier Transforms– Laguerre differential equation.- Hypergeometric function	

……. Self Study

Text Books:

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, 7th edition, New Delhi (2005).
   Unit – II :7.12-7.16,7.22,7.26,7.28,7.35-7.38
   Unit -III :4.1-4.7, 5.2-5.5, 11.1,11.2,11.8-11.12
   Unit – IV :10.5-10.8,10.22
   Unit – V: 13.1-13.2,13.4-13.6,13.13,13.16-13.22

Reference Books

1. Charlie Harper, Introduction to Mathematical Physics, PHI,New Delhi,2006.
2. P.K. Chattopadhyay, Mathematical Physics, New Age International,New Delhi,1990
3. Dass, H.K., & Rama Verma., (2018).Mathematical Physics.(1st Edition) S.Chand& Co, New Delhi.

Web Resources

1. 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

Course Outcomes		
Upon successful completion of this course, the student will be able to:		
CO No.	**CO Statement**	**Cognitive Level (K-Level)**
CO1	Remember and Understand the various mathematical concepts used in physics	**K2**
CO2	Analyze mathematical tools like vector, matrix, group theory, complex integration, Fourier and Laplace series, special function will prepare the student to solve ODE; PDE's which model physical phenomena.	**K3**
CO3	Evaluate the vector, linear, simultaneous and differential equations which will be necessary to pursue other areas in physics.	**K4**
CO4	Apply mathematical methods to predict the problems in classical physics, statistical physics and quantum mechanics as well as electrodynamics.	**K5**
CO5	Solve the physical problems using mathematical techniques.	**K6**

Relationship Matrix:

Course Outcomes (COs)	**Programme Outcomes (POs)**					**Programme Specific Outcomes (PSOs)**					**Mean Score of COs**
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PSO1**	**PSO2**	**PSO3**	**PSO4**	**PSO5**	
CO1	**3**	2	**3**	**2**	**1**	**3**	**2**	**2**	**2**	**3**	**2.3**
CO2	**2**	**3**	**2**	**3**	**3**	**3**	**3**	**2**	**2**	**3**	**2.6**
CO3	**2**	**2**	**3**	**1**	**2**	**2**	**3**	**2**	**3**	**2**	**2.2**
CO4	**2**	**1**	**2**	**3**	**3**	**2**	**3**	**2**	**3**	**3**	**2.4**
CO5	**2**	**3**	**2**	**3**	**2**	**2**	**3**	**2**	**3**	**2**	**2.4**
Mean Overall Score											**2.38**
Correlation											**Medium**

Mean Overall Score	**Correlation**
< 1.5	Low
≥ 1.5 and < 2.5	Medium
≥ 2.5	High

Course Coordinators:

Dr. R.RAJ MUHAMED
Dr. S. SHEK DHAVUD

Semester	Course Code	Course Category	Hours/ Week	Credits	Marks for Evaluation		
					CIA	ESE	Total
II	23PPH2CC6	CORE - VI	6	5	25	75	100

Course Title	MOLECULAR SPECTROSCOPY

SYLLABUS		
Unit	**Contents**	**Hours**
I	**Rotation of Molecules** Classification of Molecules – Rotational spectra of rigid diatomic molecules – Isotope effect in rotational spectra – non-rigid rotator – linear polyatomic molecules –symmetric top molecules – asymmetric top molecules – *Stark Effect* – Microwave Spectrometer – Instrumentation	**18**
II	**Infrared Spectroscopy** Vibrational energy of a diatomic molecule – Infrared selection rules – Vibrating diatomic molecule – Diatomic vibrating rotator – vibrations of polyatomic molecules – normal vibrations of CO_2 and H_2O molecules –rotation – vibration– spectra of polyatomic molecules – linear molecules – * symmetric top molecules* – FTIR Instrumentation	**18**
III	**Raman Spectroscopy** Theory of Raman scattering – classical theory – Quantum theory – rotational Raman spectra: linear molecules – symmetric top molecule – asymmetric top molecule – Vibrational Raman Spectra – *mutual exclusion principle* – Raman spectrometer – Fourier transform Raman spectrometer – structure determination using IR and Raman Spectroscopy – Molecules of XX_2, XX_3 –Coherent-anti-stokes Raman scattering – Photo acoustic Raman Scattering	**18**
IV	**Electronic Spectra of Diatomic molecules & ESR** Vibrational course structure – Vibrational analysis of band systems – Deslanders table – Frank-Condon principle – Rotational fine structure of electronic – Vibration Spectra – Dissociation – Election Spin Resonance – Principle – ESR spectrometer – Total Hamiltonian – * Hyperfine structure *	**18**
V	**Resonance Spectroscopy** Magnetic properties of nuclei – Resonance condition – NMR instrumentation – Relaxation process – Bloch equations – chemical shift – High Resolution Hamiltonian NMR Imaging – The quadruple nucleus – principle of NQR – Transition for nonaxially symmetric systems – * NQR Instrumentation chemical bonding*	**18**
VI	**Current Trends (For CIA only) –** Photoacoustic spectroscopy-PAS spectra-ATR Spectroscopy	

……. Self Study

Text Book :

G. Aruldhas, Molecular structure and Spectroscopy, Eastern Economy Edition , II Edition , 2009.

Unit – I: Chapter- VI: 6.1, 6.3, 6.4, 6.6, 6.8 – 6.11, 6.14
Unit – II:Chapter-VII: 7.1 – 7.18
Unit- III:Chapter-VIII& XV: 8.1 – 8.17,15.8,15.9
Unit – IV:Chapter-IX& XI : 9.1 – 9.3, 9.6, 9.7, 9.9, 11.1 – 11.5
Unit – V:Chpater-XII: 12.1, 12.2, 12.4, 12.5, 12.7
Colin N. Banwell

Reference Books
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. 3. H. Kaur, Spectroscopy, Pragati Publications, 9th Edition,2014v
Web Resources:
1.https://www.southampton.ac.uk/assets/centresresearch/documents/compchem/DFT_L6.pdf 2. e-PgPathshala,NME-ICT,paper10-M-15 3. JLExp13.pdf (mit.edu) 2. https://nptel.ac.in/courses/115101003

Course Outcomes		
Upon successful completion of this course, the student will be able to:		
CO No.	**CO Statement**	**Cognitive Level (K-Level)**
CO1	Recall the fundamental concepts and applications of microwave, IR, Raman and other spectroscopic methods , explain the basic, principle and underlying quantum concepts of spectroscopy	**K2**
CO2	Make use of electronic spectroscopy for chemical analysis. Analyze the NMR and FTIR spectra of various samples and identify their chemical structure.	**K3**
CO3	Analyze the NMR and FTIR spectra of various samples and identify their chemical structure , understand the spectroscopic applications in allied fields	**K4**
CO4	Choose suitable spectroscopic technique and examine the chemical composition of a material. familiarize to differentiate various types of spectra	**K5**
CO5	Develop the knowledge acquired and use spectroscopic instruments to examine and develop new materials. motivate towards research in spectroscopy	**K6**

Relationship Matrix:

Course Outcomes (COs)	**Programme Outcomes (POs)**					**Programme Specific Outcomes (PSOs)**					**Mean Score of COs**
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PSO1**	**PSO2**	**PSO3**	**PSO4**	**PSO5**	
CO1	**3**	3	**3**	**2**	**2**	**2**	**1**	**2**	**2**	**2**	**2.2**
CO2	**2**	**3**	**2**	**3**	**2**	**2**	**2**	**2**	**3**	**2**	**2.3**
CO3	**2**	**2**	**2**	**3**	**3**	**2**	**3**	**3**	**2**	**2**	**2.4**
CO4	**2**	**1**	**2**	**2**	**2**	**2**	**2**	**3**	**2**	**2**	**2.0**
CO5	**2**	**3**	**3**	**2**	**3**	**3**	**2**	**1**	**2**	**2**	**2.3**
										Mean Overall Score	**2.22**
										Correlation	**Medium**

Mean Overall Score	**Correlation**
< 1.5	Low
≥ 1.5 and < 2.5	Medium
≥ 2.5	High

Course Coordinators:

Dr. A. ABBAS MANTHIRI
Dr. S. ABBAS MANTHIRI

Semester	Course Code	Course Category	Hours/ Week	Credits	Marks for Evaluation		
					CIA	ESE	Total
II	23PPH2CC7	CORE - VII	6	5	25	75	100

Course Title	ELECTROMAGNETIC THEORY

SYLLABUS

Unit	Contents	Hours
I	**UNIT – I: ELECTROSTATICS AND BOUNDARY VALUE PROBLEM** Gauss law and its applications: field due to infinite, straight uniformly charged wire – Poisson and Laplace equations – Multipole expansion – Method of separation of variables: Cartesian coordinates – Potential at point between the plates of a parallel plate capacitor – Spherical coordinates – Potential at point between the plates of a spherical capacitor - Method of images: Classic image problem – *Boundary value problems with linear dielectrics*.	**18**
II	**UNIT – II: MAGNETOSTATICS** Lorentz force law – Biot-Savart's law and its applications: Magnetic field due to the current flowing in a straight wire – Ampere's circuital law and its applications: Field inside a long Solenoid – *Divergence and curl of magnetic induction* – Magnetic scalar potential – Magnetic vector potential – #Magnetic dipole moment# – Magnetization – Magnetic intensity – Magnetic susceptibility and permeability – Boundary conditions for B and H between two media.	**18**
III	**UNIT – III: FIELD EQUATIONS AND THEIR POTENTIALS** Maxwell's equation – Equation of continuity – Displacement current – Poynting theorem – Poynting vector – electromagnetic potentials - Gauge transformation: Lorentz and coulomb gauges – #Retarded potentials# – Lineard Wiechert potentials – Fields at a point charge in uniform rectilinear motion	**18**
IV	**UNIT – IV: ELECTROMAGNETIC WAVE PROPAGATION** Propagation of Electromagnetic waves: free space, non-conducting medium (isotropic dielectric), conducting medium – *Reflection and refraction of electromagnetic waves* - Kinematic and dynamic properties – Fresnel's equation – Wave guides – TE and TM modes in rectangular wave guides	**18**
V	**UNIT – V: RADIATION AND PLASMA PHYSICS** Electric dipole radiation – Magnetic dipole radiation – Radiation from an arbitrary source – Power radiated by a point charge: Larmor formula – Radiation reaction: Abraham-Lorentz formula. Basics of plasma – Composition and characteristics of plasma – Pinch effect – *Maxwell's equations in a homogeneous plasma* – Dispersion relation in plasma medium: Phase and group velocity.	**18**

……. Self Study

Text Book(s):

