# DRAFT

# **National Education Policy-2020**

# Common Minimum Syllabus for Uttarakhand State Universities and Colleges

Four Year Undergraduate Programme-FYUP/Honours Programme/Master in Science

# PROPOSED STRUCTURE FOR FYUP/MASTER'S PHYSICS SYLLABUS

**DEPARTMENT OF PHYSICS** 

Semester-wise List and Titles of the Papers for B.Sc. Degree in Physics									
Year	Sem.	Course Code	Paper Title	Theory/ Practical	Credits				
			Undergraduate Certificate Course in Physics						
	Ι	DSC A1	Mechanics and Theory of Oscillations	Theory	3				
		DSC Pr1	Mechanics and Theory of Oscillations Lab	Practical	1				
<b>IAR</b>		GE P1	Basic Physics I	Theory + Tutorial	3+1				
S TYF		SEC P1	Basic Instrumentation Skills I	Theory	02				
FIR	II	DSC A2	Electricity and Magnetism	Theory	3				
		DSC Pr2	Electricity and Magnetism Lab	Practical	1				
		GE P2	Basic Physics II	Theory +	3+1				
				Tutorial					
		SEC P2	Basic Instrumentation Skills II	Theory	02				
	-1	1	Diploma in Applied Physics	-					
	III	DSC A3	Thermodynamics and Statistical Physics	Theory	3				
		DSC Pr3	Thermodynamics and Statistical Physics Lab	Practical	1				
		DSE A1	Waves and Acoustics	Theory	3				
		DSE Pr1	Waves and Acoustics Lab	Practical	1				
ND R		GE P3	Fundamental Mechanics	Theory +	3+1				
SECO		SEC P3	Basic Instrumentation Skills III	Tutorial Theory	(02)				
	IV	DSC A4	Optics	Theory	3				
		DSC Pr4	Optics Lab	Practical	1				
		DSE A2	Solid State and Statistical Physics	Theory	3				
		DSE Pr2	Solid State and Statistical Physics Lab	Practical	1				
		GE P4	Basic Electricity and Magnetism	Theory +	3+1				
				Tutorial	(2.2)				
	1	SEC P4	Basic Instrumentation Skills IV	Theory	(02)				
			Bachelor of Science		2				
	V	DSC A5	Modern Physics	Theory	3				
		DSC Pr5	Modern Physics Lab	Practical	1				
HIRD (EAR		DSE A3	Basic Quantum Mechanics	Theory	3				
		DSE Pr3	Basic Quantum Mechanics Lab	Practical	1				
		GE P5	Basics of Heat Transfer	Theory +	3+1				
				Tutorial					

1				<u> </u>	
		SEC P5	Advanced Instrumentation and Measurement Techniques-I Or	Theory	(02)
			Electrical circuit network Skills - I		
		IAPC	IAPC	-	04
	VI	DSC A6	Electronics	Theory	3
		DSC Pr6	Electronics Lab	Practical	1
		DSE A4	Special Theory of Relativity	Theory	3
		DSE Pr4	Special Theory of Relativity Lab	Practical	1
		DSE A5	Research Methodology in Physics	Theory + Tutorial	3+1
		GE P6	Basics of Digital Electronics	Theory + Tutorial	3+1
		SEC P6	Advanced Instrumentation and Measurement Techniques-II or	Theory	2
			Electrical circuit network Skills – II		
		IAPC	IAPC	-	04

	Semester-wise List and Titles of the Papers for M.Sc. Degree in Physics							
Year	Sem.	Course Code	Paper Title	Theory/ Practical	Credits			
			Major in Physics					
	VII	DSC A7	Mathematical Physics	Theory	3			
		DSE A6	Classical Mechanics	Theory	3			
		DSE A7	Quantum Mechanics	Theory	3			
		DSE A8	Communication Electronics	Theory	3			
			Practical	Practical	4			
EAR		DSE A5	Research Methodology in Physics	Theory + Tutorial	3+1			
[H Y]		GE P7	Renewable Energy Resources	Theory + Tutorial	3+1			
OUR		GE P8	Radiation Physics	Theory + Tutorial	3+1			
1			Dissertation		(06)			
	VIII	DSC A8	Electrodynamics	Theory	3			
		DSE A9	Atomic and Molecular Physics	Theory	3			
		DSE A10	Nuclear Physics	Theory	4			
		DSE A11	Elementary Particle Physics	Theory	3			
			Practical	Practical	4			
		GE P9	Physics of Weather and Climate	Theory +	3+1			

I				Tutorial	
		CE P 10	Digital Electronics and Computer	Theory +	3+1
		OLT IU	Architecture	Tutorial	511
			Dissertation		(06)
	L	<u> </u>	Master in Physics		
		DSC A9	Advanced Quantum Mechanics	Theory	3
	IX	25011			
		DSE A12	Plasma Physics	Theory	3
		DSE A13	Advanced Electronics-I/Astrophysics-I/ High Energy-I/Spectroscopy- I/Condensed Matter Physics-I	Theory	3
		DSE A14	Advanced Electronics-II/Astrophysics- II/ High Energy-II/Spectroscopy-II/ Condensed Matter Physics-II	Theory	3
			Practical	Practical	4
~		GE P11	BIO physics/ Photonics-I	Theory + Tutorial	3+1
YEAI		GE P 12	Nanoscience and Nanotechnology	Theory + Tutorial	3+1
HTAI			Dissertation		(06)
Ξ.	Х	DSC A10	Solid State Physics	Theory	3
		DSE A15	Statistical Physics	Theory	3
		DSE A16	Advanced Electronics-III/Astrophysics- III/ High Energy-III/Spectroscopy-III/ Condensed Matter Physics-I	Theory	3
		DSE A17	Advanced Electronics-IV/Astrophysics- IV/ High Energy-IV/Spectroscopy-IV/ Condensed Matter Physics-II	Theory	3
			Practical	Practical	4
		GE P13	Medical Physics/ Photonics-II	Theory + Tutorial	3+1
		GE P 14	Basics of Astrophysics	Theory + Tutorial	3+1
			Dissertation		(06)

Abbreviations-DSC-Discipline Specific Course; DSE- Discipline Specific Electives; GE-Generic Electives

# **Programme outcomes (POs):**

Students having Degree in B.Sc. (with Physics) should have knowledge of different concepts and fundamentals of Physics and ability to apply this knowledge in various fields of academics and industry. They may pursue their future career in the field of academics, research and industry.

PO 1	1. Competence in the methods and techniques of calculations using Mechanics.
	2. Students are expected to have hands-on experience to apply
	the theoretical knowledge tosolve practical problems.
PO2	1. Students are expected to have deep understanding of
	electricity and magnetism.
	2. Student should be able to make basic electrical circuits and
	handle electrical instruments.
PO 3	1. Competence in the concepts of Thermodynamics.
	2. Students are expected to have hands on experience in
	Thermal Physics Experiments.
PO 4	1. Knowledge of different concepts in Geometrical Optics.
	2. Students are expected to have hands on experience of
	Experiments of GeometricalOptics
PO 5	1. Knowledge of basic concepts of optical instruments with
	their applications in technology
	2. Students are expected to have an insight in handling
	electronic instruments.
PO 6	1. Comprehensive knowledge of Analog & Digital Principles
	and Applications.
	2. Learn the integrated approach to analog electronic circuitry
	and digital electronics forR&D.
	Programme specific outcomes (PSOs):
	UG I Year /Undergraduate
	Certificate Course in Physics

After completing this certificate course, the student should have:

- 1. Acquired the basic knowledge of Mechanics, Electricity and Magnetism.
- 2. Hands-on experience to apply the theoretical knowledge to solve practical problems of basic physical phenomena. Student should be able to carry out experiments to understand the laws and concepts of Physics.
- 3. An insight in understanding electrical circuits and in handling electrical instruments.

# Programme specific outcomes (PSOs):

# UG II Year/ (Diploma in Applied Physics)

After completing this diploma course, the student should have

- 1. Knowledge of different concepts in Thermodynamics, and Geometrical Optics.
- 2. Knowledge of different aspects of Thermal Physics which serves as a basis for many physical systems used in industrial applications and deals with the physics and technology of Engines and Refrigerators.
- 3. A deeper insight in Ray Optics to understand the Physics of many optical instruments which are widely used in research and Industry, Optoelectronics, IT and communication devices, and in industrial instrumentation.

4. Knowledge of ba technology.	asic concepts of optical instruments with their applications in
	Programme specific outcomes (PSOs):
	UG III Year / Bachelor of Science
After completing th	is degree course, the student should have:
PSO 1	<ol> <li>Knowledge of Mechanics and basic properties of matter.</li> <li>The course will empower him to apply his theoretical knowledge in various physical phenomena that occur in day-to-day life and he can use this scientific knowledge for the betterment of the society.</li> </ol>
PSO2	<ol> <li>Understanding of basic concepts related to Electricity and Magnetism.</li> <li>Students should be proficient in designing and handling different electrical circuits</li> </ol>
PSO3	1. Expertise in different aspects of Thermal Physics which serves as a basis for many physical systems used in industrial applications and deals with the physics and technology of Engines and Refrigerators.
PSO4	<ol> <li>Proficient in the field of Optics which will increase his demand in research and industrial establishments engaged in activities involving optical instruments.</li> </ol>
PSO5	1. Basic knowledge in the field of Modern physics, which have utmost importance at both undergraduate and graduate level.
PSO6	<ol> <li>Comprehensive knowledge of Analog &amp; Digital Principles and Applications. Learn the integrated approach to analog electronic circuitry and digital electronics for R&amp;D.</li> </ol>

# **SEMESTER-I**

# UNDERGRADUATE CERTIFICATE COURSE IN PHYSICS

		DISCIPI	LINE SPECI	FIC COURS	E (DSC A1)			
Programme: <i>U</i>	U <b>ndergraduate</b>	Certificate	Course in Ph	ysics	Yea	r: I Semest	er: I	
Subject: Physics								
Course Title	& Credits	Credit d	istribution of	the course	Eligibility	Pre-requi	isite of the	
Code		Lecture	Tutorial	Practical	Criteria	со	urse	
DSC A1: Mechanics an Theory of Oscillations	nd 4	3	0	1	12th pass	Physics ar Mathemat	nd ics in 12 <sup>th</sup>	
Course Outco	mes							
1. Understandin	g of Vector A	lgebra and V	ector Calculu	18.				
2. Understandin	g the physical	interpretatio	on of gradient	, divergence a	and curl.			
3. Study of grav	vitational field	and potentia	and understa	anding of Kej	pler's laws of l	Planetary mo	tion.	
4. Understandi	ng of different	frames of re	eferences and	conservation	laws.			
5. Understand t different bodies	the dynamics of and its applied	of rigid body cations.	and concept	of moment of	f inertia. Study	of moment	of inertia of	
6. Study the production an	operties of m d its application	atter, respon ons.	use of the cla	ssical system	ns to external	forces and t	their elastic	
7. Comprehene applications.	d the dynamic	s of Fluid an	d concept of	viscosity and	l surface tensio	on along with	n its	
8. Comprehens	sive study of t	he theory of	oscillations.					
		<u>THE</u>	ORY COMP	<u>ONENT</u>				
Unit	, r	Горіс					No. of Lectures	
Unit IVectors Algebra Vector algebra. Scalar and vector products, scalar and vector triple products. Derivative of a vector with respect to a parameter, Line, surface and volume integral of a vector function. Del operator, gradient, divergence and curl, applications of divergence and curl, Gauss divergence theorem, Stokes curl theorem and Green's theorem and their applications.						05		

Unit II	<b>Gravitation field and potential</b> Gravitational field and potential, Gravitational potential energy, Gravitational field Intensity and potential due to a ring, a spherical shell, solid sphere and circular disc, inertial and gravitational mass, gravitational self-energy, gravitational self-energy of a uniform solid sphere, Inverse square law of forces, Kepler's laws of planetary motion.	10
Unit III	Rotational and translational motion & Conservation Laws	
	Frames of reference, Concept of inertial and Non-inertial frames of references,	
	Work energy theorem, Conservative and non-Conservative forces, Linear	
	restoring force, Gradient of potential, Conservation of energy for the particle;	
	Energy function, Concept of Centre of mass, translatory and rotatory motion,	
	equation of motion for rotating rigid bodies, Angular momentum and torque,	10
	Laws of conservation of total energy, total linear momentum and total angular	
<b>TT A TTT</b>	momentum along with their examples.	
Unit IV	Dynamics of rigid body and Moment of Inertia and Properties of matter	
	Moment of inertia, Theorem of parallel and perpendicular axes, Moment of	
	inertia of a rod, lamina, ring, disc, spherical shell and solid sphere, kinetic energy	
	of rotation, basic concepts about elasticity, Hook's law, Young's modulus, Bulk	
	modulus, modulus of rigidity, poisson ratio, relation connecting various elastic	10
	Bernoulli's theorem Posieville's formula Stokes's law Surface tension and its	
	molecular interpretation	
Unit V	Theory of Oscillations	
	Simple Harmonic Motion (S.H.M.) differential equation of S.H.M. and its	
	solution energy of harmonic oscillator. Lissajous' figures for equal frequencies	
	ratio and 2:1 frequencies ratio, damping forces, damped harmonic oscillator.	
	differential equation of damped harmonic oscillator and its solution, power	
	dissipation in a damped harmonic oscillator, relaxation time, quality factor.	10
	simple and compound pendulum, forced or driven harmonic oscillator. its	
	differential equation, amplitude resonance, velocity resonance, sharpness of	
	resonance.	
	simple and compound pendulum, forced or driven harmonic oscillator, its differential equation, amplitude resonance, velocity resonance, sharpness of resonance.	