1. K.K. Chopra and G.C. Agarwal, Electromagnetic Theory, Sixth edition, K. Nath& Co., Meerut. 2019−2020.
2. David. J. Griffith, Introduction to Electrodynamics, Third edition, Prentice Hall of India. 2009.
3. Satya Prakash, Electromagnetic theory and Electro dynamics, Eleventh edition, KedarNath Ram Nath, Meerut. 2014.
4. B.B. Laud, Electrodynamics, Second edition, Wiley Eastern Limited, Second Reprint, September 1990.
5. S. N. Goswami, Elements of Plasma Physics, New Central Book Agency (P) Ltd., Calcutta, 2016.
6. Edward C. Jordan and Keith G. Balmain

UNIT	BOOK	SECTION NO.
I	1	1.3, Ex 3 a, 1.4, 2.2 a, 2.2 b, 2.3 a, 2.3 b
	2	2.3.3, 3.4, 3.2.1, 4.4.2
	4	1.6, 3.1, 3.10
II	1	3.2 a, 3.2 b, 3.2 c, 3.3, 3.3 b, 3.5, 3.6, 3.8, 3.9, 3.10 a, 3.10 b, 3.11
	3	6.2, 6.3, 6.6, 6.8, 6.9, 6.10, 6.11, 6.12, 6.14, 6.16, 6.17, 6.21, 6.22, 6.30
	2	5.1, 5.2, 5.3, 6.1.4, 6.4.1, 6.1.1
	4	4.7, 4.9 a, 4.9 b, 4.15, 4.17, 5.7, 4.18
III	1	4.3, 4.1, 4.2, 4.5, 4.7, 4.9, 4.10, 4.11, 8.1, 8.2,8.3
	3	8.5, 8.2, 8.3, 8.9, 8.10, 11.3, 11.4, 9.12, 9.13, 9.14, 9.15
	2	10.1.2, 10.1.3, 10.2.1
	4	9.1, 8.5
IV	1	5.1, 5.2, 5.4, 6.2, 6.3, 6.8,6.9
	3	8.12, 8.14, 8.15, 9.2, 9.4, 9.7, 9.8
V	2	11.1.1, 11.1.2, 11.1.3, 11.1.4, 11.2.1, 11.2.2
	5	1.1, 1.2, 3.7, 3.8.2, 3.8.3

Reference Book(s):

1. J.D. Jackson, Classical Electrodynamics, Third edition, John-Wiley, New York.
2. P. Lorrain and D. Corson, Electromagnetic fields and Waves, Second edition, CBS Publishers and Distributers, New Delhi.
3. Edward C. Jordan and Keith G. Balmain, Electromagnetic waves and Radiating system, Second edition, Prentice Hall of India, New Delhi.

Web Resource(s):

1. https://farside.ph.utexas.edu/teaching/jk1/Electromagnetism/node42.html
2. https://digimat.in/nptel/courses/video/115104088/L35.html
3. https://digimat.in/nptel/courses/video/115106122/L71.html
4. https://www.youtube.com/watch?v=SvoUmF_CjnY
5. https://en.wikipedia.org/wiki/Fresnel_equations
6. https://www.digimat.in/nptel/courses/video/115102020/L07.html

Course Outcomes

Upon successful completion of this course, the student will be able to:

CO No.	CO Statement	Cognitive Level (K-Level)
CO1	Apply the basic concepts of electrostatics, magnetostatics, and field equations	**K3**
CO2	Classify the method of different transformations, TE and TM modes in circular and rectangular wave guides	**K4**
CO3	Analyze the Magnetic dipole radiation relation and electromagnetic wave propagation in plasma medium	**K4**
CO4	Determine the boundary conditions in electrostatics and magneto statics and Poynting theorem.	**K5**
CO5	Adapt and solve classic image problem, electromagnetic waves in different medium, Larmor formula, Abraham-Lorentz formula and Dispersion relation in plasma	**K6**

Relationship Matrix:

Course Outcomes (COs)	Programme Outcomes (POs)					Programme Specific Outcomes (PSOs)					Mean Score of COs
	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3	PSO4	PSO5	
CO1	**2**	2	**0**	**3**	**2**	**2**	**2**	**3**	**2**	**2**	2.2
CO2	**2**	**1**	**2**	**2**	**2**	**3**	**2**	**2**	**2**	**1**	2.3
CO3	**1**	**2**	**0**	**1**	**0**	**2**	**3**	**3**	**1**	**1**	1.8
CO4	**3**	**2**	**0**	**0**	**0**	**3**	**3**	**1**	**0**	**2**	2.0
CO5	**2**	**3**	**0**	**0**	**0**	**1**	**2**	**2**	**3**	**2**	1.8
										Mean Overall Score	**2.02**
										Correlation	**Medium**

Mean Overall Score	Correlation
< 1.5	Low
≥ 1.5 and < 2.5	Medium
≥ 2.5	High

Course Coordinators: Dr. Peer Mohamed Sadhik
Dr. J. Ebenezar

Semester	Course Code	Course Category	Hours/ Week	Credits	Marks for Evaluation		
					CIA	ESE	Total
II	23PPH2CC8P1	CORE – VIII	3	2	10	40	50

Course Title	CONDENSED MATTER PHYSICS – PRACTICAL

List of Experiments:

1. Determination of Rydberg's constant using Hydrogen arc lamp.
2. Determination of wavelength and refractive index using Bi-prism & Spectrometer.
3. Determination of Planck's constant.
4. Hysteresis 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.

Text Books:

1.M.N. Srinivasan, S. Balasubramaniyan, R. Ranganathan, A text book of Practical Physics, S. Chand&Sons , Reprint 2010.
2.C.C. Ouseph, U.J. Rao& V. Vijayendran, Practical physics and electronics, S. Viswanathan, Pvt,Ltd, First Edition, 2007.

Web References:

www.physicstutoruials.org
www.sciencelearn.org.nz

Course Outcomes		
Upon successful completion of this course, the student will be able to:		
CO No.	**CO Statement**	**Cognitive Level (K-Level)**
CO1	Recall the basic principles of Solid State Physics	**K2**
CO2	Make practical skills essential for experimentation.	**K3**
CO3	Analyze initial adjustments of CRO, sensitive balance etc.	**K4**
CO4	evaluate the experimental skills	**K5**
CO5	Create the ideas required and methods of the skills developed to future problems.	**K6**

Relationship Matrix:

Course Outcomes (COs)	Programme Outcomes (POs)					Programme Specific Outcomes (PSOs)					Mean Score of COs
	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3	PSO4	PSO5	
CO1	**3**	3	**3**	**2**	**2**	**2**	**2**	**2**	**2**	**2**	**2.3**
CO2	**2**	**3**	**2**	**3**	**2**	**2**	**2**	**2**	**3**	**2**	**2.3**
CO3	**2**	**2**	**2**	**3**	**3**	**2**	**3**	**3**	**2**	**2**	**2.4**
CO4	**2**	**2**	**2**	**2**	**2**	**2**	**1**	**3**	**3**	**3**	**2.2**
CO5	**2**	**3**	**3**	**2**	**3**	**3**	**2**	**1**	**2**	**2**	**2.3**
									Mean Overall Score		**2.34**
									Correlation		**Medium**

Mean Overall Score	Correlation
< 1.5	Low
≥ 1.5 and < 2.5	Medium
≥ 2.5	High

Course Coordinator: Mr. Umar Malik

Semester	Course Code	Course Category	Hours/ Week	Credits	Marks for Evaluation		
					CIA	ESE	Total
II	23PPH2CC8P2	CORE – VIII	3	2	10	40	50

Course Title	ANALOG ELECTRONICS – PRACTICAL

List of Experiments:

1. IC Regulated dual power supply using IC (7812, 7912) and Op – Amp characteristics.
2. Astable Multivibrator using 555 timer.
3. Characteristics of LDR.
4. Wien's Bridge Oscillator using Op- Amp.
5. Characteristics of UJT and UJT Relaxation Oscillator.
6. D/A converter –R - 2R Ladder Method.
7. Monostable Multivibrator using 555 timer.
8. Low Pass and High Pass Filters.

Books for Reference:

1.M.N. Srinivasan,S. Balasubramaniyan, R. Ranganathan, A text book of Practical Physics, S.Chand&Sons , Reprint 2010.
2.C.C. Ouseph, U.J. Rao& V. Vijayendran, Practical physics and electronics, S. Viswanathan, Pvt,Ltd, First Edition, 2007.

Web References:

www.physicstutoruials.org
www.sciencelearn.org.nz

Upon successful completion of this course, the student will be able to:

CO No.	CO Statement	Cognitive Level (K-Level)
CO1	Recall the basic principles of Analog Electronics	**K2**
CO2	Make practical skills of components and their tolerances.	**K3**
CO3	Analyze initial adjustments of CRO, ammeters, voltmeters , sensitive balance etc.	**K4**
CO4	evaluate the troubleshoot deficiencies and rectify problems that may occur	**K5**
CO5	Create the ideas to design electronic circuits to device new experiments.	**K6**

Relationship Matrix:

Course Outcomes (COs)	Programme Outcomes (POs)					Programme Specific Outcomes (PSOs)					Mean Score of COs
	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3	PSO4	PSO5	
CO1	3	3	3	2	2	2	2	2	2	2	2.3
CO2	2	3	2	3	2	2	2	2	3	2	2.3
CO3	2	2	2	3	3	2	3	3	2	2	2.4
CO4	2	2	2	2	2	2	1	3	3	3	2.2
CO5	2	3	3	2	3	3	2	1	2	2	2.3
Mean Overall Score											2.34
Correlation											Medium

Mean Overall Score	Correlation
< 1.5	Low
≥ 1.5 and < 2.5	Medium
≥ 2.5	High

Course Coordinator: Dr. A. Mohamed Saleem

Semester	Course Code	Course Category	Hours/ Week	Credits	Marks for Evaluation		
					CIA	ESE	Total
II	23PPH2DE2A	Discipline Specific Electives - II	6	4	25	75	100

Course Title	COMPUTATIONS IN PHYSICS USING PYTHON

SYLLABUS		
Unit	**Contents**	**Hours**
I	**The Python Ecosystem** Python Basics –variables and strings – lists – nested lists – tuples – sets – dictionaries – conditionals (if – else, if – elif – else) – Loops (while loops – for loops)– comprehensions –The Python Ecosystem – Python Packages: Matplotlib – NumPy – SciPy – SymPy – VPython – Python Visualization Tools –Python Matrix Tools – *Python Algebraic Tools*	**18**
II	**Computational Basics of Physics** Floating Point Arithmetic – Uncertainties in Computed Numbers-Numerical Derivatives-Numerical Integration-Gaussian Quadrature – *Random Number Generation* –Test for Random Generators – Ordinary Differential Equations – Euler and Runge-Kutta Rules **–** Partial Differential Equations	**18**
III	**Data Analytics for Physics** Functions – scope – recursion – Lambdas – *File Operations* – Read/Write data to file –Curve Plotting – Root Finding – Least Squares Fitting – Linear Least Squares Fitting – Discrete Fourier Transforms – Fast Fourier Transforms	**18**
IV	**Problems in Classical Dynamics, Electricity and Magnetism** Oscillators – Linear and Nonlinear Oscillators – Assessing precision via Energy Conservation – Models of Friction-linear and Nonlinear Resonances –Realistic Pendulum –Elliptic Integrals Double Pendula –Period Algorithm – Phase Space Orbits –*Projectile Motion* – Bound States –Scattering –Rutherford Scattering – Stable Points in Electric Fields – AC circuits – LCR circuit	**18**
V	**Problems in Quantum Mechanics and Statistical Physics** Bound states for 1-D box (Semi-analytic) – Arbitrary Potential- Klein-Gordon Equation- Harmonic Oscillator Wave Functions – Hydrogen Atom Wave Functions – Scattering –*Spontaneous Decay* – Fitting a Black Body Spectrum – Heat Equation – Solution for various geometries-Random Walks-Brownian Motion	**18**

……. Self Study

Text Books :

1. Anthony Scopatz and Kathryn D. Huff, Effective Computation in Physics,O'Reilly Media, Inc., CA. USA, (2015)
2. Rubin H. Landau and Manuel Jose Paez, Computational Problems for Physics-With Guided Solutions Using Python, CRC Press, Taylor & Francis Group, Florida, (2018).