- 1. R. Resnick and D. Hilliday : Physics Vol-I 2.Berkeley Physics Course : Mechanics Vol-I
- 2. R.P. Feynman, R.B.Lightan and M.Sand : The Feynman Lectures in Physics
- 3. D.S. Mathur : Mechanics
- 4. Murray Spiegel, Seymour Lipschutz, Dennis Spellman, "Schaum's Outline Series: Vector Analysis", McGraw Hill, 2017.
- 5. J. C. Upadhaya: Mechanics, S. Chand

# **Suggested Online Link:**

- 1. MIT Open Learning Massachusetts Institute of Technology, https://openlearning.mit.edu/
- 2. National Programme on Technology Enhanced Learning (NPTEL), https://www.youtube.com/user/nptelhrd
- Swayam Prabha DTH Channel, https://www.swayamprabha.gov.in/index.php/program/current\_he/8

# PRACTICAL COMPONENT

- 1. To determine the Moment of Inertia of a Flywheel.
- 2. To determine g and velocity for a freely falling body using DigitalTiming Technique.
- 3. To determine Coefficient of Viscosity of water by Capillary FlowMethod (Poiseuille's method).
- 4. To determine the Young's Modulus of a Wire by Optical LeverMethod.
- 5. To determine the Young's Modulus by bending of beam.
- 6. To determine the Modulus of Rigidity of a Wire by Maxwell'sneedle.
- 7. To determine the elastic Constants of a wire by Searle's method.
- 8. To determine the coefficient of damping, relaxation time, and quality factor of damped simple harmonic motion using simple pendulum
- 9. To determine the value of g using Bar Pendulum.
- 10. To determine the value of g using Kater's Pendulum.
- 11. To determine Surface Tension.

- B.L. Worsnop, H.T. Flint, "Advanced Practical Physics for Students", Methuen & Co., Ltd., London, 1962.
- 2. S. Panigrahi, B. Mallick, "Engineering Practical Physics", Cengage Learning India Pvt. Ltd., 2015.
- 3. Indu Prakash: Practical Physics
- 4. S.L. Gupta, V. Kumar, "Practical Physics", Pragati Prakashan, Meerut, 2014.

#### Suggestive Digital Platforms / Web Links:

- 1. Virtual Labs at Amrita Vishwa Vidyapeetham, https://vlab.amrita.edu/?sub=1&brch=74
- 2. Digital Platforms /Web Links of other virtual labs may be suggested / added to this lists byindividual Universities

#### **GENERAL ELECTIVE (GE P1) -- BASIC PHYSICS-I** Programme: General Elective Year: I Semester: I **Course Title &** Credits **Credit distribution of the course** Eligibility **Pre-requisite of the** Code Criteria course Lecture Tutorial **Practical** GE P1: 4 3 1 0 12th pass 12th pass **Basic Physics I Course Outcomes:** 1. To understand the nature of forces and Newton's laws of motion. 2. To understand the rotational motion and angular variables. 3. To explore the concepts of work and energy. Unit Topic No. of Lectures Unit I Rest and motion, Distance and displacement, Speed, velocity and acceleration, Motion in a straight line, Motion in a plane, Newton's first, 15 second and third law of motion, Pseudo forces, Vector and scalars, Equality of vectors, addition and subtraction of vectors, Resolution of vectors, scalar and vector product of two vectors. Forces: Gravitational, electromagnetic, nuclear and weak forces, scope of Unit II classical physics, Friction as a component of central force, Kinetic and static 15 frictions, Laws of Frictions, Friction at atomic levels. Unit III Circular Motion, angular variables, acceleration in a circular motion, Dynamics of a circular motion, Circular turnings and banking of roads, 15

	Centrifugal and centripetal forces, Effect of Earth's rotation on apparent weight.	
Unit IV	Work and energy: Kinetic and potential energy, Work and work energy theorem, Calculation of work done, work energy theorem for a system of particles, Conservative and non-conservative forces, Gravitational potential energy, Conservation of mechanical energy, mass-energy equivalence.	15

# Suggested Reading

1. H. C. Verma: Concepts of Physics

2. Robert Resnick Jearl Walker, David Halliday: Principles Of Physics

3. <u>Halliday</u>, <u>Resnick</u>, <u>Walker</u>: Fundamentals of Physics Extended(Old Edition)

# Suggested Online Link:

- 1. MIT Open Learning Massachusetts Institute of Technology, https://openlearning.mit.edu/
- 2. National Programme on Technology Enhanced Learning (NPTEL), https://www.youtube.com/user/nptelhrd
- 3. SwayamPrabha DTH Channel,

 $https://\underline{www.swayamprabha.gov.in/index.php/program/current\_he/8}$ 

# SKILL ENHANCEMENT COURSE (SEC P1) - Basic Instrumentation Skills -I

Programme: Skill Enhancement Course						ar: I	Semester: I	
Course Title &	Credits	Credit distribution of the course			e	Eligibility	Pre-requisite of the	
Code		Lecture/Th eory	Tutorial	hands of trainin	on Ig	Criteria	course	
SEC P1: Basic Instrumentation Skills -I	2	1	0	2		12 <sup>th</sup> pass	Physics and Mathematics in 12 <sup>th</sup>	

# **Course Outcomes:**

- 1. To understand the basic gain of mechanical tools and errors.
- 2. To understand the hand on experience of different mechanical and electrical tools.
- 3. To gain the knowledge of electrical cables, and their specifications.

Unit	Topic (Theory / Experiments/hands on training)	No. of Lectures
Unit I	<b>Errors and Mechanical Tools:</b> Instruments accuracy, precision, sensitivity, resolution, range, least count of different instruments, Errors in measurements, Types of errors. Hand tools and their Uses: Identification, specifications, uses and maintenance of commonly used hand tools: Tweezers Screwdriver (Combination Set), Pliers, Wire Cutters, Wire Strippers, Crimping Tools, Sockets & Hex drivers, Clamps, Rotary Tools: Grinders, Portable Drill Machine, Small Hand Saws.	15
Unit II	<b>Electrical &amp; Electronics Cables and Connector</b> Different type of electrical cables and their Specifications. Types of wires & cables, Standard wire gauge (SWG), Practice on different type of cable joint, Testing phase, neutral and Earth by tester and multi-meter and test lamp.	15

#### **Suggested Reading**

- 1. B L Theraja : A text book in Electrical Technology
- 2. M G Say: Performance and design of AC machines
- 3. S. Salivahanan & N. S. Kumar : Electronic Devices and Circuits, , 3rd Edn
- 4. Shashi Bhushan Sinha, Handbook of Repair and Maintenance of Domestic Electronics Appliances hand book.
- 5. M. Lotia, Modern Basic Electrical & House Wiring Servicing

# SEMESTER-II

# UNDERGRADUATE CERTIFICATE COURSE IN PHYSICS

DISCIPLINE SPECIFIC COURSE (DSC A2)								
Programme: U	ndergraduate	Certificate	Course in Phy	vsics	Y	ear: I	Semeste	er: II
Subject: Physic	28							
Course Title &	<b>k</b> Credits	Credit di	stribution of	the course	Eligibil	ity	Pre-requi	site of the
Coue		Lecture	Tutorial	Practical	Criter	18	cou	irse
DSC A2: Electricity an Magnetism	nd 4	3	0	1	As per t univers ordinan	the ity ice	As per the universion ordinance	
Course Outcom	ies:							
<ul> <li>1. Onderstanding of Electric Freid and Fotential. Evaluation of Electric Freid and Fotential for different types of charge distributions.</li> <li>2. Study of Electric and Magnetic Fields in matter. Understand the concept of polarizability, Magnetization and Electric Displacement Vector.</li> <li>3. Study of Steady and Varying electric currents.</li> <li>4. Understanding of different aspects of alternating currents and its applications.</li> <li>5. Understand the Magnetostatics, Lorentz Force and Energy stored in magnetic Field.</li> <li>6. Comprehend the different aspects of Electromagnetic induction and its applications.</li> </ul>								
Umt	1	opic						Lecture
Unit I E C E E d	t I Electric field and potential Coulomb law, Gauss' theory, its integral and differential forms, line integral of Electric field, Electric field and potential due to an arbitrary charge distribution. Electrostatic energy, energy stored in an Electric field. Electric field and potential due to long charged wire, Spherical shell, sphere, disc, dipole.						08	
Unit II E M V SI M fe E	Electric and Magnetic fields in Matter Moments of charge distributions, Polar and non-polar molecule, polarization vector, electric displacement vector, three electric vectors, dielectric susceptibility and permittivity, polarizability, Clausius-Mossotti relation. Magnetization, magnetic susceptibility, diamagnetic, paramagnetic and ferromagnetic substances, Hysteresis and B-H curve, Langevin's theories of Diamagnetism and paramagnetism, Weiss theory of ferromagnetism.						10	

Unit III	Electric Currents (Steady and Varying)	
	Current density, Equation of Continuity, Ohm's law and electrical	
	conductivity, Lorentz Drude theory, Wiedmann-Frenz law, Kirchhoff's	08
	laws	
	and their applications, Transient current, Growth and decay of D. C. in L - R	
	and L - C circuits, charging and discharging of a capacitor through a resistance.	
Unit IV	Magnetostatics	
	Lorentz force, Bio-Savert's law, Ampere's law, Application of Bio-Savert	09
	law, magnetic field due steady current in a long straight wire, Interaction	
	between two wires, field due a Helmholtz coil, solenoid and current loop,	
	magnetic vector potential, permeability, Energy stored in Magnetic field.	
Unit V	Electromagnetic Induction and Alternating Current	
	Faraday's laws of induction, Lenz's law, Electromotive force, Measurement of	
	magnetic field, Eddy current, Mutual inductance, Self-inductance. Impedance,	10
	admittance and reactance, R-C, R-L and L-C circuits with alternating e.m.f.	
	source, series and parallel L-C-R circuits, resonance and sharpness, Quality	
	factor, Power in A. C. circuits, Choke coil.	

- 1. Edward M. Purcell : Electricity and Magnetism
- 2. J.H. Fewkes&J.Yarwood : Electricity & Magnetism, Vol. I
- 3. D C Tayal : Electricity and Magnetism ", Himalaya Publishing House Pvt. Ltd., 2019.
- 4. D.J.Griffiths : Introduction to Electrodynamics .
- 5. Lal and Ahmed : Electricity and Magnetism
- 6. H. K. Malik and A.K. Singh "Engineering Physics", McGraw Hill Education (India) PrivateLimited, 2018.
- 7. Richard P. Feynman, Robert B. Leighton, Matthew Sands, "The Feynman Lectures on PhysicsVol. 2", Pearson Education Limited, 2012.

# Suggested Online Link:

- 2. MIT Open Learning Massachusetts Institute of Technology, <u>https://openlearning.mit.edu/</u>
- 3. National Programme on Technology Enhanced Learning (NPTEL), https://www.youtube.com/user/nptelhrd
- 4. SwayamPrabha DTH Channel, https://www.swayamprabha.gov.in/index.php/program/current\_he/8

# **Practical Component**

- 1. Calibration of Voltmeter by potentiometer.
- 2. Calibration of ammeter by potentiometer.
- 3. Specific resistance determination.
- 4. Conversion of a Galvanometer into a Voltmeter.
- 5. Conversion of a Galvanometer into Ammeter.

- 6. Variation of magnetic field along the axis of a current carrying circular coil.
- 7. Comparison of capacities by Ballistic Galvanometer.
- 8. Determination of Ballistic Constant.
- 9. Electrochemical equivalent.
- 10. De Sauty's bridge- C1/ C2
- 11. R1/R2 by potentiometer.
- 12. Determination of self inductance, mutual inductance.
- 13. Magnetic field determination by search coil and ballistic galvanometer
- 14.

- 1. B.L. Worsnop, H.T. Flint, "Advanced Practical Physics for Students", Methuen & Co., Ltd.,London, 1962.
- 2. S. Panigrahi, B. Mallick, "Engineering Practical Physics", Cengage Learning India Pvt. Ltd., 2015.
- 3. Indu Prakash: Practical Physics
- 4. S.L. Gupta, V. Kumar, "Practical Physics", PragatiPrakashan, Meerut, 2014.

# Suggestive Digital Platforms / Web Links:

- 1. Virtual Labs at Amrita Vishwa Vidyapeetham, https://vlab.amrita.edu/?sub=1&brch=74
- 2. Digital Platforms /Web Links of other virtual labs may be suggested / added to this lists by individual Universities

GENERAL ELECTIVE (GE P2) BASIC PHYSICS-II								
Programme: General Elective Year: I Semester: II								
Course Title & Code	Credits	Credit distribution of the course			<u>_1</u>	Eligibility Criteria	Pre-requisite of the course	
		Lecture	Tutonai	Flactic	ai			
GE P2: Basic Physics II	4	3	1	0		As per University Ordinance	As per University Ordinance	

Course Outcomes:

- 1. To understand the linear and angular motion
- 2. To understand the Gravitational field and Simple Harmonic Motion
- 3. To learn about the mechanical properties of matter.

Unit	Торіс	No. of Lecture
		S
Unit I	Center of mass, Motion of the center of mass, Linear momentum and its conservation, Rocket propulsion, Collision, Elastic collision in one dimensions, Impulse and Impulsive forces, Rotation of rigid body about a given fixed line, Rotational dynamics, Torque of force about the axis of rotation. Angular momentum and conservation of angular momentum.	15
Unit II	Gravitation: Historical introduction, measurement of gravitational constant 'G', Gravitational potential energy, Gravitational potential, Gravitational field, Relation between gravitational field and potential, Variation in the value of acceleration due to gravity, Planets and satellites, Kepler's law, Weightlessness in a satellite, Escape velocity, Gravitational binding energy, Black holes.	15
Unit III	Simple Harmonic Motion (SHM): Qualitative nature of SHM, Equation of motion of a SHM, Terms associated with SHM, SHM as a projection of a circular motion, Energy conservation in SHM, Angular SHM.	15
Unit IV	Mechanical properties of matter: Molecular structure of a material, Elasticity, Stress, Strain, Hooke's law and the modulus of elasticity, Relation between longitudinal stress and strain, Elastic potential energy of a strained body, Surface tension and energy, Viscosity, Poiseuille's equation, Stoke's law.	15

# **Suggested Reading**

- 1. H. C. Verms: Concepts of Phyiscs
- 2. Robert Resnick Jearl Walker, David Halliday: Principles Of Physics
- 3. <u>Halliday</u>, <u>Resnick</u>, <u>Walker</u>: Fundamentals of Physics Extended(Old Edition)

SVII I		MENT COL		D) Roci	o Instrumonto	tion Skills	п
SKILL			KSE ( SEC	(P2) - Dasi	c msti umenta	ulon Skills	-11
Programme:	Skill Enhance	ement Cours	se		Year: I	Semester:	II
Course Title	& Credits	Credit distribution of the course			Eligibility	Pre-requisite of the	
Code		Lecture/The ory	Tutorial	Hands-on training	Criteria	course	
SEC P2: Bas Instrumentati Skills -II	sic 2 ion	1	0	2	As per University Ordinance	The studer have done Instrumen I course in	nt should the Basic tation Skill Sem I
1. To und 2. Knowle 3. To get	lerstand the dif edge of second the knowledge	ferent types ary cells of the testin	of batteries,	maintenance	es and their uses.		Nece
Unit		Topic (Theo	ory / Experi	ments/hand	s on training)		Lectures
Unit I	Batteries and Maintenance: Types of Batteries, Primary Cell, Secondary Cell, Wet charged, Dry-charged, Low maintenance, Construction of Battery, Case Cover plates, Separator, Cells, Electrolyte, Principles of Batteries, Lead Acid battery, Electrochemical reaction, Measure the voltages of the given cells/battery using analog/ digital multimeter, Charge and discharge the battery through load maintenance/Maintenance/Acid Secondary cells15					15	
Unit II	of the electro	lyte using hy	drometer.		· · · · ·		
Omt II	Testing Factor testing, visual whether the b	ors affecting linspection, pattery is read	g charging, Heavy load ly for use of	Cause of b test Professi needs recha	attery failure, d onal, Test a batte rrging.	iagnosis and ry and verify	15

- 1. B L Theraja : A text book in Electrical Technology
- 2. M G Say : Performance and design of AC machines
- 3. S. Salivahanan& N. S.Kumar : Electronic Devices and Circuits, , 3rd Edn
- 4. Shashi Bhushan Sinha, Handbook of Repair and Maintenance of Domestic Electronics Appliances hand book.
- 5. M. Lotia, Modern Basic Electrical & House Wiring Servicing

# Suggested Online Link:

- 1. MIT Open Learning Massachusetts Institute of Technology, https://openlearning.mit.edu/
- 2. National Programme on Technology Enhanced Learning (NPTEL),

https://www.youtube.com/user/nptelhrd

3. SwayamPrabha - DTH Channel, https://www.swayamprabha.gov.in/index.php/program/current\_he/8

# SEMESTER-III DIPLOMA IN APPLIED PHYSICS

# **DISCIPLINE SPECIFIC COURSE (DSC A3)**

# Programme: DIPLOMA IN APPLIED PHYSICS

Year: II Semester: III

**Subject: Physics** 

Course Title & Code	Credits	Credit distribution of the course Lecture Tutorial Practical		Eligibility Criteria	Pre-requisite of the course	
<b>DSC A3:</b> Thermodynamics and Statistical Physics	4	3	0	1	As per the university ordinance	As per the university ordinance

Course Outcomes:

1. Understand First, Second and Third Law of Thermodynamics and concept of Entropy.

2. Understand the physical significance of thermodynamical potentials.

3. Comprehend the kinetic model of gases with respect to various gas laws.

4. Study the implementations and limitations of fundamental radiation laws.

5. Understand basics of statistical Physics and concept of thermodynamic probability

# **Theory Component**

Unit	Торіс	No. of Lectures
Unit I	<b>Laws of thermodynamics</b> : Zeroth and first law of thermodynamics, Heat Capacities, Adiabatic Processes, Vander Wall equation, Distinction between Joule, Joule-Thompson and Adiabatic expansion of a gas, Carnot's Engine and Carnot's Cycle, Second law of thermodynamics, Carnot's Theorem, Thermodynamic scale of temperature, Entropy, T-S diagram and its applications, Evaluation of Entropy changes in simple cases, Third law of thermodynamics.	10
Unit II	<b>Thermodynamic Relations:</b> Thermodynamic potentials, Maxwell's equation from thermodynamic potentials, Some useful manipulations with partial derivatives (cooling in adiabatic processes and Adiabatic stretching of a wire), The Clausius–Clapeyron's equations, Triple point, Applications of Maxwell's thermodynamical relations.	10
Unit III	<b>Transport of Heat :</b> Conduction, Convection and Radiation, Fourier's law, One dimensional steady state conduction, Thermal conductivity and its experimental detection, Newton's law of cooling, Black body radiation, Thermodynamics of radiations inside a hollow enclosure, Kirchoff's Laws, Stefan Boltzmann Law, Wien's displacement law, Raleigh Jean's Law, Quantum theory of Radiation, Planck's formula, Wien's law.	10

Unit IV	<b>Basics of Statistical Physics:</b> Basic postulates of Statistical Physics, Macro and Micro States, Phase Space, Condition of equilibrium, Postulate of equal a priori probability, Entropy and Thermodynamic probability, Boltzmann entropy relation, Maxwell-Boltzmann (M-B) statistics and Distribution law.	08
Unit V	<b>Kinetic Theory of Gases:</b> Kinetic theory of gases, Microscopic description of an Ideal gas, Degrees of freedom, Law of Equipartition of Energy, Distribution law of velocities, Most probable speed, Average speed and root mean square velocity of molecules, Pressure exerted by a perfect gas, Kinetic Interpretation of Temperature.	07

- 1. S. Loknathan : Thermodynamics, Heat and Statistical Physics
- 2. Sharma and K.K. Sarkar : Thermodynamics, and Statistical Physics
- 3. Brijlal and Subrahmanyam : Heat and Thermodynamics
- 4. Garg, Bansal and Ghose : Thermal Physics, McGraw Hill, 2012.
- 5. M.W. Zemansky, R. Dittman, "Heat and Thermodynamics", McGraw Hill, 1997.
- 6. Enrico Fermi, "Thermodynamics", Dover Publications, 1956.
- 7. MeghnadSaha, B.N. Srivastava, "A Treatise on Heat", Indian Press, 1973
- 8. F.W. Sears, G.L. Salinger, "Thermodynamics, Kinetic theory & Statistical thermodynamics", Narosa Publishing House, 1998.
- 9. Singhal and Prakash: Heat and Thermodynamics, Pragati Prakashan

# **Suggested Online Link:**

- 1. MIT Open Learning Massachusetts Institute of Technology, https://openlearning.mit.edu/
- 2. National Programme on Technology Enhanced Learning (NPTEL), https://www.youtube.com/user/nptelhrd
- 3. SwayamPrabha DTH Channel, https://www.swayamprabha.gov.in/index.php/program/current\_he/8

# **Practical Component**

- 1. Thermal conductivity of a bad conductor by Lee's method.
- 2. Mechanical equivalent of heat by Searle's method.
- 3. Stefan's law
- 4. Platinum resistance thermometer.
- 5. J by Callendar and Barnes method.
- 6. Random throw- statistical method.
- 7. Newton's law of cooling, sp. heat of Kerosene oil.
- 8. Constant volume thermometer.
- 9. Variation of thermo-emf across two junctions of a thermocouple with temperature.

# **Suggested Readings:**

- 1. B.L. Worsnop, H.T. Flint, "Advanced Practical Physics for Students", Methuen & Co., Ltd., London, 1962.
- 2. S. Panigrahi, B. Mallick, "Engineering Practical Physics", Cengage Learning India Pvt. Ltd., 2015.

- 3. Indu Prakash: Practical Physics
- 4. S.L. Gupta, V. Kumar, "Practical Physics", Pragati Prakashan, Meerut, 2014

# Suggestive Digital Platforms / Web Links:

- 1. Virtual Labs at Amrita Vishwa Vidyapeetham, https://vlab.amrita.edu/?sub=1&brch=74
- 2. Digital Platforms /Web Links of other virtual labs may be suggested / added to this lists by individual Universities

# **DISCIPLINE SPECIFIC ELECTIVE (DSE A1)**

Programme: DISC	CIPLINE	Year: II	Semester: III				
Course Title &	Credits	Credit d	listribution of t	he course	Eligibility Criteria	Pre-requisite of the course	
Code		Lecture	Tutorial	Practical			
<b>DSE A1:</b> Waves and Acoustics	4	3	0	1	As per the university ordinance	As per the university ordinance	

# **Course Outcomes:**

- 1. To understand the wave motion
- 2. To understand the Ultrasonic waves and its application
- 3. Measurement of acoustic intensity and energy density
- 4. To understand the application of wave propagation in various physical cases.

# **Theory Component**

Unit	Торіс	No. of Lectures
Unit I	Analysis of wave motion: Characteristics, Differential equation of a wave motion, principle of superposition, Interference, Beats, stationary waves, Energy of stationary waves, Wave velocity and group velocity, Fourier theorem, Fourier analysis of square, triangular and saw-tooth waves.	15
Unit II	<b>Ultrasonics:</b> Classification of Sound waves, Ultrasonics, Quartz crystal and Piezo electric effect, Magnetostriction effect, Properties of Ultrasonic, Detection of ultrasonic waves, Determination of velocity of ultrasonic waves in liquid (Acoustic grating method). Application of Ultrasonics.	10
Unit III	Acoustics : Energy density of plane acoustic waves, Acoustic intensity, Measurement of acoustic intensity – the dB scale, Characteristics and loudness of Musical sound, Acoustic impedance, Reflection and transmission of acoustic waves.	10
Unit IV	<b>Applications</b> : Application of wave propagation in various physical cases, Applications of Ultrasonics, Acoustics of buildings, reverberation time, Sabine's formula, Principle of sonar system.	10

# Suggested Reading

1. R. Resnick and D. Hilliday : Physics Vol-I

- 2. D.S. Mathur : Mechanics
- 3. Brijlal and Subrahmanyam : Waves and Oscillations
- 4. B.S.Semwal and M.S.Panwar : Wave Phenomena and MaterialScience
- 5. Berkeley Physics Course : Mechanics Vol-I
- 6. R.K.Ghose : The mathematics of waves an Vibrations
- 7. D.P.Khandelwal : Oscillations and Waves
- 8. I.I.Pain : Physics of Vibration
- 9. A. P. French : Vibrations and Waves

# **Suggested Online Link:**

- 1. MIT Open Learning Massachusetts Institute of Technology, https://openlearning.mit.edu/
- 2. National Programme on Technology Enhanced Learning (NPTEL),

https://www.youtube.com/user/nptelhrd

3. Swayam Prabha - DTH Channel,

https://www.swayamprabha.gov.in/index.php/program/current\_he/8

# PRACTICAL COMPONENT

- 1. To study the Motion of Spring and calculate (a) Spring constant, (b) g and (c) Modulus of rigidity.
- 2. To determine the frequency of tuning fork with the help of sonometer.
- 3. To determine the frequency of AC mains with a Sonometer using magnetic wire.
- 4. To determine the frequency of AC mains with a Sonometer using non- magnetic wire.
- 5. To determine the frequency of AC mains by Melde's experiment.
- 6. To determine the velocity of sound in air at room temperature with Kundt's tube.
- 7. To determine the velocity of Ultrasonic wave in a given liquid.
- 8. To compare the velocities of sound in two gasses at room temperature.

# **Suggested Readings:**

- 1. B.L. Worsnop, H.T. Flint, "Advanced Practical Physics for Students", Methuen & Co., Ltd., London, 1962.
- 2. S. Panigrahi, B. Mallick, "Engineering Practical Physics", Cengage Learning India Pvt. Ltd., 2015.
- 3. Indu Prakash: Practical Physics
- 4. S.L. Gupta, V. Kumar, "Practical Physics", Pragati Prakashan, Meerut, 2014.

# **Suggestive Digital Platforms / Web Links:**

- 1. Virtual Labs at Amrita Vishwa Vidyapeetham, https://vlab.amrita.edu/?sub=1&brch=74
- 2. Digital Platforms /Web Links of other virtual labs may be suggested / added to this lists byindividual Universities

Programme: General Elective Year: II Semester							
Course Title	& Credits	Credit dist	ribution of the	course	Eligibility	Pre-requi	site of the
Code		Lecture	Tutorial	Practical	Criteria	course	
GE P3: Fundamental Aechanics	4	3	1	0	As per University Ordinance	As per University Ordinance	
ourse Outco	mes:						
<ol> <li>To un</li> <li>Study</li> <li>To un</li> </ol>	derstand the fran of the Keplelr's derstand the elas	mes of refe laws of m sticity rela	erences and N otion . ted to differer	ewton's law o nt laws.	f motion.		
Unit	Торіс						No. of Lecture
Unit I	Vectors Algebra and Ordinary Differential Equations Vector algebra. Scalar and vector products. Derivatives of a vector with respect to a parameter. 1st order homogeneous differential equations. 2nd order homogeneous differential equations with constant coefficients.						15
Unit II	<b>Translatory a</b> Frames of ref particles. Cent Conservation of momentum. To	nd Rotato Terence. N are of Ma of energy prque. Cor	ewton's Law ss, Conservat Motion of servation of	nd Conservation is of motion. tion of mome rockets, Ang angular mome	<b>tion Laws</b> Dynamics of a entum. Work an ular velocity an entum.	system of nd energy nd angular	15
Unit III	<b>Gravitation</b> Newton's Law of Gravitation. Motion of a particle in a central force field						
	(motion in a (statement only orbits. Basic i Physiological e	plane, a y). Satellit dea of gle effects on a	ngular mom- e in circular obal position astronauts.	entum conser orbit and app ing system ((	rvation). Keple lications. Geosy GPS). Weightle	r's Laws nchronous ssness.	
Unit IV	Elasticity Hooke's law -	Stress-stra	in diagram -	Elastic modu	li-Relation betw	een elastic	15

1. Sears, Zemansky and Young : University Physics

2. Berkeley Physics Course : Volume-1 Mechanics

3. Resnick, Halliday & Walker Fundamentals of Physics

- 4. Basudeb Bhattacharya : Engineering Mechanics 2nd Edn
- 5. Ronald Lane Reese : University Physics
- 6. B.L. Flint and H.T. Worsnop : Advanced Practical Physics forStudents

# Suggested Online Link:

- 1. MIT Open Learning Massachusetts Institute of Technology, https://openlearning.mit.edu/
- 2. National Programme on Technology Enhanced Learning (NPTEL), https://www.youtube.com/user/nptelhrd
- 3. Swayam Prabha DTH Channel, https://www.swayamprabha.gov.in/index.php/program/current\_he/8

SKILL ENHANCEMENT COURSE (SEC P3)									
Programme: Skill	Enhance	Year: II		Semester: III					
Course Title & Code	Credits	Credit distrib Lecture/The	ution of the cou Tutorial	urse Hands-on	1	Eligibility Criteria	Pre-requisite of the course		
		ory		training					
<b>SEC P3</b> : Basic Instrumentation Skills -III	2	1	0	2		As per University Ordinance	As per University Ordinance		

# **Course Outcomes:**

- 1. Hands on practice of domestic wiring and electrical systems.
- 2. To understand the soldering and practice it's on different electronic components.