Unit -I : Textbook 1., Chapters 2.0, 3.0, 4.0
Textbook 2., Section 1.2
Unit- II : Textbook 2., Sections1.3, 1.4, 1.5, 1.6, 1.7, 1.8
Unit-III : Textbook 1. Chapter 5.0
Textbook 2. Sections2.2, 2.3, 2.4, 2.4, 2.5, 3.4, 3.5
Unit- IV : Textbook 2. Sections3.2, 3.3, 3.6, 3.7,3.9, 9.4, 9.10
Unit -V : Textbook 2. Sections 6.2, 6.3, 6.4, 6.6, 6.8, 7.2, 7.3

Reference Book

Hans PetterLangtangen, A Primer on Scientific Programming with Python, 5th Edition, Springer-Verlag Berlin Heidelberg, (2016)

Web Resource:

http://physics.oregonstate.edu/~landaur/Books/CPbook/eBook/Lectures/

Course Outcomes		
Upon successful completion of this course, the student will be able to:		
CO No.	**CO Statement**	**Cognitive Level (K-Level)**
CO1	acquire the basic knowledge of the constructs of Python language and the skill to write simple and efficient codes in it.	**K3**
CO2	learn the computational needs such as floating-point arithmetic, numerical methods for integration, differentiation, random number generation etc.	**K3**
CO3	Analyze the numerical and graphical results to explain the dynamical behaviours in the light of the laws of Physics	**K4**
CO4	Explain the mathematically model the physical systems in terms of equations and derive the solutions numerically	**K5**
CO5	Develop the numerical solutions using Python graphics packages	**K6**

Relationship Matrix:

Course Outcomes (COs)	Programme Outcomes (POs)					Programme Specific Outcomes (PSOs)					Mean Score of COs
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PSO1**	**PSO2**	**PSO3**	**PSO4**	**PSO5**	
CO1	**3**	3	**3**	**2**	**2**	**2**	**1**	**2**	**2**	**2**	**2.2**
CO2	**2**	**3**	**2**	**3**	**2**	**2**	**2**	**2**	**3**	**2**	**2.3**
CO3	**2**	**2**	**2**	**3**	**3**	**2**	**3**	**3**	**2**	**2**	**2.4**
CO4	**2**	**1**	**2**	**2**	**2**	**2**	**2**	**3**	**2**	**2**	**2.0**
CO5	**2**	**3**	**3**	**2**	**3**	**3**	**2**	**1**	**2**	**2**	**2.3**
									Mean Overall Score		**2.22**
									Correlation		**Medium**

Mean Overall Score	Correlation
< 1.5	Low
≥ 1.5 and < 2.5	Medium
≥ 2.5	High

Course Coordinators:

Dr. A. IshaqAhamed
Mr. J. Umar Malik

Semester	Course Code	Course Category	Hours/ Week	Credits	Marks for Evaluation		
					CIA	ESE	Total
II	23PPH2DE2B	Discipline Specific Electives - II	6	4	25	75	100

Course Title	NANOSCIENCE AND TECHNOLOGY

SYLLABUS

Unit	Contents	Hours
I	**Nanomaterials** *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 – *carbon nanostructures* – oxides: zinc oxide – aluminium oxide – copper oxide	18
II	**Growth techniques of Nanomaterials** 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 – Sol–gel synthesis – microwave method – co–precipitation method	18
III	**Properties of Nanomaterials** 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*	18
IV	**Characterization of Nanomaterials** 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	18
V	**Applications of Nanomaterials** Nanomaterials in medicine – energy sector –*nanomaterials in next generation computer technology* - communication sector –food –fabric industries – automobiles –ceramic industries	18

……. Self Study

Text Books :

M.A. Shah TokeerAhmad ,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

Reference Books

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

Web Resource:

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

Course Outcomes		
Upon successful completion of this course, the student will be able to:		
CO No.	**CO Statement**	**Cognitive Level (K-Level)**
CO1	Acquired the basic principles and fundamental concepts of nanotechnology	**K3**
CO2	learn the theablity to evaluate nanostructures in quantum mechanical approaches computational needs such as floating-point arithmetic, numerical methods for integration, differentiation, random number generation etc.	**K3**
CO3	Analyze the importance of nanotechnology in various fields	**K4**
CO4	Explain the the capacity to convey their views on the implication of nano sciences for the society	**K5**
CO5	Develop towards research in Nanotechnology	**K6**

Relationship Matrix:

Course Outcomes (COs)	**Programme Outcomes (POs)**					**Programme Specific Outcomes (PSOs)**					**Mean Score of COs**
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PSO1**	**PSO2**	**PSO3**	**PSO4**	**PSO5**	
CO1	**3**	3	**3**	**2**	**2**	**2**	**1**	**2**	**2**	**2**	**2.2**
CO2	**2**	**3**	**2**	**3**	**2**	**2**	**2**	**2**	**3**	**2**	**2.3**
CO3	**2**	**2**	**2**	**3**	**3**	**2**	**3**	**3**	**2**	**2**	**2.4**
CO4	**2**	**1**	**2**	**2**	**2**	**2**	**2**	**3**	**2**	**2**	**2.0**
CO5	**2**	**3**	**3**	**2**	**3**	**3**	**2**	**1**	**2**	**2**	**2.3**
Mean Overall Score											**2.22**
Correlation											**Medium**

Mean Overall Score	**Correlation**
< 1.5	Low
≥ 1.5 and < 2.5	Medium
≥ 2.5	High

Course Coordinators:

Dr. A. S. Haja Hameed
Mrs. G. Pragadeeswari

Semester	Course Code	Course Category	Hours/ Week	Credits	Marks for Evaluation		
					CIA	ESE	Total
III	23PPH3CC9	CORE - IX	6	6	25	75	100

Course Title	NUCLEAR AND PARTICLE PHYSICS

SYLLABUS		
Unit	**Contents**	**Hours**
I	**Unit – I : General properties of Atomic Nucleus** Binding energy – Stability Curve - semi empirical mass formula – optical model – shell model: evidence for the existence of magic numbers – extreme single particle model – spin orbit potential. Nuclear Forces: *Exchange forces* – Yukawa potential – ground state and excited state of deuteron – low energy n-p scattering - scattering length – phase shift – effective range theory	**18**
II	**Unit – II: Radioactive Decays** Alpha decay – Gamow's theory of Alpha decay – Geiger-Nuttal law – neutrino hypothesis – Fermi's theory of beta decay – selection rules – *induced radio activity* –Wu's experiment – non conservation of parity in beta decay – parity in β – decay – gamma decay – selection rules – internal conversion – nuclear isomerism – Multiple order gamma radiations	**18**
III	**Unit – III: Nuclear Fission and Fusion** ***Types of Fission* – distribution of Fission products – Nuclear chain reactions – Q-equation - Four factor formula – Bohr-Wheeler's theory of nuclear fission – liquid drop model. Nuclear Fusion – Thermo nuclear reactions as source of stellar energy – controlled thermo nuclear reactions – Plasma confinement – Fusion reaction in the plasma – conditions for maintained fusion reactions	**18**
IV	**Unit – IV: Nuclear reaction** Nuclear Transmutation by alpha , protons and neutron - neutron spectroscopy – Nuclear reaction cross sections – theory of compound nucleus – reciprocity theorem – Direct reactions – Stripping and pick up reactions – Partial wave analysis of nuclear reaction cross sections – level width – Breit-Wigner dispersion formula for $l = 0$ neutrons.	**18**
V	**Unit – V: Elementary particles** Classification of elementary particle - fundamental interactions – conservation laws and their validity – the C-P-T theorem – symmetry schemes of elementary particles – SU(2) multiplets – SU(3) multiplets of Hadrons – Gellmann – Okubo mass formula for (1/2) octect baryons – (3/2) decouplet – Gellmann-Nishijima formula – Quarks – *classification and fundamental properties* – Flavours and colours.	**18**

….. Self Study

Text Book(s):

1. Nuclear Physics – D.C. Tayal, Himalaya Publishing House – New Delhi
   Unit – I: Chapter-I: 1.6, 1.7, 8.3, 8.4, 8.9-A, 9.4, 9.4- 10.21
   Unit – II: Chapter-V: 5.4, 5.5, 5.7, 6.3, 6.5, 6.6, 6.9, 7.4, 7.6
   Unit- III: Chapter-XIII: 13.1A, 13.2
   Unit – IV: Chapter-X: 10.4, 10.7, 10.9, 10.12, 10.14, 10.20, 10.24
   Unit – V: Chpater-XVIII: 18.1-18.4

Reference Book(s):

1. Nuclear Physics - R.R.Roy and B.P.Nigam, New Age Publishers.
2. Nuclear Physics – R.C. Sharma, KedarNath Ram Nath, New Delhi.
3. Nuclear and particle Physics – S.L.Kakani, ShubhraKakani, Viva books, First Pub, 2008.
4. Elements of nuclear Physics – M.L. Pandya, R.P.S. Yadav , KedarNath Ram Nath, New Delhi.
5. Nuclear Physics & Particle Physics – SatyaPrakash, Sultan Chand & Sons, New Delhi

Web Resource(s):