Unit	Topic (Theory and hands on practice)	No. of Lectures
Unit I	<b>Domestic Wiring</b> Introduction and explanation of electrical wiring systems, cleat wiring, casing & Capping, house wiring, specification and types, rating & material, Demonstration & Practice on connecting common electrical accessories in circuits and testing them in series board., Testing & replacement of different types of fuses, switches, plug, sockets. Identification of different wiring materials and their specification, Removal of insulation from assorted wires and cable, Making a switchboard with electrical accessories, Making an Extension board.	15
Unit II	Soldering : Solders, flux and soldering technique. Different types of soldering guns related to Temperature and wattages, types of tips, Solder materials and their grading. Use of flux and other materials, Selection of soldering gun for specific requirement, Soldering and De-soldering stations and their specifications. Soldering/ De-soldering and Various Switches, Practice soldering on different electronic components, small transformer, Practice de-soldering	15

- 1. B L Theraja : A text book in Electrical Technology
- 2. M G Say : Performance and design of AC machines
- 3. S. Salivahanan& N. S. Kumar : Electronic Devices and Circuits, , 3rd Edn
- 4. Shashi Bhushan Sinha, Handbook of Repair and Maintenance of Domestic Electronics Appliances hand book.
- 5. M. Lotia, Modern Basic Electrical & House Wiring Servicing

## SEMESTER IV

# **DIPLOMA IN APPLIED PHYSICS**

		DISCIPLINE	SPECIFIC (	COURSE-DSC	A4	
Programme:	DIPLOMA I	IN APPLIED P	HYSICS	Year: II	Seme	ester: IV
Subject: Phy	sics			I		
Course Title &	Credits	Credit distrib	Credit distribution of the course			Pre-requisite
Code		Lecture	Tutorial	Practical		of the course
DSC A4: Optics	4	3	0	1	As per the university ordinance	As per the university ordinance
Course Outco1.Studybehind2.Under3.Study4.Study5.Studyamplit6.Under7.Under8.Studydiffrac	of Fermat's F lreflection an stand the theo of different ty of different ty of Interference ude. standing Diff stand the pola of different ty tion of light y	Principle of Extr d refraction of 1 ory of image for ypes of optical <i>A</i> ypes of optical in the of light. Inter fraction of Light arization of light ypes of associate which are widely	emum Path a ight. mation by an Aberrations a nstruments u ference by di and concept t. ed optical ins y used in indu	and understand f optical system nd techniques for sed in industry vision of wavef of Zone Plate. struments based astry and resear	fundamental phy or their reduction and research front and division on interference ch.	sics n. n of and
∐nit		Tonic				No of
		Topic				Lecture
Unit I Fermat's Principle and Theory of Image Formation: Fermat's principle of extremum path and its application to deduce laws of reflection and refraction, Refraction at concave surface, Principal foci, Lateral and longitudinal magnifications, Aplanatic points of spherical surface; Gauss's general theory of image formation, Coaxial symmetrical system, Cardinal points of an optical system, Thick and Thin lens, Newton's formula, Coaxial lens system, Lagrange's equation of magnification, Refraction through a thick lens; Nodal Slide, Eyepiece, Ramsden's, Huygen's and Gaussian eyepieces, Astronomical refracting telescope, Microscopes, Speatrometer and its uses						

Unit II	<b>Optical Aberrations and Dispersion:</b> Aberrations in images, Spherical aberration, Monochromatic and Chromatic aberration, Condition of achromatism, Achromatic combination of lenses in contact and separated lenses, Spherical mirrors and Schmidt corrector plates, Theory of dispersion.	07
Unit III	<b>Interference:</b> The principle of superposition, Two slit interference, coherence, Optical path retardations, lateral shift of fringes, Fresnel biprism, Interference with multiple reflection, Thin films, Application for precision measurements, Haidinger fringes, Fringes of equal thickness and equal inclination; Michelson intereferometer and its application for precise measurement of wavelength, Wavelength difference and width of spectral lines, Fabry-Perot interferometer and Etalon	10
Unit IV	<b>Diffraction:</b> Fresnel's and Fraunhofer diffraction: Diffraction of single slit, Zone plates, intensity distribution, Resolution of image, Rayleigh criterion, Resolving power of telescopes and microscopes, Diffraction due to 2-slits and N-slits, Diffraction grating, Resolving power of grating and comparison with resolving powers of prisms.	08
Unit V	<b>Polarization:</b> Plane polarized, Circular polarized and elliptically polarized light, Malus law, Brewster's law, Double reflection and uniaxial crystals, Application of bi-refringence, Dichroism, Optical rotation, Rotation of plane of polarization, Optical rotation in liquids and crystals, Polarimeter.	10

- 1. D.P. Khandelwaland : Optics and Atomic Physics
- 2. Jenkins and White : Fundamentals of Optics
- 3. A.K. Ghatak : Physical Optics
- 4. Brijlal and Subrahmanyam : Optics
- 5. K.D. Moltev : Optics
- 6. B. K. Mathur : Optics
- 7. B. D. Guenther : Modern Optics, Oxford Press
- 8. E. Hecht: Optics, Pearson.

# Suggested Online Link:

- 1. MIT Open Learning Massachusetts Institute of Technology, https://openlearning.mit.edu/
- 2. National Programme on Technology Enhanced Learning (NPTEL), https://www.youtube.com/user/nptelhrd SwayamPrabha - DTH Channel, https://www.swayamprabha.gov.in/index.php/program/current\_he/8

# **Practical Component**

- 1. Nodal slide assembly, Location of cardinal points of lens system.
- 2. Newton's formula.
- 3. Dispersive power of prism.
- 4. Resolving power of a telescope.

- 5. To determine the Resolving Power of a Prism.
- 6. To find the thickness of the wire using optical bench.
- 7. To determine the thickness of mica-sheet by using Biprism
- 8. Biprism- determination of  $\lambda$ .
- 9. Newton's ring experiment- Determination of  $\lambda$ .
- 10. Zone-plate experiment study of different orders.
- 11. Malus Law
- 12. Polarimeter: Specific rotation of sugar solution.

- 1. B.L. Worsnop, H.T. Flint, "Advanced Practical Physics for Students", Methuen & Co., Ltd., London, 1962.
- 2. S. Panigrahi, B. Mallick, "Engineering Practical Physics", Cengage Learning India Pvt. Ltd., 2015.
- 3. Indu Prakash, Practical Physics
- 4. S.L. Gupta, V. Kumar, "Practical Physics", PragatiPrakashan, Meerut, 2014.

#### Suggestive Digital Platforms / Web Links:

- 1. Virtual Labs at Amrita Vishwa Vidyapeetham, https://vlab.amrita.edu/?sub=1&brch=74
- 2. Digital Platforms /Web Links of other virtual labs may be suggested / added to thi lists by individual Universities

# **DISCIPLINE SPECIFIC ELECTIVE (DSE A2)**

## Programme: DISCIPLINE SPECIFIC ELECTIVE

Year: II Semester: IV

Subject: Physics

Course Title	&	Credits	Credit distri	oution of the co	urse	Eligibility	Pre-requisi	te of the	
Code		creates	Lecture	Tutorial	Practical	Criteria	course		
DSE A2 Elementary S State Physi	2 Solid- ics	4	3	0	1	As per the university ordinance	As per the university ordinance		
				Theory Co	mponent		•		
Unit		r	Горіс					No. of Lectures	
Unit I	Crys of m num Type	talline an atters, La ber. Tran es of latti	d non - crys attice, Basis slational ve ces and sev	talline sate of a primitive and ctors, symmet en crystal syst	solids. Single l non-primitiv ry operations tem. Lattice I	and polycrystal we unit cells, coo , point and space planes and Mille	line forms ordination ce groups. er indices.	10	
	Struc Struc	cture of a cture of d	SC, BCC, I iamond.	FCC (with exa	amples) and	closed packed s	structures.		
Unit II	Lattice constant, Inter-planar spacing, density of lattice points, atomic packing fractions. Reciprocal lattices and their properties, X-rays diffraction by matter, Bragg's law, Laue methods of X-rays diffraction. Brillouin zones and their applications.						10		
Unit III	<sup>I</sup> Free electron theory of metals, Lorentz Drude theory and its limitations, Somerfield theory of free electrons. Specific heat, Dulong and Petit's law, departure of the law at low temperatures. Einstein's theory of specific heat and its limitations, Debye's theory of specific heat of solids,					15			
Unit IV	Moti in se Intrin mass	ion of an o olids, dis nsic and I s of electr	electron in p stinction be Extrinsic ser on.	eriodic potent tween conduc niconductors,	ial, Kronig-Pe ctors, semico Fermi level ar	enny model. Ene onductors and i nd Fermi energy	ergy bands insulators, , effective	10	

# **Suggested Reading**

1. Agarwal and Agarwal "Fundamentals of Modern Physics" (Pragati Prakashan- Meerut)

2. Dekker "Solid State Physics" (Laxmi Publications)

3. C.Kittel "Introduction to Solid State Physics" (Wiley)

4. S.O.Pillai "Solid State Physics" (New Age International)

5. Saxena, Gupta and Saxena, "Fundamental of Solid-State Physics" (PragatiPrakashan-Meerut)

# **Practical Component**

- 1. Thermal conductivity of a good conductor by Searle's method.
- 2. To determine Hall voltage and Hall coefficient in n-type semiconductor.
- 3. To determine the number of charge carriers per unit volume in n-type semiconductor.
- 4. To determine Hall angle and mobility in n-type semiconductor.
- 5. To determine the band gap in a semiconductor using a p-n junction diode.
- 6. To determine the ionization potential of gas filled Thyratorn.
- 7. To plot the characteristics of thermistor and hence find the temperature coefficient of resistance.

# **Suggested Readings:**

- 1. B.L. Worsnop, H.T. Flint, "Advanced Practical Physics for Students", Methuen & Co., Ltd., London, 1962.
- 2. S. Panigrahi, B. Mallick, "Engineering Practical Physics", Cengage Learning India Pvt. Ltd., 2015.
- 3. Indu Prakash, Practical Physics
- 4. S.L. Gupta, V. Kumar, "Practical Physics", PragatiPrakashan, Meerut, 2014.

# Suggestive Digital Platforms / Web Links:

- 1. Virtual Labs at Amrita Vishwa Vidyapeetham, <u>https://vlab.amrita.edu/?sub=1&brch=74</u>
- 2. Digital Platforms /Web Links of other virtual labs may be suggested / added to this lists Universities.

Programme:       General Elective       Yar: II       Semester: I         Course Title &       Credits Credit distribution of the course       Eligibility       Pre-requisite of the course         Code       I       Intorial       Practical       Criteria       course         GE P4: Basic Electricity and Magnetism       4       3       1       0       As per University Ordinance       As per University Ordinance         Course Outcomes:       .       .       .       .       .       As per University Ordinance       .       .         . <td< th=""><th></th><th></th><th></th><th>GENE</th><th>RAL ELF</th><th>CTIVE (</th><th>GE <b>P</b>4)</th><th></th><th></th></td<>				GENE	RAL ELF	CTIVE (	GE <b>P</b> 4)		
Course Title &         Credits Credit distribution of the course         Eligibility Criteria         Pre-requisite of the course           GE P4: Basic Electricity and Magnetism         4         3         1         0         As per University Ordinance         As per University Ordinance           Course Outcomes:         .         .         .         .         .         As per University Ordinance         As per University Ordinance           .<	Programm	e: Gene	eral Ele	ective			Year: II	S	emester: IV
Code         Lecture         Tutorial         Practical         Criteria         course           GE P4: Basic Electricity and Magnetism         4         3         1         0         As per University Ordinance         As per University Ordinance           Course Outcomes:         .<	Course Tit	le &	Credits	Credit distri	bution of the	course	Eligibility	Pre-reg	usite of the
GE P4: Basic Electricity and Magnetism       4       3       1       0       As per Universit Ordinance       As per Universit Ordinance         Course Outcomes:       .	Code			Lecture	Tutorial	Practical	Criteria	course	
GE P4: Basic Electricity and Magnetism       4       3       1       0       As per University Ordinance       As per University Ordinance         Course Outcomes:       . Understanding of Electric Field and Potential. Evaluation of Electric Field and Potential for lifferenttypes of charge distributions.       .									
Course Outcomes:         . Understanding of Electric Field and Potential. Evaluation of Electric Field and Potential for lifferenttypes of charge distributions.         2. Study of Steady and Varying electric currents.         3. Understanding of different aspects of alternating currents and its applications.         4. Understand the Magnetostatics, Lorentz Force and Energy stored in magnetic Field.         Joint I Electrostatics:         Electrostatic Field, electric flux, Gauss's theorem of electrostatics Applications of Gauss theorem - Electric field due to point charge infinite line of charge, uniformly charged spherical shell and solid sphere plane charged sheet, charged conductor. Electric potential as line integral of electric field, potential due to a point charge, electric dipole, uniformly charged spherical shell and solid sphere.       10         Junit I Magnetism         Magnetostatics: Biot-Savart's law and its applications- straigh conductor, circular coil, solenoid carrying current. Divergence and curr of magnetic field. Magnetic vector potential. Ampere's circuital law. Magnetic properties of materials: Magnetic intensity, magnetic induction, permeability, magnetic susceptibility. Brief introduction of dia-, para-and ferromagnetic materials.       10         Juit III       Electromagnetic Induction and Alternating Current       10         Faraday's laws of electromagnetic induction, Lenz's law, self and mutualinductance, L of single coil, M of two coils. Energy stored in magnetic field. Basic concepts of alternating currents.       10         Unit IV       Maxwell's equations and Electromagnetic field, elec	GE P4: Electric Magne	Basic ity and etism	4	3	1	0	As per University Ordinance	As per Or	r University dinance
.Understanding of Electric Field and Potential. Evaluation of Electric Field and Potential for lifferenttypes of charge distributions.         2.Study of Steady and Varying electric currents.         8. Understanding of different aspects of alternating currents and its applications.         2. Understand the Magnetostatics, Lorentz Force and Energy stored in magnetic Field.         Jnit       Topic         Vo. of Electrostatics:         Electrostatic Field, electric flux, Gauss's theorem of electrostatics.         Applications of Gauss theorem- Electric field due to point charge infinite line of charge, uniformly charged spherical shell and solid sphere plane charged sheet, charged conductor. Electric potential as line integral of electricfield, potential due to a point charge, electric dipole, uniformly charged spherical shell and solid sphere.         Jnit II       Magnetostatics: Biot-Savart's law and its applications- straight conductor, circular coil, solenoid carrying current. Divergence and curr of magnetic field. Magnetic vector potential. Ampere's circuital law. Magnetic properties of materials: Magnetic intensity, magnetic induction, permeability, magnetic susceptibility. Brief introduction of dia-, para-and ferromagnetic materials.         Jnit III       Electromagnetic Induction and Alternating Current         Faraday's laws of electromagnetic induction, Lenz's law, self and mutualinductance, L of single coil, M of two coils. Energy stored in magnetic field. Basic concepts of alternating currents.         Jnit IIV       Maxwell's equations and Electromagnetic field, electromagnetic field, electromagnetic field, electromagnetic field, electromagnetic fie	Course Ou	tcomes:							
Jnit       Topic       No. of Lectures         Jnit I       Electrostatics:       Electrostatics       10         Applications of Gauss theorem - Electric field due to point charge infinite line of charge, uniformly charged spherical shell and solid sphere plane charged sheet, charged conductor. Electric potential as line integral of electricfield, potential due to a point charge, electric dipole, uniformly charged spherical shell and solid sphere.       15         Jnit II       Magnetism       Magnetostatics: Biot-Savart's law and its applications- straigh conductor, circular coil, solenoid carrying current. Divergence and curr of magnetic field. Magnetic vector potential. Ampere's circuital law. Magnetic properties of materials: Magnetic intensity, magnetic induction, permeability, magnetic susceptibility. Brief introduction of dia-, para-and ferromagnetic materials.       10         Jnit III       Electromagnetic Induction and Alternating Current Faraday's laws of electromagnetic induction, Lenz's law, self and mutualinductance, L of single coil, M of two coils. Energy stored in magnetic field. Basic concepts of alternating currents.       10         Jnit IV       Maxwell's equations and Electromagnetic wave propagation Equation of continuity, Displacement current, Maxwell's equations, Poynting vector, energy density in electromagnetic field, electromagnetic induction of a continuity, Displacement current, Maxwell's equations, Poynting vector, energy density in electromagnetic field, electromagnetic	1. Understan differenttyp 2. Study of S 3. Understa 4. Understa	nding of E bes of cha Steady an nding of nd the Ma	Electric F rge distri d Varyin different agnetosta	Field and Po ibutions. ag electric c aspects of a atics, Loren	otential. Eva urrents. alternating c tz Force and	luation of El currents and d Energy sto	lectric Field and its applications red in magnetic	d Potent c Field.	tial for
Juit I       Electrostatics:       10         Electrostatic Field, electric flux, Gauss's theorem of electrostatics       10         Applications of Gauss theorem- Electric field due to point charge infinite line of charge, uniformly charged spherical shell and solid sphere plane charged sheet, charged conductor. Electric potential as line integra of electricfield, potential due to a point charge, electric dipole, uniformly charged spherical shell and solid sphere.       10         Juit II       Magnetism       Magnetostatics: Biot-Savart's law and its applications- straigh conductor, circular coil, solenoid carrying current. Divergence and cur of magnetic field. Magnetic vector potential. Ampere's circuital law. Magnetic properties of materials: Magnetic intensity, magnetic induction, permeability, magnetic susceptibility. Brief introduction of dia-, para-and ferromagnetic materials.       10         Juit III       Electromagnetic Induction and Alternating Current       10         Faraday's laws of electromagnetic induction, Lenz's law, self and mutualinductance, L of single coil, M of two coils. Energy stored in magnetic field. Basic concepts of alternating currents.       10         Juit IV       Maxwell's equations and Electromagnetic wave propagation Equation of continuity, Displacement current, Maxwell's equations, Poynting vector, energy density in electromagnetic field, electromagnetic wave and its remurement three.       10	Unit	Topic	0	,			0	]	No. of
Init I       Electrostatics.       10         Applications of Gauss theorem- Electric field due to point charge infinite line of charge, uniformly charged spherical shell and solid sphere plane charged sheet, charged conductor. Electric potential as line integral of electricfield, potential due to a point charge, electric dipole, uniformly charged spherical shell and solid sphere.       10         Jnit II       Magnetism       15         Magnetostatics:       Biot-Savart's law and its applications- straight conductor, circular coil, solenoid carrying current. Divergence and curl of magnetic field. Magnetic vector potential. Ampere's circuital law. Magnetic properties of materials: Magnetic intensity, magnetic induction, permeability, magnetic susceptibility. Brief introduction of dia-, para-and ferromagnetic materials.       10         Jnit III       Electromagnetic Induction and Alternating Current       10         Maxwell's equations and Electromagnetic wave propagation       10         Poynting vector, energy density in electromagnetic field, electromagnetic field, electromagnetic wave propagation       10	Unit I	Floctr	ostatics:						Lectures
<ul> <li>Infinite line of charge, uniformly charged spherical shell and solid sphere, plane charged sheet, charged conductor. Electric potential as line integral of electricfield, potential due to a point charge, electric dipole, uniformly charged spherical shell and solid sphere.</li> <li>Unit II Magnetism Magnetostatics: Biot-Savart's law and its applications- straigh conductor, circular coil, solenoid carrying current. Divergence and curr of magnetic field. Magnetic vector potential. Ampere's circuital law. Magnetic properties of materials: Magnetic intensity, magnetic induction, permeability, magnetic susceptibility. Brief introduction of dia-, para-and ferromagnetic materials.</li> <li>Unit II Electromagnetic Induction and Alternating Current Faraday's laws of electromagnetic induction, Lenz's law, self and mutualinductance, L of single coil, M of two coils. Energy stored in magnetic field. Basic concepts of alternating currents.</li> <li>Jnit IV Maxwell's equations and Electromagnetic wave propagation Equation of continuity, Displacement current, Maxwell's equations, Poynting vector, energy density in electromagnetic field, electromagnetic wave and its transverse networe</li> </ul>		Electro Applic	ostatic F ations o	Field, elect	ric flux, G eorem- Ele	auss's theoretic field	rem of electro due to point	ostatics. charge.	10
plane charged sheet, charged conductor. Electric potential as line integral         of electricfield, potential due to a point charge, electric dipole, uniformly         charged         spherical shell and solid sphere.         Unit II       Magnetism         Magnetostatics:       Biot-Savart's law and its applications- straight         conductor, circular coil, solenoid carrying current. Divergence and curl       15         of magnetic field. Magnetic vector potential. Ampere's circuital law.       Magnetic properties of materials: Magnetic intensity, magnetic         induction, permeability, magnetic       susceptibility. Brief introduction of dia-, para-and ferromagnetic materials.         Unit III       Electromagnetic Induction and Alternating Current         Faraday's laws of electromagnetic induction, Lenz's law, self and mutualinductance, L of single coil, M of two coils. Energy stored in magnetic field. Basic concepts of alternating currents.       10         Unit IV       Maxwell's equations and Electromagnetic wave propagation       10         Equation of continuity, Displacement current, Maxwell's equations, Poynting vector, energy density in electromagnetic field, electromagnetic wave and its transverse networe       10		infinite	e line of o	charge, unif	ormly charg	ed spherical	shell and solid	sphere.	
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<ul> <li>spherical shell and solid sphere.</li> <li>Jnit II Magnetism         <ul> <li>Magnetostatics: Biot-Savart's law and its applications- straight conductor, circular coil, solenoid carrying current. Divergence and curl of magnetic field. Magnetic vector potential. Ampere's circuital law. Magnetic properties of materials: Magnetic intensity, magnetic induction, permeability, magnetic susceptibility. Brief introduction of dia-, para-and ferromagnetic materials.</li> </ul> </li> <li>Jnit III Electromagnetic Induction and Alternating Current Faraday's laws of electromagnetic induction, Lenz's law, self and mutualinductance, L of single coil, M of two coils. Energy stored in magnetic field. Basic concepts of alternating currents.</li> <li>Jnit IV Maxwell's equations and Electromagnetic wave propagation Equation of continuity, Displacement current, Maxwell's equations, Poynting vector, energy density in electromagnetic field, electromagnetic urangetic urangetic urange.</li> </ul>		of elec	d	, potential d	ue to a poin	t charge, ele	ctric dipole, un	normiy	
Jnit II       Magnetism         Magnetostatics:       Biot-Savart's law and its applications- straight conductor, circular coil, solenoid carrying current. Divergence and curl of magnetic field. Magnetic vector potential. Ampere's circuital law. Magnetic properties of materials:       Magnetic intensity, magnetic induction, permeability, magnetic susceptibility. Brief introduction of dia-, para-and ferromagnetic materials.       15         Unit III       Electromagnetic Induction and Alternating Current       10         Faraday's laws of electromagnetic induction, Lenz's law, self and mutualinductance, L of single coil, M of two coils. Energy stored in magnetic field. Basic concepts of alternating currents.       10         Unit IV       Maxwell's equations and Electromagnetic wave propagation Equation of continuity, Displacement current, Maxwell's equations, Poynting vector, energy density in electromagnetic field, electromagnetic field, electromagnetic field, electromagnetic		spheric	cal shell	and solid sr	ohere.				
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<ul> <li>conductor, circular coil, solenoid carrying current. Divergence and curl of magnetic field. Magnetic vector potential. Ampere's circuital law. Magnetic properties of materials: Magnetic intensity, magnetic induction, permeability, magnetic susceptibility. Brief introduction of dia-, para-and ferromagnetic materials.</li> <li>Unit III Electromagnetic Induction and Alternating Current Faraday's laws of electromagnetic induction, Lenz's law, self and mutualinductance, L of single coil, M of two coils. Energy stored in magnetic field. Basic concepts of alternating currents.</li> <li>Unit IV Maxwell's equations and Electromagnetic wave propagation Equation of continuity, Displacement current, Maxwell's equations, Poynting vector, energy density in electromagnetic field, electromagnetic uvua and its transvarse nature</li> </ul>		Magne	etostatics	: Biot-Sav	vart's law	and its	applications-	straight	15
of magnetic field. Magnetic vector potential. Ampere's circuital law.         Magnetic properties of materials: Magnetic intensity, magnetic induction, permeability, magnetic susceptibility. Brief introduction of dia-, para-and ferromagnetic materials.         Unit III       Electromagnetic Induction and Alternating Current Faraday's laws of electromagnetic induction, Lenz's law, self and mutualinductance, L of single coil, M of two coils. Energy stored in magnetic field. Basic concepts of alternating currents.       10         Unit IV       Maxwell's equations and Electromagnetic wave propagation Equation of continuity, Displacement current, Maxwell's equations, Poynting vector, energy density in electromagnetic field, electromagnetic field, electromagnetic field, electromagnetic field, electromagnetic		conduc	ctor, circ	ular coil, s	olenoid carr	ying current	t. Divergence a	ind curl	
Magnetic properties of materials: Magnetic intensity, magnetic induction, permeability, magnetic susceptibility. Brief introduction of dia-, para-and ferromagnetic materials.       Init III       Electromagnetic Induction and Alternating Current         Faraday's laws of electromagnetic induction, Lenz's law, self and mutualinductance, L of single coil, M of two coils. Energy stored in magnetic field. Basic concepts of alternating currents.       10         Unit IV       Maxwell's equations and Electromagnetic wave propagation       10         Poynting vector, energy density in electromagnetic field, electromagnetic vave and its transverse nature       10		of ma	agnetic f	ield. Magn	etic vector	potential. A	mpere's circuit	tal law.	
Induction, permeability, magnetic         susceptibility.       Brief introduction of dia-, para-and ferromagnetic         materials.         Unit III       Electromagnetic Induction and Alternating Current         Faraday's laws of electromagnetic induction, Lenz's law, self and       10         mutualinductance, L of single coil, M of two coils. Energy stored in       10         magnetic field. Basic concepts of alternating currents.       10         Unit IV       Maxwell's equations and Electromagnetic wave propagation         Equation of continuity, Displacement current, Maxwell's equations,       10         Poynting vector, energy density in electromagnetic field, electromagnetic       10		Magne	ion por	perties of	materials:	Magnetic	intensity, m	agnetic	
Jisseepholity:       Diff information of each, part and forfolding for each, part and for each, part and forfolding for each and for each an		suscen	tibility	Brief intr	roduction o	f dia- na	ra-and ferrom	aonetic	
Unit III       Electromagnetic Induction and Alternating Current         Faraday's laws of electromagnetic induction, Lenz's law, self and       10         mutualinductance, L of single coil, M of two coils. Energy stored in       10         magnetic field. Basic concepts of alternating currents.       10         Unit IV       Maxwell's equations and Electromagnetic wave propagation         Equation of continuity, Displacement current, Maxwell's equations,       10         Poynting vector, energy density in electromagnetic field, electromagnetic       10		materi	als.	Difer intr	oddetion o	i ulu, pu		agnetie	
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mutualinductance, L of single coil, M of two coils. Energy stored in         magnetic field. Basic concepts of alternating currents.         Unit IV       Maxwell's equations and Electromagnetic wave propagation         Equation of continuity, Displacement current, Maxwell's equations,       10         Poynting vector, energy density in electromagnetic field, electromagnetic       10		Farada	ıy's laws	of electro	magnetic in	nduction, Le	enz's law, self	and	10
magnetic field. Basic concepts of alternating currents.         Unit IV       Maxwell's equations and Electromagnetic wave propagation         Equation of continuity, Displacement current, Maxwell's equations,       10         Poynting vector, energy density in electromagnetic field, electromagnetic       10         uwway and its transverse pature       10		mutua	linductar	nce, L of sir	ngle coil, M	of two coils	. Energy stored	l in	
Equation of continuity, Displacement current, Maxwell's equations, 10 Poynting vector, energy density in electromagnetic field, electromagnetic	TT	magne	tic field.	Basic conc	epts of alter	mating curre	ents.		
Poynting vector, energy density in electromagnetic field, electromagnetic	Unit IV		en s equ	ations and	Dianla com	gnetic wave	e propagation	ations	10
uovo and ita transversa natura		Equati Pounti	UII OI C	r energy do	Displaceme	nt current,	field electrom	uations,	10
		r Oynu wave a	and its tr	i, chici gy de	fure	uomagnetic		agnetic	