1. https://swayam.gov.in/nd1_noc20_ph19/preview
2. https://ocw.mit.edu/courses/22-02-introduction-to-applied-nuclear-physics-spring-2012/d0d046f78c917f107d925f11ac862ae4_MIT22_02S12_lec_ch1.pdf
3. https://archive.nptel.ac.in/courses/115/104/115104043/

Course Outcomes

Upon successful completion of this course, the student will be able to:

CO No.	CO Statement	Cognitive Level (K-Level)
CO1	acquire essential knowledge on nuclear models and related theories.	**K1**
CO2	can understand and apply the conservation laws for any nuclear reaction	**K2**
CO3	shall be able to apply the nuclear theory to expound their radioactive decays	**K3**
CO4	analyse the nuclear fission and fusion related problems	**K4**
CO5	solve the reaction mechanism of elementary particles	**K5**

Relationship Matrix:

Course Outcomes (COs)	Programme Outcomes (POs)					Programme Specific Outcomes (PSOs)					Mean Score of COs
	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3	PSO4	PSO5	
CO1	2	3	3	2	2	3	3	3	2	2	2.5
CO2	3	3	3	2	2	3	2	1	1	2	2.2
CO3	3	3	3	1	3	2	2	2	2	3	2.4
CO4	3	3	2	3	2	3	3	3	1	3	2.6
CO5	2	3	2	2	2	2	3	3	2	2	2.3
Mean Overall Score											**2.40**
Correlation											**Medium**

Mean Overall Score	Correlation
< 1.5	Low
≥ 1.5 and < 2.5	Medium
≥ 2.5	High

Course Coordinators:

Dr. N. Peer Mohamed Sathik

Dr. C. Hariharan

Semester	Course Code	Course Category	Hours/ Week	Credits	Marks for Evaluation		
					CIA	ESE	Total
III	23PPH3CC10	Core – X	6	5	25	75	100

Course Title	QUANTUM MECHANICS

SYLLABUS		
Unit	**Contents**	**Hours**
I	**Concepts and Formalism of Quantum Mechanics** Time dependent Schrödinger equation- Physical Interpretation of Wave function ψ: Normalization and Probability Interpretation -Conservation of Probability: Equation of Continuity Expectation Values: Ehrenfest's Theorem -*Admissibility conditions on wave functions*-Stationary states: Time-independent Schrödinger wave equation.	18
II	**Exactly Soluble Eigen Value Problems and Matrix Formulation** Commutation relations -Eigen values and Eigen functions of angular momentum operators - One Dimensional Linear Harmonic Oscillator-Reduction of a Two Body Hamiltonian-Hydrogen Atom Hilbert Space-Linear Operators-Eigen Functions and Eigen Values - *Hermitian Operators*–Simultaneous Measurability of Observables-General Uncertainty Relation-Dirac's Notation - Equations of Motions - Schrodinger, Heisenberg and Interaction Representations	18
III	**Approximation Methods** Stationary State Perturbation theory (non-degenerate and degenerate cases)-Application to Stark Effect in the ground state (n=1) and first excited state (n=2) of Hydrogen atom Time Dependent Perturbation Theory: First Order Perturbation–*Harmonic Perturbations*- Transition to Continuum States : Fermi's Golden Rule	18
IV	**Angular Momentum and Spin States** General angular momentum - *Eigen values of J^2 and J_Z*– Matrix Representation of J_+ , J_-, $J_x$and J_y– Angular Momentum Matrices - Angular Momentum Matrices Problems Spin angular momentum- spin ½ states -Pauli's spin matrices and their properties-Particle Exchange Operator - Symmetric and Antisymmetric Wave Functions-Construction of wave - Symmetric and Antisymmetric Wave Functions–Pauli's Exclusion Principle –Wave Function for a Particle including spin	18
V	**Relativistic Wave Equations** Klein-Gordon Equation for free particle- Interpretation of Klein-Gordon's Equation-Dirac's Relativistic Equation for a free particle-Dirac's Matrices-Covariant form of Dirac's Equation-Probability Density. Plane Wave Solutions of the Dirac's Equation- Negative Energy States -Dirac's Equation for a Particle in a Central Potential– *Spin of a Dirac Particle*	18

….. Self Study

Text Book(s):

1. P.M. Mathews and K. Venkatesan, A Text Book of Quantum Mechanics, Tata McGraw Hill, New Delhi, Second Edition-2017
2. G. Aruldhas, Quantum Mechanics, Prentice Hall of India, New Delhi, Second Edition,2009

Reference Book(s):

1. Leonard Issac Schiff &Jayendra N Bandyopadhyay,Quantum Mechanics , McGraw Hill Education (India) Private Limited, New Delhi, Fourth Edition, 2014.
2. John L Powell and Bernd Crasemann,Quantum Mechanics, Dover Publications Inc., 2015

Web Resource(s):

NPTEL Course in Physics- Quantum Mechanics and Applications- Prof.AjoyGhatak, IIT New Delhi **https://nptel.ac.in/courses/115/102/115102023/**, by Klein-Gordan and Dirac which lead to the concept of negative energy states.

Course Outcomes		
Upon successful completion of this course, the student will be able to:		
CO No.	**CO Statement**	**Cognitive Level (K-Level)**
CO1	Conceptualize the abstract nature of the wave function and its interpretation in a statistical sense, the admissibility conditions that the wave function should obey and realize the importance ofconservation laws and equation of continuity in quantum dynamics	**K1**
CO2	Reason out the equivalence between the classical concepts and quantum ideas under suitablerestraining conditions	**K2**
CO3	Apply the theory of Wave Mechanics to understand simple exactly solvable problems like Linear Harmonic Oscillator, Hydrogen Atom etc., and find how the Matrix Mechanics developed by Heisenberg complements the Wave Mechanics theory developed by Schroedinger	**K3**
CO4	Introduce the various approximation methods developed to study higher order systems, interactions of matter with waves and radiations, as well as to understand the concepts of angular momenta and spin and how these lead to the concept of Pauli's exclusion principle	**K4**
CO5	Understand the behaviour of physical systems in the relativistic limits using the methodsdeveloped by Klein-Gordan and Dirac which lead to the concept of negative energy states.	**K6**

Relationship Matrix:

Course Outcomes (COs)	**Programme Outcomes (POs)**					**Programme Specific Outcomes (PSOs)**					**Mean Score of COs**
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PSO1**	**PSO2**	**PSO3**	**PSO4**	**PSO5**	
CO1	2	3	3	2	2	3	2	3	2	3	2.5
CO2	3	3	2	2	2	3	2	3	2	2	2.4
CO3	3	2	3	2	3	3	2	3	2	3	2.6
CO4	2	3	2	3	2	3	2	3	2	3	2.5
CO5	2	3	2	2	2	2	3	3	2	2	2.3
Mean Overall Score											**2.46**
Correlation											Medium

Mean Overall Score	**Correlation**
< 1.5	Low
≥ 1.5 and < 2.5	Medium
≥ 2.5	High

Course Coordinators:

Dr. A. Ishaq Ahamed

Dr. R. Raj Muhamed

Semester	Course Code	Course Category	Hours/ Week	Credits	Marks for Evaluation		
					CIA	ESE	Total
III	23PPH3CC11	Core - Xl	6	5	25	75	100

Course Title	STATISTICAL MECHANICS

SYLLABUS

Unit	Contents	Hours
I	**KINETIC THEORY** Introduction-distribution function-Equation of motion for distribution function-Boltzmann transport equation-H-theorem and its proof - Maxwell-Boltzmann distribution function - most probable speed- root mean square speed - Equilibrium distribution function for dilute gas – Thermodynamics of dilute gas - Mean free path - Effusion.	18
II	**STATISTICAL MECHANICS AND THERMODYNAMICS** Foundations of statistical mechanics - Specification of states of a system - Micro canonical ensemble - Phase space – Entropy - Connection between statistics and thermodynamics – Entropy of an ideal gas using the micro canonical ensemble - Entropy of mixing and Gibb's paradox.	18
III	**CANONICAL AND GRAND CANONICAL ENSEMBLES** Trajectories and density of states - Liouville's theorem – Canonical and grand canonical ensembles - Partition function - Calculation of statistical quantities - Energy and density fluctuations.	18
IV	**CLASSICAL AND QUANTUM STATISTICS** Density matrix - Statistics of ensembles - Statistics of indistinguishable particles - – Ideal Fermi gas – Degeneracy –Photon gas: radiation pressure-radiation density-Plank radiation formula - Ideal Bose gas - Bose-Einstein condensation	18
V	**ADVANCED QUANTUM STATISTICS** Super fluids - Liquid Helium - λ-transition - Tisza's two fluid model - Landau's theory of phase transitions - Pauli's theory of paramagnetism - General formulation of Ising model – *One dimensional Ising model *- Electron gas in metals.	18

….. Self Study

Text Book(s):

1. K. Huang, *Statistical Mechanics,* Taylor and Francis, London, Second Edition. 2002
2. Statistical Mechanics, B.K. Agarwal and Melvin Eisner, Newage Publication, Second Edition.
3. Statistical Mechanics, Gupta and Kumar, PragathPrakasan Publication, 22nd Edition
4. Fundementals of statistical mechanics, B.B.Laud New age international publishers second edition 2012

Reference Book(s):

1. R. K. Pathria, 1996, *Statistical Mechanics,* 2nd edition, Butter WorthHeinemann, New Delhi.
2. L. D. Landau and E. M. Lifshitz, 1969, *Statistical Physics,* PergamonPress, Oxford.
3. J. K. Bhattacharjee, 1996, *Statistical Mechanics*: An IntroductoryText, Allied Publication, New Delhi
4. W. Greiner, L. Neise and H. Stoecker, *Thermodynamics and StatisticalMechanics,* Springer Verlang, New York.

Web Resource(s):

1. https://swayam.gov.in/nd1_noc20_cy28/preview
2. http://stxavierstn.edu.in/ict_ppts/phy/anavenus/9.pdf
3. https://ps.uci.edu/~cyu/p238C/LectureNotes/IsingModel/IsingModel.pdf

Course Outcomes		
Upon successful completion of this course, the student will be able to:		
CO No.	**CO Statement**	**Cognitive Level (K-Level)**
CO1	To examine and elaborate the effect of changes in thermodynamic quantities on the states of matter during phase transition	**K5**
CO2	To analyze the macroscopic properties such as pressure, volume, temperature, specific heat, elastic moduli etc. using microscopic properties like intermolecular forces, chemical bonding, atomicity etc. Describe the peculiar behaviour of the entropy by mixing two gases Justify the connection between statistics and thermodynamic quantities	**K4**
CO3	Differentiate between canonical and grand canonical ensembles and to interpret the relation between thermodynamical quantities and partition function	**K1**
CO4	To recall and apply the different statistical concepts to analyze the behaviourof ideal Fermi gas and ideal Bose gas and also to compare and distinguishbetween the three types of statistics	**K4,K5**
CO5	To discuss and examine the thermodynamical behaviour of gases under fluctuation	**K3**

Relationship Matrix:

Course Outcomes (COs)	Programme Outcomes (POs)					Programme Specific Outcomes (PSOs)					Mean Score of COs
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PSO1**	**PSO2**	**PSO3**	**PSO4**	**PSO5**	
CO1	3	3	3	1	1	2	3	1	1	3	2.1
CO2	3	3	3	1	1	2	3	1	1	3	2.1
CO3	3	3	3	1	1	2	3	2	1	3	2.2
CO4	3	3	3	1	1	2	3	2	1	3	2.2
CO5	3	3	3	1	1	2	3	1	1	3	2.1
Mean Overall Score											**2.14**
Correlation											**MEDIUM**

Mean Overall Score	Correlation
< 1.5	Low
≥ 1.5 and < 2.5	Medium
≥ 2.5	High

Course Coordinators:

Majar. F.S. Muzzamil

Mr. J. Umar Malik

Semester	Course Code	Course Category	Hours/ Week	Credits	Marks for Evaluation		
					CIA	ESE	Total
III	23PPH3CC12P1	CORE – XII	3	2	10	40	50

Course Title	DIGITAL ELECTRONICS – PRACTICAL

S.No.	List of Experiments
1	Verification of De Morgan's theorem and Boolean expressions
2	Adders and Subtractors using basic logic gates.
3	One bit and two bit comparators.
4	Multiplexer (4×1) and Demultiplexer (1 x 4).
5	R-S, J-K & D flip flops.
6	Shift left and shift right shift registers.
7	Counter (0 – 9) using IC 7490 and decoder driver 7447
8	Asynchronous up/down counters using IC 7476.

Text Book(s):
1. M.N. Srinivasan,S. Balasubramaniyan, R. Ranganathan, A text book of Practical Physics, S.Chand&Sons , Reprint 2010.
Reference Book(s):
1. C.C. Ouseph, U.J. Rao& V. Vijayendran, Practical physics and electronics, S. Viswanathan, Pvt,Ltd, First Edition, 2007.
Web Resource(s):
1. www.physicstutoruials.org 2. www.sciencelearn.org.nz

Course Outcomes		
Upon successful completion of this course, the student will be able to:		
CO No.	**CO Statement**	**Cognitive Level (K-Level)**
CO1	Construct digital circuits using basic logic gates.	**K2**
CO2	Minimisation of logic gates using Boolean laws.	**K3**
CO3	Construct combinational and sequential logic circuits.	**K3**
CO4	Design modulus counter	**K4**
CO5	Apply the digital principles to newer problems that they may encounter in future	**K5**

Relationship Matrix:

Course Outcomes (COs)	Programme Outcomes (POs)					Programme Specific Outcomes (PSOs)					Mean Score of COs
	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3	PSO4	PSO5	
CO1	2	3	3	2	3	3	3	3	2	3	2.7
CO2	3	3	3	2	2	3	2	1	1	2	2.2
CO3	3	2	3	2	3	3	2	3	2	3	2.6
CO4	3	3	2	3	2	3	2	3	1	3	2.5
CO5	2	3	2	2	2	2	3	3	2	2	2.3
									Mean Overall Score		2.46
									Correlation		Medium

Mean Overall Score	Correlation
< 1.5	Low
≥ 1.5 and < 2.5	Medium
≥ 2.5	High

Course Coordinators:

Dr. J. Ebenezar

Dr. V. Kalyanavalli

Semester	Course Code	Course Category	Hours/ Week	Credits	Marks for Evaluation		
					CIA	ESE	Total
III	23PPH3CC12P2	CORE - XII	3	2	10	40	50

Course Title	Numerical programming in Physics using Python - Practical

S.No.	List of Experiments
1	Numerical Integration using Gaussian Quadrature for a function, comparison with its analytical value and determining the error.
2	Random Number Generation using Linear Congruential Technique or Power Residue Method and tests for randomness. Prove that the sum of random variables tends towards a Gaussian Distribution.
3	Roots of Polynomial Equations: Newton Raphson Algorithm
4	Fourier Analysis of Oscillations
5	Oscillations: Linear and Nonlinear Resonances
6	Identification of slow and fast oscillations of a double pendulum
7	Study of Projectile Motion using Verlet Algorithm
8	Bound State Problem: Motion of a planet in Gravitational Field.
9	Verification of Rutherford's Scattering formula
10	Surface plots of a dipole and quadra-pole

Text Book(s):

1. Rubin H. Landau and Manuel Jose Paez, Computational Problems for Physics with Guided Solutions Using Python, CRC Press, Taylor & Francis Group, USA,(2018).
2. Anthony Scopatz and Kathryn D. Huff, Effective Computation in Physics: Field Guide to Research with Python, O'Reilly Media Inc., CA. USA, (2015)

Reference Book(s):

1. Jake VanderPlas, Python Data Science Handbook,O'Reilly Media Inc., CA. USA, (2017)
2. Paul Deitel and Harvey Deitel, Python for Programmers, Pearson India Education Services Pvt. Ltd. India, (2020)

Web Resource(s):

http://physics.oregonstate.edu/landaur/Books/CPbook/eBook/Lectures

Course Outcomes

Upon successful completion of this course, the student will be able to:

CO No.	CO Statement	Cognitive Level (K-Level)
CO1	acquire the basic knowledge of the constructs of Python language and the skill to write simple and efficient codes in it.	K3
CO2	learn the computational methods such as RK4 algorithm, Fast Fourier Transforms, Random Number generation etc.	K3
CO3	apply numerical methods so learnt to solve the mathematical models of many physical systems	K4
CO4	Use graphical results to corelate the theoretical results of many classical and quantum systems	K5
CO5	To apply the skill so developed to newer physical problems independently	K6

Relationship Matrix:

Course Outcomes (COs)	Programme Outcomes (POs)					Programme Specific Outcomes (PSOs)					Mean Score of COs
	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3	PSO4	PSO5	
CO1	3	3	3	3	1	3	3	2	2	3	2.6
CO2	3	3	3	1	2	3	3	3	2	1	2.4
CO3	3	3	3	3	3	3	3	3	2	1	2.7
CO4	3	3	3	2	2	3	3	3	3	1	2.7
CO5	3	3	3	3	2	3	3	3	3	2	2.8
									Mean Overall Score		2.64
									Correlation		High

Mean Overall Score	Correlation
< 1.5	Low
≥ 1.5 and < 2.5	Medium
≥ 2.5	High

Course Coordinators:

Dr. A. Ishaq Ahamed

Mr. J. Umar Malik

Semester	Course Code	Course Category	Hours/ Week	Credits	Marks for Evaluation		
					CIA	ESE	Total
III	23PPH3DE3A	Discipline Specific Elective - III	6	4	25	75	100

Course Title	MICROPROCESSOR AND MICROCONTROLLER

SYLLABUS		
Unit	**Contents**	**Hours**
I	**The Microprocessor 8086** 8086 Microprocessor Architecture-General Purpose Registers-Segment Register-Pointer Register-Instruction Pointer-Flag Register-Instruction Queue-ALU-Control Unit-Memory-Program, Data, Stack memories. 8086 Signals-Pin Diagram-minimum mode signals-Maximum mode signals-System Bus Architecture	**18**
II	**Instruction Set and Programming** Addressing modes-Instruction Set-Data transfer Instructions-Arithmetic Instruction-Bit Manipulation Instructions-String Instructions- Program Transfer Instruction -Processor Control Instructions Addition, Subtraction, Multiplication and Division of two 16 bit data – Sum of the elements in an array – Largest data in an array – Sorting an array of data in ascending order – Factorial of 8 bit data	**18**
III	**I/O Interfacing** Programmable Peripheral Interfacing (8255A)-Pin diagram-Block diagram-BSR mode-Input/Output mode. DAC 0800 8-bit digital to Analog Converter-Interfacing of DAC 0800 with 8086-ADC 0808/0809 – Block diagram and Pin diagram – Interfacing ADC 0808 with 8086 using 8255 pins – Keyboard / Display Controller (IC 8279) – Pin diagram – Block diagram	**18**
IV	**Intel 8051 Microcontroller** Differences between microprocessor and microcontroller – architecture of 8051 – memory organization – pin details of 8051 – special function registers – Timers/Counters – Timer and control registers – Timer modes of operation – counters – serial data I/O – SCON – PCON – Serial data transmission modes – Interrupts in 8051 *Interrupt control*	**18**
V	**8051 Assembly Language** Instruction set: addressing modes – data transfer, arithmetic, logical, Boolean variable manipulation and program branching groups Programming: *BCD addition* – Average of the given numbers – I/O Port – Timer Mode 1 – Counter *Self Study Portions *	**18**
VI	**Current Trends (For CIA only)** Arduino-Basics and Design	

Text Book(s):
Unit-I , Unit-II and Unit-III: P.S.Manoharan, Microprocessor and Microcontroller, Charulatha Publication, Regulation 2013Authors, Title of the Book, Publication, Edition, Year Unit-I: Chapter 1.2,1.2.1-1.2.12,1.3.1-1.3.3 Unit-II: Chapter 1.4,1.4.1-1.4.11,1.5,1.5.1-1.5.6 Unit-III Chapter 3.1,3.2,3.2.1-3.2.5,3.4,3.5,3.7-3.7.3 Unit - IV, V: P.S. Manoharan, Microprocessor&Microcontroller, Charulatha Publication, 2011. Unit - IV: Chapter: 4.1 – 4.9 Unit – V: Chapter : 5.2,5.3, 5.3.1,5.3.2, 5.3.3, 5.3.4, 5.3.4, 5.4, 5.5, 5.6.1, 5.7

Reference Book(s):
1. Ramesh S.Gaonkar, Microprocessor architecture, Programming and applications with the 8086, Penram International Publishing (India) , Fourth edition. 2. A.P.Godse D.A. Godse, Microprocessor and Microcontroller, Technical Publication Pune, First edition-2009. 3. V.Vijayendran, Fundamentals of Microprocessors-8086 Architecture, Programming & Interfacing, S.Vishvanathan (Printers & Publishers), PVT. LTD
Web Resource(s):
1. https://ict.iitk.ac.in/courses/microprocessors-and-microcontrollers/ 2. https://www.arduino.cc/

Course Outcomes		
Upon successful completion of this course, the student will be able to:		
CO No.	**CO Statement**	**Cognitive Level (K-Level)**
CO1	Learn the hardware and software functions of Intel 8086 microprocessor and 8051 microcontroller	**K2**
CO2	Develop the assembly language programming skills	**K2**
CO3	Learn the functions of memory and I/O peripherals for interfacing of Intel 8086 Microprocessor and Intel 8051 microcontroller	**K3**
CO4	Understand the microprocessor/microcontroller architectures and programming concepts	**K4**
CO5	Acquire the talent to implement the applications of microprocessor/microcontroller for data processing, electronic instrumentation and control systems according to the social needs.	**K6**