1. Edward M. Purcell : Electricity and Magnetism

2. J.H. Fewkes & J.Yarwood : Electricity & Magnetism, Vol. I

**3.** D C Tayal : Electricity and Magnetism

4. Ronald Lane Reese : University Physics

**5.** D.J.Griffiths : Introduction to Electrodynamics, 3rd Edn.

6. B.L.Flint & H.T.Worsnop : Advanced Practical Physics for Students

7. M. Nelson and J. M. Ogborn : Advanced level Physics Practicals, 4th Ed

8. I.Prakash & Ramakrishna : A Text Book of Practical Physics, 11th Ed

9. S.Panigrahi & B.Mallick : Engineering Practical Physics

#### **Suggested Online Link:**

1. MIT Open Learning - Massachusetts Institute of Technology, https://openlearning.mit.edu/

2. National Programme on Technology

Enhanced Learning (NPTEL),

https://www.youtube.com/user/nptelhrd

3. Swayam Prabha - DTH Channel,

https://www.swayamprabha.gov.in/ind

ex.php/program/current\_he/8

Programme: Skill Enhancement Course					Year: II	Semester: IV
Course Title & Code	Credits	Credit distrib Lecture/The ory	oution of the co Tutorial	urse Hands-on training	Eligibility Criteria	Pre-requisite of the course
<b>SEC P4:</b> Basic Instrumentation Skills -IV	2	1	0	2	As per University Ordinance	As per University Ordinance

# **Course Outcomes:**

- 1. To understand the theory and use of CRO
- 2. To understand the Signal and pulse Generators

Unit	Topic (Theory and hands on practice)	No. of Lectures
Unit I	<b>Impedance Bridges:</b> Block diagram of bridge. Working principles of basic (balancing) RLC bridge, Specifications of RLC bridge, Block diagram and	
	working principle as of a Q-meter, Digital LCR bridges.	15
Unit II	<b>Electronic Voltmeter:</b> Principles of voltage, measurement (block diagram only). Specifications of an electronic Voltmeter, AC millivoltmeter: Type of AC millivoltmeters, Block diagram ac milli -voltmeter, specifications and their significance.	15

# **Suggested Reading**

- 1. B L Theraja: A text book in Electrical Technology
- 2. M G Say: Performance and design of AC machines
- 3. S. Salivahanan& N. S. Kumar: Electronic Devices and Circuits, , 3rd Edn
- 4. Shashi Bhushan Sinha, Handbook of Repair and Maintenance of Domestic Electronics Appliances hand book.
- 5. M. Lotia, Modern Basic Electrical & House Wiring Servicing

# SEMESTER V BACHELOR IN SCIENCE

DISCIPLINE SPECIFIC COURSE (DSC A5)									
Programme: DISCIPLINE SPECIFIC COURSE Year: III Semester: V									
Subject: Physics									
Course Title & Credits Credit distribution of the course Eligibility Pre-requisite of the course Eligibility									
Code		Lecture	Tutorial	Practical	Crit	eria	course		
DSC A5: Modern Physics	4	3	0	1	As per the university ordinance		As per the university ordinance		
Course Outcomes: 1. Study of dif 2. Study of op 3. Study of str 4. X-rays: the 5. Lasers and 6. Einstein's A He-Ne laser	fferent at tical spec ructure o ir produc their wo A and B c rs and free	omic model etra, X- rays f atomic nuc etion and sp rking princi oefficients, se electron la	s. 5 and LASER cleus ectra: contin ple, spontane Metastable st aser.	S. uous and cha eous and stim tates, compon	aracte nulate nents	eristic X-ra ed emission of a laser a	ys, Moseley Law. Is and absorption. and lasing action in		
He-Ne lase	rs and fre	e electron la	aser.						

# Theory Component

Unit	Торіс	No. of Lectures
Unit I	Atomic Models : Thomson model, Rutherford model, Bohr model and spectra of hydrogen atom, Fine structure, Bohr Magnetron, Larmor"s precession, Somerfield model, Stern-Gerlach experiment, Vector atomic model, Space Quantization and Spinning of an electron.	08
Unit II	<b>Optical Spectra and X-rays :</b> Optical spectra, Spectral notations, L-S, J-J coupling, Selection rules and intensity rules, Explanation of fine structure of Sodium D line, Zeeman effect, X-ray spectra(characteristics and continuous), Moseley"s law.	07
Unit III	Theory of Lasers : Einstein A and B coefficients, Spatial and Temporal coherence, Optical pumping, Population inversion, Laser action, Basic idea of LASER and MASER, Ruby Laser and He-Ne laser, Some applications.	10
Unit IV	Molecular Spectroscopy : Franck-Condon Principle, Molecular spectra, Rotational, Vibration and Electronic spectra of diatomic molecules, General features of electronic spectra, Luminescence, Basics of Raman effect.	10

Unit V	Subatomic Physics	
	Structure of atomic nucleus, nuclear properties (charge, mass, spin, shape) nuclear binding energy liquid drop model and somi empirical	
	mass formula	10

- 1. H.S. Mani and Mehta : Introduction to Modern Physics
- 2. A. Beiser : Perspective of Modern Physics
- 3. Ahmad and Lal, : Modern Physics
- 4. B.V.N. Rao : Modern Physics
- 5. R. Murugeshan : Modern Physics
- 6. S.N. Ghosal : Nuclear Physics
- 7. C. B. Banwell : Fundamentals of Molecular Spectroscopy

#### **Suggested Online Link:**

- 1. MIT Open Learning Massachusetts Institute of Technology, https://openlearning.mit.edu/
- 2. National Programme on Technology Enhanced Learning (NPTEL), https://www.youtube.com/user/nptelhrd
- 3. SwayamPrabha DTH Channel,

https://www.swayamprabha.gov.in/index.php/program/current\_he/8

# **Practical Component**

- 1. Absorption coefficient of a liquid with the help of voltaic cell.
- 2. Frank-Hertz Experiment.
- 3. To verify Malus law using MASER and LASER.
- 4. Stern-Gerlach experiment.
- 5. To determine the wavelength and angular spread of He-Ne laser
- 6. Determination of Ionization Potential using thyratron valve.
- 7. To determine the value of electronic change by Millikan's method.

#### **Suggested Readings:**

- 1. B.L. Worsnop, H.T. Flint, "Advanced Practical Physics for Students", Methuen & Co., Ltd.,London, 1962.
- 2. S. Panigrahi, B. Mallick, "Engineering Practical Physics", Cengage Learning India Pvt. Ltd., 2015.
- 3. Indu Prakash: Practical Physics
- 4. S.L. Gupta, V. Kumar, "Practical Physics", Pragati Prakashan, Meerut, 2014. Suggestive Digital Platforms / Web Links:
  - 1. Virtual Labs at Amrita Vishwa Vidyapeetham, https://vlab.amrita.edu/?sub=1&brch=74
  - 2. Digital Platforms /Web Links of other virtual labs may be suggested/ added to this lists byindividual Universities

#### **DISCIPLINE SPECIFIC ELECTIVE (DSE A3)**

Programme: DISCIPLINE SPECIFIC ELECTIVE Year: III Semester: V								
Course Title &	Credits	Credit distribution of the course			Eligibility		Pre-requisite of the	
Code		Lecture	Tutorial	Practical	Crite	ria	course	

<b>DSE A3</b> : Basic Quantum Mechanics	4	3	0	1	As per the university ordinance	As per the university ordinance
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#### **Course Outcomes:**

- 1. Main aspects of the inadequacies of classical mechanics as well as understanding of the historical development of quantum mechanics.
- 2. Heisenberg's Uncertainty principle and its applications, photoelectric effect and Compton scattering.
- 3. The Schrodinger equation in 1-dimension, wave function, probability and probability, current densities, normalization
- 4. Particle in a box problem, energy levels.

#### **Theory Component**

Unit	Торіс	No. of Lectures
Unit I	<b>Origin of Quantum theory:</b> Origin of quantum theory, limitation of Classical Physics, Black body Radiation, Planck's radiation law and Einstein's explanation, The photo electric effect and Einstein correction, Compton effect.	10
Unit II	<b>Wave-Particle Duality:</b> De Broglie's Hypothesis, Wave-Particle Duality, Davisson- Germer Experiment, G.P Thomson experiment, Taylor's experiment, Wave description of Particles by Wave Packets, Group and Phase Velocities, Principle of Complimentarity, Heisenberg Uncertainty principle, Gamma ray microscope, Single slit experiment.	10
Unit II	<b>Formalism of Quantum mechanics:</b> Linear vector space, Linear Operator, Definition of position, momentum, Energy and Angular momentum operator, Eigen value and Eigen functions, Hermitian operators, Postulates and basic theorems of Quantum mechanics, Operator method for solving Eigen values problem, Energy of Harmonic oscillator.	10
Unit IV	Schrödinger equation – The first law of Quantum Mechanics : Origin of non relativistic Quantum Mechanics, Overview of wave mechanics, Simple one dimensional quantum system Oscillator, Time independent and time dependent one dimensional Schrödinger equation, Steady state solutions, Physical interpretation of wave functions, probability current density, Ehrenfest's theorem, Particle in a box, Idea of Tunneling	15

#### **Suggested Reading**

- 1. L.I. Schiff, "Quantum Mechanics" (McGraw Hill Book Co.)
- 2. Chris J. Isham, "Lectures on Quantum Theory" (Allied Publisher)
- 3. B.S. Rajput, "Advanced Quantum Mechanics" (Pragati Prakashan)
- 4. Ghatak and Lokanathan, "Quantum Mechanics" (Macmillan Pub.)
- 5. Mathew and Venkatesan , "Quantum Mechanics"( Tata McGraw-Hill )

# **Practical Component**

- 1. Determination of Rydberg's constant.
- 2. Determination of 'h' Planck's constant by Photoelectric effect.
- 3. 'e/m' by Thomson method.
- 4. 'e/m' Magnetron method.
- 5. 'e/m' Helical method
- 6. To determine the Planck's constant using LEDs of at least 4 different colours.

- 1. B.L. Worsnop, H.T. Flint, "Advanced Practical Physics for Students", Methuen & Co., Ltd., London, 1962.
- 2. S. Panigrahi, B. Mallick, "Engineering Practical Physics", Cengage Learning India Pvt. Ltd., 2015.
- 3. Indu Prakash: Practical Physics
- 4. S.L. Gupta, V. Kumar, "Practical Physics", Pragati Prakashan, Meerut, 2014.

# **Suggestive Digital Platforms / Web Links:**

- 1. Virtual Labs at Amrita Vishwa Vidyapeetham, https://vlab.amrita.edu/?sub=1&brch=74
- 2. Digital Platforms /Web Links of other virtual labs may be suggested / added to this lists by individual Universities

GENERAL ELECTIVE (GE P5)								
Programme: General Elective					Year: III	Semester: V		
Course Title & Code	Credits	Credit distrib Lecture	ution of the con Tutorial	urse Practical	Eligibility Criteria	Pre-requisite of the course		
<b>GE P5:</b> Basics of Heat Transfer	4	3	1	0	As per University Ordinance	As per University Ordinance		

# **Course Outcome:**

- 1. To understand the of Heat Transfer processes.
- 2. Thermal radiation, Kirchoff's Laws, Derivation of Stefan Boltzmann law, and Wein's displacement law.
- 3. To understand the black body radiation and related laws.

Unit	Торіс	No. of Lectures
Unit I	<b>Conduction :</b> Modes of heat transfer via Conduction: Fourier's law, One dimensional steady state conduction, Heat conduction through plane and composite walls, Cylinders and spheres, Electrical analogy, Thermal conductivity and its experimental detection.	10
Unit II	<b>Convection</b> : Modes of heat transfer via Convection : Newton's law of cooling. Dimensional analysis applied to forced and free convection, Dimensionless numbers and their physical significance.	10
Unit III	<b>Thermal Radiation</b> : Physical quantities associated with Radiation, Black body, Radiation from non-black-bodies, Thermodynamics of radiations inside a hollow enclosure, Kirchoff's Laws, Derivation of Stefan Boltzmann Law, Wein's displacement law.	15
Unit IV	<b>Black Body Radiation:</b> Black body spectrum formula- early attempts, Raleigh Jean's Law, Quantum theory of Radiation, Planck's formula for black body spectrum, Wien's law, Radiation as a photon gas.	10

- 1. S. Loknathan, "Thermodynamics, Heat and Statistical Physics" (Prentice Hall India)
- 2. Sharma and K.K. Sarkar "Thermodynamics, and Statistical Physics" (Himalaya Pub.)
- 3. Brijlal and Subrahmanyam, "Heat and Thermodynamics" (S Chand)
- 4. Saha and Srivastav "Treatise on heats", (The Indian Press Publications)

## Suggested Online Link:

- 1. MIT Open Learning Massachusetts Institute of Technology, https://openlearning.mit.edu/
- National Programme on Technology Enhanced Learning (NPTEL), https://www.youtube.com/user/nptelhrd
- Swayam Prabha DTH Channel, https://www.swayamprabha.gov.in/index.php/ program/current\_he/8
| Programme:  | Skill Enhanc  | ement Cou  | rse  |   | Year: III   | Semester:                           | V                 |
|---|---|--|--|---|---|-------------------------------------|-------------------|
| Course Title  | <b>9 C 1</b> <sup>2</sup> <b>4 -</b>                          |  | •1 4• 641  |   |   |                                     | •4 • • 41         |
| Course The  | a Creatts   | Credit dist  | ribution of th   | e course  | Eligibility<br>Criteria   | Pre-requis                          | site of the       |
| coue  |   | Lecture/Th<br>ory                                      | ne Tutorial  | Hands-on<br>Training  | Cincina   | course                              |                   |
| SEC P5: Adva<br>Instrumentatio<br>Measureme<br>Techniques | anced<br>n and<br>ent<br>-I 2                                 | 1  | 0  | 2   | As per<br>University<br>Ordinance                                     | As per Ur<br>Ordinance              | iversity          |
| 1. To und<br>2. To und                                    | erstand the In<br>erstand the Pr                              | pedance Br   | idges.<br>uses of electr                                     | onic voltmet  | er.   |                                     |                   |
| Unit  |   | Topic (The   | eory and han   | ds on practi  | ce)   |                                     | No. of<br>Lecture |
| Unit I  | Multimeter:<br>voltage, ac c<br>significance.<br>measuremen   | Principles<br>current and<br>Advantag<br>t with respec | of measurer<br>resistance. S<br>ge over co<br>ctto input imp | nent of dc v<br>pecifications<br>onventional<br>pedance and s | voltage and dc c<br>of a multimeter<br>multimeter for<br>sensitivity. | current, ac<br>and their<br>voltage | 15                |
| Unit II   | <b>Digital Mult</b><br>Working prin<br>universal coursolution | timeter: Blo<br>nciple of tim<br>unter/freque          | ock diagram a<br>ne interval, fr<br>ncy counter,             | and working equency and time-base sta                         | of a digital multi<br>period measuren<br>bility, accuracy a           | meter.<br>nent using<br>and         | 15                |

#### **Suggested Reading**

- 1. B L Theraja : A text book in Electrical Technology
- 2. M G Say : Performance and design of AC machines
- 3. S. Salivahanan& N. S.Kumar : Electronic Devices and Circuits, , 3rd Edn
- 4. Shashi Bhushan Sinha, Handbook of Repair and Maintenance of Domestic Electronics Appliances hand book.
- 5. M. Lotia, Modern Basic Electrical & House Wiring Servicing

# <u>OR</u>

SKILL ENHANCEMENT COURSE (SEC P5)							
Programme:	Skill Enhance	ement Cours	se		Year: III	Semester:	V
Course Title	& Credits	Credit distri	bution of the d	rourse	Fligibility	Pre-requis	ite of the
Code		Lecture/The	Tutorial	Hands-or	Criteria	course	ne or the
		ory		Training			
SEC P5_Electr circuit networ Skills - I	ical rk 2	1	0	2	As per University Ordinance	As per Un Ordinance	iversity
Course Outcor	ne:						
1. To unde 2. To unde	rstand the Im rstand the Pri	pedance Brid	lges. ses of electror	nic voltmet	ter.		
Unit	,	Topic (Theo	ry and hands	s on pract	ice)		No. of Lectures
Unit I	<b>Electrical Circuit Fundamentals and Series Circuits:</b> Zero Reference level, Chassis Ground, Ohm's Law, Graphical representation of Ohm's Law, Linear and Non-linear resistor, Cells in series in electrical circuits, Resistances in series circuit, Characteristics, Case of zero IR drop, Polarity of IR drops, Total Power, Series Aiding and series opposing voltages, Proportional voltage formula in series circuits, Series Voltage dividers, opens and Shorts in a series circuit.						15
Unit II	Parallel Electrical circuits:         Cells in parallel in electrical circuits, Parallel resistive circuits, Laws of parallel circuits,         Special case of equal resistances in all branches and only two branches, Any branch resistance, Proportional current formula, opens and shorts in a parallel circuit.						15

#### **Suggested Reading**

- 1. B L Theraja : A text book in Electrical Technology
- 2. B L Theraja : A text book in Basic Electronics
- 3. M G Say : Performance and design of AC machines
- 4. S. Salivahanan& N. S.Kumar : Electronic Devices and Circuits, , 3rd Edn
- 5. Shashi Bhushan Sinha, Handbook of Repair and Maintenance of Domestic Electronics Appliances hand book.
- 6. M. Lotia, Modern Basic Electrical & House Wiring Servicing

#### SEMESTER VI

### **BACHELOR IN SCIENCE**

# DISCIPLINE SPECIFIC COURSE (DSC A6)

Programme: I	Programme: DISCIPLINE SPECIFIC COURSE Year: III Semeste						
Subject: Phys	ics						
<b>Course Title</b>	& Credits	Credit dist	ribution of th	ne course	Eligibility	Pre-requi	site of the
Code		Lecture	Tutorial	Practical	Criteria	course	
DSC A6: Electronics	4	3	0	1	As per the university ordinance	As per the toordinance	university
<ol> <li>Course Outcon</li> <li>Study o</li> <li>Study o</li> <li>Regulat</li> <li>Study o</li> <li>Study o</li> <li>Study o</li> <li>Study o</li> </ol>	<b>mes:</b> f different Net f Regulated Po or. f different typ f Bipolar Junct f Field Effect	It Network Theorems for simplifying complicated electronics circuits. The Power Supply. Understand different types of Rectifiers, Filters and Voltage and types of special diodes and their applications Junction Transistors. Iffect Transistor Inteory Component					
Unit	Торіс						No. of Lectures
Unit I	Network The Theorem, N Semiconducto rectifiers, Brio pass filters, B characteristics	eorems and Norton''s or diode: P- dge rectifier and pass an s, Voltage re	<b>Power Supp</b> Theorem, M -N Junction d s, Efficiency, I ad Band stop f gulation	<b>lies:</b> Superpos (aximum po liode, Diode Ripple factor, ilters, L and a	sition Theorem, ower transfer as a: Half and Filters: Low pas τ – filters, Zener	Thevenin's theorem, Full wave s and High diode, its	10
Unit II	<ul> <li>II Solid State Devices : Tunnel diode, Varactor diode, V-I characteristic of these diodes, Optoelectronic devices: Light emitting diode, Photodiode, Bipolar junction transistor, Transistor operation and its Biasing rule, Transistor currents, Transistor circuit configuration (CB, CE, and CC configuration), Transistor characteristics in different configuration, cut-off and saturation points, Active region, Relation between transistor current in various configuration, General idea of FETs</li> </ul>						10
Unit III	Amplifiers : Single-stage transistor amplifiers, Common base (CB) amplifier, Common10emitter (CE) amplifier, Common collector (CC) amplifier, Amplifier based on biasing condition, Power amplifiers, Noise and Distortion in amplifiers, RC- coupled two stage amplifier and its frequency response, Feedback amplifiers, positive and negative feedback.10						10
Unit IV	feedback, Advantage of negative feedback.VOscillators : Classification of oscillators, Frequency of oscillating current, Frequency stability of an oscillator, Essential of a feedback LC oscillator, Tuned base oscillator, Tuned collector oscillator, Hartley oscillator, Colpitt oscillator, Clapp oscillator, Tunnel diode oscillator, Crystal oscillator, Phase shift oscillator, Wien Bridge oscillator, Relaxation oscillator, Multivibrators (Astable, monostable and bistable).					08	

Unit VDigital Electronics: Number systems, Decimal, Binary, Octal and Hexadecimal<br/>number systems, Binary to decimal conversion, Boolean algebra, Laws of Boolean<br/>algebra, De Morgan's theorems, Logic gates, OR gate, Exclusive OR gates, AND gate,<br/>NOT gate, NOR gate, NAND gate, NAND and NOR as universal gates, XNOR gate,<br/>Half Adder, Full adder, Half subtractor and Full subtractor.07

#### Suggested Reading

- 1. M.K. Baagde, S.P. Singh and Kamal Singh : Elements of Electronics
- 2. B.L. Theraja : Basic Electronics
- 3. V.K. Mehta : Elements of Electronics
- 4. J.D. Ryder : Networks, Lines and Fields
- 5. J.D. Ryder : Electronic Fundamentals and Applications.
- 6. Millman and Halkias : Integrated Electronics

#### **Suggested Online Link:**

- 1. MIT Open Learning Massachusetts Institute of Technology, https://openlearning.mit.edu/
- 2. National Programme on Technology Enhanced Learning (NPTEL), https://www.youtube.com/user/nptelhrd
- 3. SwayamPrabha DTH Channel, https://www.swayamprabha.gov.in/index.php/program/current\_he/8

### **Practical Component**

- 1. To study the characteristics of integrating and differentiating circuit.
- 2. To draw the characteristics of P-N junction diode.
- 3. To draw the characteristics of PNP and NPN junction transistor.
- 4. Measurements of h-parameters of a transistor.
- 5. Study of different types of Rectifiers and Filters.
- 6. Verification of Network theorems.
- 7. Child Langmuir law.
- 8. Triode/ Tetrode/ Pentode characteristics and constants.
- 9. Study of power supply (Ripple factor).
- 10. Study of Zener diode and regulation (taking different source voltage andloads).

11. To study the Characteristics of a Photo-diode.

#### **Suggested Readings:**

- 1. B.L. Worsnop, H.T. Flint, "Advanced Practical Physics for Students", Methuen & Co., Ltd., London, 1962.
- 2. S. Panigrahi, B. Mallick, "Engineering Practical Physics", Cengage Learning India Pvt. Ltd., 2015.
- 3. Indu Prakash: Practical Physics
- 4. S.L. Gupta, V. Kumar, "Practical Physics", Pragati Prakashan, Meerut, 2014.

#### Suggestive Digital Platforms / Web Links:

- 1. Virtual Labs at Amrita Vishwa Vidyapeetham, https://vlab.amrita.edu/?sub=1&brch=74
- 2. Digital Platforms /Web Links of other virtual labs may be suggested / added to this lists by

individual Universities

		DISCI	PLINE SPEC	CIFIC ELEC	TIVE (DSE A4	)		
Drogramma	Dissipling Sp		time		Voar	TII Semeste	\r·	
r rogramme:	Discipline Sp		live		1 car.	VI VI		
Subject: Phy	vsics							
Course Title	e & Credits Credit distribution of the course Eligibility Pre-requisi							
Code		Lecture	Tutorial	Practical	Criteria	course		
<b>DSE A4:</b> Sp Theory of Relativity	ecial 4	3	0	1	As per the university ordinance	As per the u ordinance	miversity	
Course Outco	ome:							
<ol> <li>To und</li> <li>Lorent</li> <li>To und</li> <li>To und</li> </ol>	derstand the sp z Transformat derstand the M derstand about	ecial theory ions and it axwell's eq the four ve	y of relativity s Consequence uations and the ctor and four	ces heir physical s vector formu	significance lation of current	t and continuit	y equation	
			<b>Theory</b>	Component				
Unit	Unit Topic						No. of Lectures	
Unit I	Foundation	of Special	theory of <b>F</b>	Relativity : F	rames of refere	nce, Galilean		
	transformation	ns, Ether hyp	othesis, Failur	e of Michelson	-Morley experim	ent, Postulates	10	
	of Special the	ory of relativ	vity, Lorentz tr	ansformations.				
Unit II	Consequence	s of Loren	tz Transform	ations : Leng	th contraction,	Time dilation,	10	
	Velocity trans	formations a	and Law of velo	ocity addition,	Variation of mass	with velocity,	10	
	Relativistic er	ergy and ma	ass energy equ	ivalence, Conc	ept of four vector	r, Examples of		
	position and n	nomentum fo	our vectors.					
Unit III	Electromagn	etic waves	: Maxwell's	equations in d	ifferential and in	ntegral forms,	15	
	Electromagne	tic energy ar	d Poynting the	eorem, Wave e	quations, Plane el	ectromagnetic	15	
waves in free space, Maxwell's equations for isotropic, nonisotropic and dielectric								
	medium, Plan	e Electroma	gnetic wave in	n Conducting a	una non-conducti	ng (alelectric)		
∐nit IV	Rolativity of	Flootrome	matism · Nat	ations for Four	- vectors space	and light like		
	separations F	inergy-Mom	entum Four V	actor Four ve	ctor potential el	ectromagnetic	10	
	field tensor. L	orentz invar	iance, Lorentz	force, covariar	t form of Maxwe	ell's equations.		
	four vector for	rmulation of	current and co	ontinuity equati	on.	1,		
				<i>.</i> .				