Relationship Matrix:

Course Outcomes (COs)	**Programme Outcomes (POs)**					**Programme Specific Outcomes (PSOs)**					**Mean Score of COs**
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PSO1**	**PSO2**	**PSO3**	**PSO4**	**PSO 5**	
CO1	**2**	3	**3**	**2**	**3**	**3**	**2**	**2**	**2**	**3**	**2.5**
CO2	**2**	**2**	**3**	**3**	**2**	**2**	**2**	**2**	**2**	**2**	**2.2**
CO3	**3**	**2**	**2**	**3**	**2**	**2**	**3**	**3**	**2**	**3**	**2.5**
CO4	**3**	**2**	**3**	**2**	**2**	**3**	**2**	**2**	**2**	**2**	**2.3**
CO5	**2**	**2**	**2**	**2**	**3**	**3**	**3**	**2**	**2**	**2**	**2.0**
										Mean Overall Score	**2.3**
										Correlation	**Medium**

Mean Overall Score	**Correlation**
< 1.5	Low
≥ 1.5 and < 2.5	Medium
≥ 2.5	High

Course Coordinators:

Dr. A. Abbas Manthiri
Mr. S. Mohamed Ibrahim Sulaiman Sait

Semester	Course Code	Course Category	Hours/ Week	Credits	Marks for Evaluation		
					CIA	ESE	Total
III	23PPH3DE3B	Discipline Specific Elective - III	6	4	25	75	100

Course Title	NONLINEAR OPTICS

SYLLABUS		
Unit	**Contents**	**Hours**
I	**Nonlinear Optical Susceptibility** Introduction to Nonlinear Optics – Descriptions of Nonlinear Optical Interactions: - Second Harmonic Generation - Sum and Difference Frequency Generation - Optical Parametric Oscillation – Third Order Polarization -Third Harmonic Generation - Intensity Dependent Refractive Index - Self-focusing - Optical Bistability – Definition of Nonlinear Susceptibility - Nonlinear susceptibilities of a Classical Anharmonic Oscillator	18
II	**Wave Equations for Nonlinear Optical Interaction** The wave equation for Nonlinear Optical Media – The coupled – Wave Equations for sum – Frequency Generation – Phase Matching – The Manley – Rowe Relations – Mathematical Model for Difference Frequency Generation, Parametric Amplification and Second Harmonic Generation.	18
III	**The Intensity – Dependent Refractive Index** Nonlinear Refractive Index – Mathematical Descriptions of the Nonlinear Refractive Index – Tensor Nature of Nonlinear Higher-order Refractive Index – Propagation of Light Beam Through Isotropic Nonlinear Media – Nonlinear due to Molecular Orientation	18
IV	**Optical Phase Conjugation** Define Optical Phase Conjugation – Aberration Correction by Phase Conjugation – Phase Conjugation by Four-wave Mixing – Polarization Properties of phase conjugation – Self focusing of Light – Self-trapping of Light – Mathematical Model for Optical Bistability – Two Beam Coupling – Pulse Propagation Equation and Optical solitons.	18
V	**Solitons in Optical fibers** Optical Fiber Characteristics – Linear Dispersive Effects – Nonlinear Effects – Wave- envelope Propagation – Bright and Dark solitons – Experiments on Optical Solitons	18
VI	**Current Trends (For CIA only)** **Applications of Optical Soliton:** Optical Logic Gates – Optical Completation – Vector Optical Solitons and Their Interactions	

Text Book(s):

1. Robert W. Boyd, Nonlinear Optics, Academic Press, New York, 1992
   Chapter I – Sections: 1.1, 1.2, 1.3, 1.4 (P. No: 1 – 32)
   Chapter II – Sections: 2.1, 2.2, 2.3, 2.5, 2.6 (P. No: 58 – 84)
   Chapter IV – Sections: 4.1, 4.2, 4.4 (P. No: 159 – 186)
   Chapter VI – Sections: 6.1 – 6.5 (P. No: 242 – 282)
2. Michel Remoisssenet, Waves Called Solitons, Springer, New York, 1999
   Chapter VIII – Sections: 8.1 – 8.5 (P. No: 204 – 225)

Reference Book(s):

1. M. Lakshman and S. Rajasekar, Nonlinear Dynamics, Integrobility, Chaos and patterns, Springer 2003

Web Resource(s):

1. https://www.brown.edu

Course Outcomes		
Upon successful completion of this course, the student will be able to:		
CO No.	**CO Statement**	**Cognitive Level (K-Level)**
CO1	Remembering basic theory of polarization Electric field and susceptibility	**K1**
CO2	Derive wave equation describing Nonlinear Optical Interaction	**K2**
CO3	Applications of Nonlinear Optical effects	**K3**
CO4	Analyze the Nonlinear refractive index	**K4**
CO5	Generation Optical solitons in fibers – Developing secure communication	**K6**

Relationship Matrix:

Course Outcomes (COs)	Programme Outcomes (POs)					Programme Specific Outcomes (PSOs)					Mean Score of COs
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PSO1**	**PSO2**	**PSO3**	**PSO4**	**PSO5**	
CO1	3	3	3	3	3	3	3	2	2	3	2.8
CO2	3	3	3	2	2	2	2	3	3	3	2.7
CO3	3	3	3	3	2	3	2	2	3	2	2.9
CO4	3	3	3	3	3	3	3	3	3	3	2.9
CO5	3	3	2	3	3	3	3	2	3	3	2.8
									Mean Overall Score		**2.78**
									Correlation		**High**

Mean Overall Score	Correlation
< 1.5	Low
≥ 1.5 and < 2.5	Medium
≥ 2.5	High

Course Coordinators:

Dr. R. Radhakrishnan

Mrs. M. Ayisha

Semester	Course Code	Course Category	Hours/ Week	Credits	Marks for Evaluation		
					CIA	ESE	Total
IV	23PPH4CC13	Core - XIII	6	6	25	75	100

Course Title	CONDENSED MATTER PHYSICS

SYLLABUS

Unit	Contents	Hours
I	**Unit-I: Crystal Physics** Crystals-Crystal lattice and translation vectors – Unit cell and primitive lattice - Types of lattices (3D) - number of atoms per unit cell, coordination number, atomic radius and packing factor of SC, BCC , FCC and HCP structures - Structure of Diamond and Sodium chloride - Miller indices - - Schottky and Frenkel defects (concepts only) - Reciprocal lattice - *X-ray diffraction* – Bragg's law - Powder crystal method -	18
II	**Unit-II: Semiconductors, Lattice Vibrations and Thermal Property** Intrinsic and Extrinsic semiconductors (definitions) – Carrier concentration and Fermi level for intrinsic semiconductors - Fermi level for extrinsic semiconductors (n-type and p-type) – Hall effect Lattice vibrations – *One dimensional Monatomic lattice* – Phonons - Phonon momentum - Debye's model of lattice heat capacity – Density of modes – Debye's approximation - Limitations	18
III	**Unit-III: Free Electron Theory and Band Theory of Solids** Drude - Lorentz's classical theory of free electron gas – Expression for thermal and electrical conductivity - Wiedemann-Franz Law – Bloch theorem –Kronig-Penny model – Energy Vs wave vector relationship - *Different representation of Brillouin zones* - velocity and effective mass of electron – Distinction between metals, insulators and semiconductors	18
IV	**Unit-IV: Magnetism in Solids and Dielectrics** Langevin's Classical theory of diamagnetism - quantum theory of paramagnetism -Weiss theory of ferromagnetism - Concept of domains and hysteresis –Nature and origin of Weiss molecular field *Polarization and Susceptibility* – Local field-Dielectric constant and Polarizability (Clausius-Mosotti Equation) - Sources of Polarizability – Frequency dependence of total polarizability - Ferroelectricity - Piezo electricity	18
V	**Unit-V: Superconductivity** Introduction –Meissner effect –Thermodynamical and optical properties – Type -I and Type-II superconductors- London equations – BCS theory- Quantum tunneling-Josephson tunneling- Theory of DC& DC Josephson effects- Applications- SQUID - High Tc superconductors –*Magnetic levitations*.	18

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Text Book(s):

1. Solid State Physics – S.O.Pillai, New age International, 6th Edition (2003)
2. Solid State Physics – R.K. Puri and V.K. Babbar, S. Chand & Company Ltd. (2009)
3. Solid State Physics - Gupta, Kumar, Sharma, S. Chand & Company Ltd. (2003)

Unit- I : Page No.100 – 106 , 115 – 134, 142-146, 154-156, 185-187, 189 – 190 (Book-1)
Unit – II : 199-204, 207 – 219, 103 – 110, 117 -121, 131 - 141 (Book-2) 305- 308 (Book-1)
Unit – III : Page No. 218 – 223 (Book – 3), 177 - 193 (Book-2)
Unit – IV : Page No. 230 – 233, 238 – 251, 265 – 276 (Book-2)
Unit – V : Page No. 410 – 426, 435- 448 (Book-1), 299 – 300 (Book-2)

Reference Book(s):

1. Introduction to Solid State Physics - C.Kittel, Wiley Publication.
2. Solid State Physics – R.K. Puri and V.K. Babbar, S. Chand & Company Ltd.
4. Solid State Physics - Gupta Saxena, Prakathi Prakasan Publications.

Web Resource(s):

1. https://nptel.ac.in/courses/115/105/115105099/
2. https://www.crystalage.com/crystal_information/seven_crystal_systems/
3. http://www.tutorsglobe.com/homework-help/physics/lattice-vibration-75520.aspx
4. https://opentextbc.ca/universityphysicsv3openstax/chapter/band-theory-of-solids/
5. https://www.askiitians.com/iit-jee-electrostatics/dielectrics-and-polarisation/
6. https://opentextbc.ca/universityphysicsv3openstax/chapter/superconductivity/

Course Outcomes		
Upon successful completion of this course, the student will be able to:		
CO No.	**CO Statement**	**Cognitive Level (K-Level)**
CO1	Understand and explain the temperature dependence of electrical conductivity of metals.	**K2**
CO2	Solve problems and predict electrical and thermal properties of solids and explain their origin	**K3**
CO3	differentiate lattice types and explain the concepts of reciprocal lattice and crystal diffraction.	**K4**
CO4	Analyse and conclude lattice vibrations and interaction between electrons and polarons	**K5**
CO5	formulate the knowledge of superconductivity towards development of high temperature superconductors.	**K6**

Relationship Matrix:

Course Outcomes (COs)	Programme Outcomes (POs)					Programme Specific Outcomes (PSOs)					Mean Score of COs
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PSO1**	**PSO2**	**PSO3**	**PSO4**	**PSO5**	
CO1	2	3	3	2	2	3	3	3	2	2	2.5
CO2	3	3	3	2	2	3	2	1	1	2	2.2
CO3	3	3	3	1	2	2	2	2	2	3	2.3
CO4	3	3	2	2	2	3	3	3	1	3	2.5
CO5	2	3	2	2	2	2	3	3	2	2	2.3
Mean Overall Score											**2.36**
Correlation											**Medium**

Mean Overall Score	Correlation
< 1.5	Low
≥ 1.5 and < 2.5	Medium
≥ 2.5	High

Course Coordinators:

Dr. C. Hariharan

Dr. S. Prabakaran

Semester	Course Code	Course Category	Hours/ Week	Credits	Marks for Evaluation		
					CIA	ESE	Total
IV	23PPH4CC14	Core - XIV	6	6	25	75	100

Course Title	ELECTRONIC COMMUNICATION

SYLLABUS		
Unit	**Contents**	**Hours**
I	**Unit – I: Digital Modulation** Bit rate, M-ary encoding, Baud and Minimum band width - Amplitude Shift Keying (ASK) – Frequency Shift Keying (FSK) – FSK transmitter and receiver – Binary Phase Shift Keying (BPSK) – BPSK receiver –Differential Binary Phase Shift Keying(DBPSK) *Quaternary Phase Shift Keying (QPSK) *– QPSK band width - QPSK transmitter and receiver	**18**
II	**Unit – II: Digital transmission** Pulse Modulation – PCM – PCM Sampling – Block diagram - Sampling Rate – Signal to quantization noise ratio –Coding Methods -Companding – Analog And Digital – Delta Modulation Transmitter and Receiver – Adaptive Delta Modulation - Differential PCM - *Time Division Multiplexing (TDM) *	**18**
III	U**nit – III: Optical Fiber Communications** Block diagram of an Optical Fiber Communication System – Optical Fiber types – Construction – Cable Configuration – Snell's law - critical angle – Acceptance angle, acceptance cone, and numerical aperture – *optical fiber configuration* – Mode Of Propagation – Index Profile – Single Mode and Multimode Step Index - Graded Index – optical fiber comparison – losses in optical fiber cables – power, absorption, Raleigh scattering, radiation and coupling -Chromatic or Wavelength Dispersion - modal dispersion (qualitative description only).	**18**
IV	**Unit –IV: Antennas** Basic Antenna Operation – Antenna equivalent circuit – Antenna coordinate system and radiation patterns –Near and Far fields – Radiation Resistance and Antenna Efficiency – Antenna Gain – Effective Isotropic Radiated Power(EIRP) –Antenna Polarization –Beam Width –Bandwidth – Antenna Input Impedance – *basic antenna* – Elementary Doublet –Grounded Antenna -Half Wave Dipole – Antenna Arrays – Broadside Array – End Fire Array –Parabolic Reflector Antenna – Reflectors –beam width – efficiency – power gain – Center Feed	**18**
V	**Unit – V: Satellite Communications (18 Hours)** *Kepler's laws* – Satellite Orbits – Satellite Elevation Categories – Satellite Orbital Patterns – Geosynchronous Satellites – Round Trip Time Delay Of Geosynchronous Satellites – Clarke Orbit – Advantages and disadvantages of Geosynchronous Satellites – Angle of Elevation – Azimuth Angle – Satellite System Link Models – Uplink and Downlink Model – Transponder – Satellite System Parameters – Back Off Lose – Transit Power and Bit Energy.	**18**
VI	**Current Trends (For CIA only) –** Artificial Intelligence (AI) – Omnichannel Strategies – Fifth Generation Technology (5G) – Internet of Things (IoT) – Blockchain Technology.	

……. Self Study

Text Book(s):

Wayne Tomasi, Electronic Communications Systems Fundamentals Through Advanced, Pearson Education, Fifth Edition.2013
Unit – I : 9.2 - 9..5.2
Unit – II : 10.2 – 10.4.1, 10.5, 10.9 – 10.9.2, 10.12 – 10.14 & 11.2
Unit – III : 13.5 – 13.10
Unit – IV :15.2, 15.4, 15.5, 15.7, 15.8, 15.9, 15.10, 15.11, 15.12, 15.15.1, 15.15.2, 15.7.1,15.7.2.1
Unit – V :25.3 – 25.6.2, & 25.9 – 25.9.3

Reference Book(s):

1. Louis E.Frenzel, Communication ElectronicsPrinciples and applications, Tata McGraw-Hill PublishingCompany Limited, Third edition,2002.
2. Dennis Roddy – JhonCoolen, Electronic Communications, EsternEconomy Edition, Fourth Edition.

Web Resource(s):

11. https://nptel.ac.in/courses/117/101/117101051/
2. https://swayam.gov.in/nd1_noc20_ee20/preview

Course Outcomes		
Upon successful completion of this course, the student will be able to:		
CO No.	**CO Statement**	**Cognitive Level (K-Level)**
CO1	Understand and identify the fundamental concepts and various components of analog communication systems.	K1
CO2	Explain signal to noise ratio, noise figure and noise temperature for single and cascaded stages in a communication system.	K2
CO3	Describe analog pulse modulation techniques and digital modulation technique.	K3
CO4	Develop the ability to compare and contrast the strengths and weaknesses of various communication systems	K4
CO5	Have a basic knowledge of the use of Satellite system and mobile services provided.	K5
CO6	Explain and analyzes link budget of satellite signal for proper communication	K6

Relationship Matrix:

Course Outcomes (COs)	Programme Outcomes (POs)					Programme Specific Outcomes (PSOs)					Mean Score of COs
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PSO1**	**PSO2**	**PSO3**	**PSO4**	**PSO5**	
CO1	3	3	3	3	3	3	3	2	2	3	2.8
CO2	3	3	3	2	2	2	2	3	3	3	2.7
CO3	3	3	3	3	2	3	2	2	3	2	2.9
CO4	3	3	3	3	3	3	3	3	3	3	2.9
CO5	3	3	2	3	3	3	3	2	3	3	2.8
									Mean Overall Score		**2.78**
									Correlation		**High**

Mean Overall Score	Correlation
< 1.5	Low
≥ 1.5 and < 2.5	Medium
≥ 2.5	High

Course Coordinators:

Dr. A. Mohamed Saleem

Dr. A. Abbas Manthiri

Semester	Course Code	Course Category	Hours/ Week	Credits	Marks for Evaluation		
					CIA	ESE	Total
IV	23PPH4CC15P1	CORE – XV	3	2	10	40	50

Course Title	MICROPROCESSOR AND MICROCONTROLLER - PRACTICAL

S.No.	List of Experiments
1	16 Bit Arithmetic Operations using Intel 8086 Microprocessor
2	Sum of N numbers and Ascending/Descending order using Intel 8086 Microprocessor
3	Wave form generation using DAC 0800 using Intel 8051 Microcontroller
4	Interfacing of ADC 0808 using Intel 8051 Microcontroller
5	Interfacing of Hex key board using Intel 8051 Microcontroller
6	Interfacing of seven segment display using Intel 8051 Microcontroller
7	Stepper Motor control using Intel 8051 Microcontroller
8	Traffic light control using Intel 8051 Microcontroller

Text Book(s):
1. P. S. Manoharan, Microprocessor and Microcontroller, Charulatha Publications, Reprint 2020
Reference Book(s):
1. V. Vijayendran,Fundamentals of Microprocessor 8086: Architecture Programming (MASM) and Interfacing, Viswanathan, S., Printers & Publishers Pvt Ltd, 2009. Vi microsystems Pvt.Ltd.
Web Resource(s):
1. https://www.academia.edu 2. https://www.tutorialspoint.com/index.html

Course Outcomes		
Upon successful completion of this course, the student will be able to:		
CO No.	**CO Statement**	**Cognitive Level (K-Level)**
CO1	Write ALP for arithmetic operations and sorting the numbers in an array.	**K1**
CO2	Implement the interfacing principles and generate wave forms	**K2**
CO3	Stepper motor control and traffic light control and other some similar projects	**K3**
CO4	Explore possible applications beneficial to the society	**K5**
CO5	To carry out simple electronic, microprocessor and microcontroller projects to help the society with required applications	**K6**

Relationship Matrix:

Course Outcomes (COs)	Programme Outcomes (POs)					Programme Specific Outcomes (PSOs)					Mean Score of COs
	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3	PSO4	PSO5	
CO1	2	3	3	2	3	3	3	3	2	3	2.7
CO2	3	3	3	2	2	3	2	1	1	2	2.2
CO3	3	2	3	2	3	3	2	3	2	3	2.6
CO4	3	3	2	3	2	3	2	3	1	3	2.5
CO5	2	3	2	2	2	2	3	3	2	3	2.4
										Mean Overall Score	2.47
										Correlation	Medium

Mean Overall Score	Correlation
< 1.5	Low
≥ 1.5 and < 2.5	Medium
≥ 2.5	High

Course Coordinators:

Dr. R. Radhakrishnan

Mrs. G. Pragadeeswari

Semester	Course Code	Course Category	Hours/ Week	Credits	Marks for Evaluation		
					CIA	ESE	Total
IV	23PPH4CC15P2	CORE - XV	3	2	10	40	50

Course Title	Numerical Simulations in Physics using Python - Practical

S.No.	List of Experiments
1	Solution of Ordinary Differential Equation using RK4 Method: Time Plots and Phase Portraits of a Duffing Oscillator
2	Discrete Fourier Transform: Decomposition of the momentum components of an electron wave packet
3	Noise Reduction using Fast Fourier Transforms and Auto-correlation function
4	Surface plots of the currents in an LCR circuit
5	Relativistic Bound States of a Klein-Gordon Equation
6	Bound states of a one-dimensional harmonic oscillator
7	Linear Least Squares Fit: Spectrum of Black Body Radiation
8	Simulation of Spontaneous Radioactive Decay
9	Bound states of Hydrogen Atom
10	Random Walk: Brownian Motion

Text Book(s):

1. Rubin H. Landau and Manuel Jose Paez, Computational Problems for Physics with Guided Solutions Using Python, CRC Press, Taylor & Francis Group, USA,(2018).
2. Anthony Scopatz and Kathryn D. Huff, Effective Computation in Physics: Field Guide to Research with Python, O'Reilly Media Inc., CA. USA, (2015)

Reference Book(s):

1. Jake VanderPlas, Python Data Science Handbook,O'Reilly Media Inc., CA. USA, (2017)
2. Paul Deitel and Harvey Deitel, Python for Programmers, Pearson India Education Services Pvt. Ltd. India, (2020)

Web Resource(s):

http://physics.oregonstate.edu/landaur/Books/CPbook/eBook/Lectures

Course Outcomes

Upon successful completion of this course, the student will be able to:

CO No.	CO Statement	Cognitive Level (K-Level)
CO1	acquire the basic knowledge of the constructs of Python language and the skill to write simple and efficient codes in it.	K3
CO2	learn the computational methods such as RK4 algorithm, Fast Fourier Transforms, Random Number generation etc.	K3
CO3	apply numerical methods so learnt to solve the mathematical models of many physical systems	K4
CO4	Use graphical results to corelate the theoretical results of many classical and quantum systems	K5
CO5	To apply the skill so developed to newer physical problems independently	K6

Relationship Matrix:

Course Outcomes (COs)	Programme Outcomes (POs)					Programme Specific Outcomes (PSOs)					Mean Score of COs
	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3	PSO4	PSO5	
CO1	3	3	3	3	1	3	3	2	2	3	2.6
CO2	3	3	3	1	2	3	3	3	2	1	2.4
CO3	3	3	3	3	3	3	3	3	2	1	2.7
CO4	3	3	3	2	2	3	3	3	3	1	2.7
CO5	3	3	3	3	2	3	3	3	3	2	2.8
									Mean Overall Score		2.64
									Correlation		High

Mean Overall Score	Correlation
< 1.5	Low
≥ 1.5 and < 2.5	Medium
≥ 2.5	High

Course Coordinators:

Dr. A. Ishaq Ahamed

Mr. J. Umar Malik

Semester	Course Code	Course Category	Hours/ Week	Credits	Marks for Evaluation		
					CIA	ESE	Total
IV	**23PPH4DE4A**	**Discipline Specific Elective - IV**	6	4	25	75	100

Course Title	**CRYSTAL GROWTH AND THIN FILMS**

SYLLABUS

Unit	Contents	Hours
I	**Nucleation and Nucleation theory** Solution, Solubility and Super solubility – Expression of Super saturation – Meir's solubility diagram – Measurement of metastable zone width of solution, induction period, Gibb's free energy, interfacial tension and critical radius for crystallization- Classical theory of nucleation: Energy formation of a nucleus – Spherical nucleus –*Cylindrical nucleus*.	**18**
II	**Low Temperature Solution growth** Crystallization by slow cooling method and slow evaporation method – Temperature gradient method – Sankaranarayanan Ramasamy (SR) method - Gel growth – Principle of gel growth – various types of gel – Structure of gel – Growth of Crystals in gels – *Importance of gel technique*.	**18**
III	**Other Crystal growth techniques and nanomaterials** High Temperature solution growth (Flux growth) –Choice of flux - Melt growth methods: Czochralski and Bridgeman methods - Importance of nanomaterials Bottom-up and Top-down approaches–Surface area to volume ratio- synthesis of metal and metal oxide nanoparticles: Co-precipitation, sol-gel- Applications of nanomaterials	**18**
IV	**Preparation of Thin film** Physical Method: DC sputtering – Laser beam evaporation – Electron Beam Evaporation –Chemical methods: – Pyrolysis — Disproportionation method – *****Chemical deposition***** – Electrodeposition – Massmethod (Micro balance technique) – Optical method (Photometric) – *Applications of thin films*.	**18**
V	**Thin film characterization** X-ray microanalysis –Hall Effect measurement-*Electron Microscopy* – Scanning Electron Microscopy (SEM)–Atomic Force Microscopy (AFM)- Auger Electron Spectroscopy (AES). X-Ray Photo Electron Spectroscopy (XPES) – *Scanning Tunneling Microscopy (STM)* - Secondary Ion Mass Spectrometry (SIMS).	**18**

….. Self Study

Text Book(s):

1. Crystal Growth, Dr. P. SanthanaRaghavan and Dr. P. Ramasamy, KRU Publications.
2. C.P. Poole and F.J. Owens, "Introduction to Nanotechnology",Wiley- Interscience, (2003).

Reference Book(s):

1. Thin Film Fundamentals, A. Goswami, Reprint, 2008, New Age International Publishers.

Web Resource(s):

https://www.aimspress.com/article/10.3934/matersci.2019.2.174/pdf

http://www.physics.uwo.ca/~lgonchar/courses/p9812/Lecture14_Growth.pdf

Course Outcomes

Upon successful completion of this course, the student will be able to:

CO No.	CO Statement	Cognitive Level (K-Level)
CO1	Understand various nucleation theories in crystal growth.	**K2**
CO2	Apply the knowledge of solution growth and experiment methods to grow crystals.	**K2**
CO3	Conceptualize the methods of crystal growth from melt and synthesis of nanomaterials.	**K3**
CO4	Understand various thin film techniques and apply to various fields.	**K3**
CO5	Analysing the thin films by microscopic and spectroscopic methods.	**K2**

Relationship Matrix:

Course Outcomes (COs)	Programme Outcomes (POs)					Programme Specific Outcomes (PSOs)					Mean Score of COs
	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3	PSO4	PSO5	
CO1	2	3	3	2	2	3	3	3	2	2	2.5
CO2	3	3	3	2	2	3	2	1	1	2	2.2
CO3	3	3	3	1	2	2	2	2	2	3	2.3
CO4	3	3	2	2	2	3	3	3	1	3	2.5
CO5	2	3	2	2	2	2	3	3	2	2	2.3
Mean Overall Score											**2.36**
Correlation											**Medium**

Mean Overall Score	Correlation
< 1.5	Low
≥ 1.5 and < 2.5	Medium
≥ 2.5	High

Course Coordinators:

Dr. R. Raj Muhamed

Dr. A.S. Haja Hameed

Semester	Course Code	Course Category	Hours/ Week	Credits	Marks for Evaluation		
					CIA	ESE	Total
IV	23PPH4DE4B	DISCIPLINE SPECIFIC ELECTIVE - IV	6	4	25	75	100

Course Title	FIBRE OPTICS AND ITS APPLICATIONS

SYLLABUS		
Unit	**Contents**	**Hours**
I	**Optical fibre** Propagation of light waves in an optical fibre – Basic structure and propagation of light of an optical fibre – Acceptance angle and Acceptance cone of a fibre – Numerical aperture – Numerical aperture of a graded index fibre - Modes of propagation–Meridional and Skew rays – Number of modes and cutoff parameters of fibres – Single mode propagation – *Applications of fibres*.	**18**
II	**Classification of Optical fibres** Stepped Index fibre – Stepped Index monomode fibre – Disadvantages - Graded Index multimode fibre - Comparison of step and graded index fibres – *Plastic fibres* – Other latest developed types of optical fibres – Fibre strength- Mechanical strength measurement of fibres.	**18**
III	**Fibre Losses** Attenuation in optic fibres – Material losses - Impurity losses - Rayleigh scattering loss - Absorption loss – Leaky modes - Bending losses – Radiation Induced losses – Inherent defect losses – Inverse square law losses – Transmission losses - Temperature dependence of fibre losses – *Core and cladding losses*.	**18**
IV	**Light sources for optical fibres** LED – Structures of LED - LED materials – Output power characteristics of LED – Fibre – LED Coupling – Modulation bandwidth of LED – Spectral emission of LEDs –Laser – semiconductor laser diode – Current vs Output power characteristics of a Laser – Modulation response of Laser – Laser chirp - Organic LEDs – Power efficiency - Structure and Operation – *Quantum efficiency *.	**18**
V	**Telecommunication and Network Applications** The Data link System – Optical Data Highway System Components – Optical Electrical Interface – Optical Fibre Cable - Network Transport Architecture – LAN Structure – Ethernet – Synchronous Optical Network (SONET) – SONET Standards –SONET Architecture – Medium Access Control Protocols – Code Division Multiple Access (CDMA)	**18**

….. Self Study

Text Book(s):

1. Dr. Subir kumar Sarkar, Optical fibres and fibre optic communication systems, S. Chand & Company Ltd, Revised 4th Edition, 2010
   Unit 1 Chapter 2 Section 2.2 – 2.12
   Unit II Chapter 3 Section 3.1 – 3.10
   Unit III Chapter 7 Section 7.1 – 7.12
   Unit IV Chapter 9 Section 9.2.2 – 9.4.5
2. S.C. Gupta, Textbook on Optical Fibre Communication and Its Applications, PHI Learning Private Limited, 3rd Edition, 2018.
   Unit V Chapter 8 &9 Section 8.2.1 – 8.2.4 & 9.3 – 9.5

Reference Book(s):

1. John M. Senior, Optical Fibre Communication, Pearson Education, 2nd edition, 2007
2. Gerd Keiser,Optical Fibre Communication, McGraw Hill, 3rd edition, 2000.

Web Resource(s):

1. https://www.ukessays.com/essays/physics/fiber-optics-and-its-applications.php
2. https://books.google.co.in/books?id=oG58DwAAQBAJ&printsec=frontcover&redir_esc=y#v=onepage&q&f=false
3. https://www.techtarget.com/searchnetworking/definition/fiber-optics-optical-fiber

Course Outcomes		
Upon successful completion of this course, the student will be able to:		
CO No.	**CO Statement**	**Cognitive Level (K-Level)**
CO1	Remembering the basic elements of optical fibre transmission link, fibre modes configurations and structures	**K1**
CO2	Understanding the different kind of losses and analyze the propagation characteristics of an optical signal in different types of fibers	**K2**
CO3	Applying the various light sources for optical fibres	**K3**
CO4	Analyzing different tools and instruments used in optical experiments	**K4**
CO5	Creating the design of optical systems and solve problems with various optical phenomena	**K6**

Relationship Matrix:

Course Outcomes (COs)	Programme Outcomes (POs)					Programme Specific Outcomes (PSOs)					Mean Score of COs
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PSO1**	**PSO2**	**PSO3**	**PSO4**	**PSO5**	
CO1	3	3	3	3	3	3	3	2	2	3	2.8
CO2	**3**	**3**	**3**	**2**	**3**	**2**	**2**	**3**	**3**	**3**	**2.7**
CO3	**3**	**3**	**3**	**3**	**3**	**3**	**2**	**2**	**3**	**2**	**2.7**
CO4	**3**	**3**	**3**	**3**	**2**	**3**	**3**	**3**	**3**	**3**	**2.9**
CO5	**3**	**3**	**2**	**3**	**3**	**3**	**3**	**2**	**3**	**3**	**2.8**
Mean Overall Score											**2.78**
Correlation											**HIGH**

Mean Overall Score	Correction
< 1.5	Low
≥ 1.5 and < 2.5	Medium
≥ 2.5	High

Course Coordinators:

Dr. S. Abbas Manthiri

Dr. S. Shek Dhavud