#### **Suggested Reading**

- 1. H.S. Mani and Mehta, Introduction to Modern Physics, (Allied East West Press)
- 2. A. Beiser, Perspective of Modern Physics, , (Tata McGraw Hill)
- 3. Ahmad and Lal, Modern Physics (S. Chand and Co.)
- 4. B.V.N. Rao, Modern Physics (New Age International)
- 5. B.B.Laud Electromagnetics (Wiley Eastern limited)
- 6. Berkely Physics course, Vol II "Electricity and Magnetism" (McGraw Hill.)
- 7. A. S. Mahajan and A. Rangwala "Electricity and Magnetism" (Tata McGraw Hill.)

### **Practical Component**

- 1. Speed of light in air.
- 2. To verify the Cauchy's dispersion formula.
- 3. Determination of wavelength using grating and spectrometer.
- 4. Measurement of wavelength difference of Na using Michelson Interferometer.
- 5. Measurement of thickness of mica sheet using Michelson Interferometer.
- 6. To demonstrate interference & Doppler effect in waves.

#### **Suggested Reading:**

- 1. Worsnop, B. L., Flint, H. T., "Advanced Practical Physics for Students", Methuen & Co., Ltd.,London
- 2 Panigrahi, S., Mallick, B. "Engineering Practical Physics", Cengage Learning India Pvt. Ltd.,
- 3. Gupta and Kumar, Practical Physics, Pragati Prakashan
- 4. Srivastava, Anchal, and Shukla, R. K., New Age International (P) Ltd

Programme:	Gener	al Elec	etive			Year: III	Semes	ter: VI
<b>Course Title</b>	e & 🛛 🕻	Credits	ts Credit distribution of the course Eligibility Pre-rec		equisite of the			
Code			Lecture	Tutorial	Practical	Criteria	cours	e
<b>GE P6</b> : Basic Digital electr	cs of onics 4	Ļ	3	1	0	As per University Ordinance	As pe Ordin	r University ance
ourse outco	me:							
<ol> <li>Differ</li> <li>To un</li> </ol>	rent type iderstanc	e of Log d the dif	ic gates ferent com	bination circu	ıits			
Unit		Тор	pic					No. of Lectures
Unit I	Number number a operation complem number a	Systems, systems, ns, Binar nent and as electric	: Number Binary to y addition, 2"s compl cal signals,	systems, Deci decimal conv Binary subtra ement), Binary Conversion of	mal, Binary, ersion, Double vtion, Comple divison, Rep Binary to octa	Octal and Hexad e-Dadd method, ement of a numb resentation of a l, Binary to hexad	lecimal Binary er (1"s Binary lecimal	15
Unit II	<b>Boolean</b> Boolean Morgan's	Algebra algebra, theorem	a: BCD, GF Laws of as and Dual	REY, EXCESS Boolean algeb s.	-3 codes, Bool ora, Equivalen	ean algebra, Feat t switching circu	ures of ait, De	10
Unit III	<b>Logic Ga</b> and trans gates, Th Bubbled gates Th	ates : Pos sistor OR le AND g gates, Th le XNOR	sitive and N gate, Three gate, Diode he NOR gat	Vegative logic, e input OR gate AND gate and e, The NAND	Two input OR e and its truth t transistor AN gate, NAND a	gate, Diode OR g able, Exclusive C D gate, The NOT nd NOR as unive	gate PR gate, rsal	10
Unit IV	<b>Combin</b> Parallel b	ational of the second s	<b>Circuits:</b> Adder, Half su	Adders and su libtractor and Fi	ubtractors, Hal	f Adders, Full	adders,	10

#### **Suggested Reading**

- 1. M.K. Baagde, S.P.Singh and Kamal Singh ,Elements of Electronics ,(S. Chand and Co.)
- 2. B.L.Thereza, Basic Electronics, (S. Chand and Co.)
- 3. V.K.Mehta, Elements of Electronics, (S. Chand and Co.)
- 4. Brophy, Communication Electronics (McGraw-Hill Education)
- 5. R Boylested , Electronic Devices & Circuit theory (PHI)

#### **Suggested Online Link:**

- 1. MIT Open Learning Massachusetts Institute of Technology, https://openlearning.mit.edu/
- 2. National Programme on Technology Enhanced Learning (NPTEL), https://www.youtube.com/user/nptelhrd

#### 3. Swayam Prabha - DTH Channel,

https://www.swayamprabha.gov.in/index.php/program/current\_he/8

SKILL ENHANCEMENT COURSE (SEC P6)							
Programme: Skill	Enhance	Ye	ear: III	Semester: VI			
Course Title & Code	Credits	Credit d Lecture/The	istribution of t Tutorial	the course Hands-or training	1	Eligibility Criteria	Pre-requisite of the course
SEC P6 Advanced Instrumentation and Measurement Techniques-II	2	1	0	2		As per University Ordinance	As per University Ordinance

#### **Course Outcomes:**

To understand the function of analog and digital Multimeter.

Unit	Торіс	No. of Lectures
Unit I	Cathode Ray Oscilloscope: Block diagram of basic CRO. Construction of	
	CRT, Electron gun, electrostatic focusing and acceleration (Explanation only-	
	no mathematical treatment), brief discussion on screen phosphor, visual	15
	persistence & chemical composition. Time base operation, synchronization.	
	Front panel controls. Specifications of a CRO and their significance. Use of	
	CRO for the measurement of voltage (dc and ac frequency, time period. Special	
	features of dual trace, introduction to digital oscilloscope, probes. Digital	
	storage Oscilloscope: Block diagram and principle of working.	
Unit II	Signal and pulse Generators	
	Block diagram, explanation and specifications of low frequency signal	
	generator and pulse generator. Brief idea for testing, specifications. Distortion	15
	factor meter, wave analysis.	

#### **Suggested Reading**

- 1. B L Theraja : A text book in Electrical Technology
- 2. M G Say : Performance and design of AC machines
- 3. S. Salivahanan& N. S.Kumar : Electronic Devices and Circuits, , 3rd Edn
- 4. Shashi Bhushan Sinha, Handbook of Repair and Maintenance of Domestic Electronics Appliances hand book.
- 5. M. Lotia, Modern Basic Electrical & House Wiring Servicing

# <u>OR</u>

	SKILL ENHANCEMENT COURSE (SEC P6)							
Programme: Skill Enhancement Course						ear: III	Semester: VI	
Course Title &	Credits	Credit distribution of the course				Eligibility	Pre-requisite of the	
Code		Lecture/The ory	Tutorial	Hands-oı training	n	Criteria	course	
SEC P6: Electrical circuit network Skills - II	2	1	0	2		As per University Ordinance	As per University Ordinance	

#### **Course Outcomes:**

To understand the types of electrical circuits and method of making different types of electrical circuits.

Unit	Торіс	No. of Lectures
Unit I	Series-Parallel electrical circuits and Kirchhoff's: Series –parallel circuits, Analysing series-parallel circuits, Opens and Shorts in series- parallel circuits, Voltage division in a complex Series-Parallel circuits. Kirchhoff's laws: Kirchhoff's current law, Kirchhoff's voltage law, Determination of Algebraic sign, Assumed direction of current flow, Solving circuit problems using Kirchhoff's laws.	`15
Unit II	Network Theorems: Concept of electrical Network, Different types of Network Theorems: Superposition Theorem, Application of superposition theorem for solving electrical network problems, Thevenin's Theorem, Procedure for Thevenizing an electrical circuit, Application of Thevenin's theorem, Norton's Theorem, Procedure to Nortonise an electrical circuit, Application of Norton's theorem, Maximum Power Transfer	15

#### **Suggested Reading**

- 1. B L Theraja : A text book in Electrical Technology
- 2. B L Theraja : A text book in Basic Electronics
- 3. M G Say : Performance and design of AC machines
- 4. S. Salivahanan& N. S.Kumar : Electronic Devices and Circuits, , 3rd Edn
- 5. Shashi Bhushan Sinha, Handbook of Repair and Maintenance of Domestic Electronics Appliances hand book.
- 6. M. Lotia, Modern Basic Electrical & House Wiring Servicing

# MASTER OF SCIENCE IN PHYSICS

M. Sc. (Physics)



# **SYLLABUS FRAMED AS PER THE**

# **NATIONAL EDUCATION POLICY-2024**

# **Programme Outcomes (POs):**

Students having Degree in Master of Science should have knowledge of advancedconcepts of Physics and ability to apply this knowledge in various fields of academics, research and industry. They may pursue their future career in the field of academics, research and industry.

Competence in the methods and techniques of calculations using Mathematical Physics, Classical Mechanics, Quantum Mechanics and Communication Electronics. It will develope an analytical skill on an advanced level and will enable the student to have mathematical

**PO1** tools to solve complex problems of Physics. The Programme will motivate the student to know more about the matter, the universe and the recent developments in the field of science. The student will have adequate knowledge to work for the industry,, consultancy, education, and research

The students would gain substantial knowledge in various branches of physics. The programme will enable the student to explore more in the field of his/her choice like

PO2 Advanced Electronics, Spectroscopy, Astrophysics and High energy Physics. The student will be well equipped with the knowledge required for different organizations, industry, R& D sector.

## Programme specific outcomes (PSOs) PG I YEAR/ Major in Physics

**Major in Physics** programme provides the student the adequate knowledge, general competence, and analytical skills on an advanced level, needed in industry, consultancy, education, research, or in government organisation.

## Programme specific outcomes (PSOs): PG II YEAR/ Master in Physics

- The Master of Science in Physics programme provides student the adequate knowledge to use mathematical tools to solve complex physical problems and have the solid background and experience needed to analyze and solve advanced problems in physics.
- This course would enable the student to acquire scientific skills and the practical knowledge by performing experiments in general physics and electronics.
- The student would also get some research oriented experience by doing theoretical and experimental projects in the last semester under the supervision of faculty.
- The course as a whole opens up several career doors for the students interested in various areas of science and technology in private, public and government sectors. Students may get job opportunities in higher education, research organizations, physics consultancy and many others. Some of the institutions where physics students can start their career are: BARC, DRDO, NPTC, IISc, ISRO, ONGC, BHEL, PRL, NPL, SINP, VECC, IITs, NITs, IIPR etc.

# DETAILED SYLLABUS FOR MAJOR IN PHYSICS P.G. FIRST YEAR

#### Semester: VII MAJOR IN PHYSICS DISCIPLINE SPECIFIC COURSE (DSC A7)

Programme: DIS	SCIPLIN	E SPECIFI	C COURSE	Year: IV		Semester: VII	
Subject: Physics							
Course Title & Code	Credits	Credit d <mark>Lecture</mark>	e	Eligibili Criteria	ty	Pre-requisite of the course	
DSC A7: Mathematical Physics	3	3	0		B.Sc. wi Physics	th	B.Sc. with Physics

#### **Course Outcomes**

Students would be able to understand the mathematical methods essential for solving the advanced problems in physics. It would be helpful in the development of the ability to apply the mathematical concepts and techniques to solve the problems in theoretical and experimental physics. The knowledge of mathematical physics would be beneficial in further research and development as it serves as a tool in almost every branch of science and engineering Course.

UNIT	TOPIC	No. of Lecture s
UNIT I	Special Functions Series solution of differential equations, Legendre, Bessel, Hermite, and Laguerre differential equation and related polynomial, physical integral form of polynomials and their orthogonality relations. Generating Function and recurrence relation.	10
UNIT II	Curvilinear Coordinates and Tensors Curvilinear Coordinates and various operators in circular, cylindrical and spherical coordinate systems, classification of Tensors, Rank of a Tensor, covariant and contra-variant tensors, symmetric and anti-symmetric Tensors, Kronecker delta symbol. Contraction of Tensor, metric Tensor and Tensor densities, covariant differentiation and Geodesic equation (variational Method).	10

UNIT III	Complex Variables Function of complex variable, Cauchy's	
	Riemann differential equation, Cauchy's integral theorem,	
	residues and Cauchy's residues theorem, singularities,	10
	evolution of residues and definite integral.	
UNIT IV	Integral Transforms Fourier integral and Fourier Transform,	
	Fourier integral theorem, finite and infinite integral, Laplace	15
	transform of elementary function (Dirac delta & Green's	13
	function), Solution of simple differential equations.	

#### **Suggested Readings:**

- 1. B. S. Rajput: Mathematical Physics (Pragati Prakashan, Meerut)
- 2. L. I.Pipes: Mathematical Physics (McGraw Hill)
- 3. P. K. Chattopadhyay: Mathematical Physics (Wiley Eastern, NewDelhi)
- 4. Afriken.: Mathematical methods for Physics
- 5. Harper Charlie: Introduction to Mathematical Physics
- 6. Mathews and Walker: Mathematical Methods of Physics (Benjaminpress)
- 7. Horse and Feshbach : Methods of Theoretical Physics (McGraw Hill)

- 1. MIT Open Learning Massachusetts Institute of Technology, https://openlearning.mit.edu/
- 2. National Programme on Technology Enhanced Learning (NPTEL), https://www.youtube.com/user/nptelhrd
- 3. SwayamPrabha DTH Channel, https://www.swayamprabha.gov.in/index.php/program/current\_he/8

<b>DISCIPLINE SPECIFIC ELECTIVE (DSE A6)</b>								
Programn	ne: Dis	cipline Sj	pecific Elect	tive	Ye	ar: IV Semo VII	este	r:
Course T Code	itle &	Credits	Credit disti course	ribution of the		Eligibility Criteria	Pre of t	-requisite he course
			Lecture	Tutorial				
DSE A6: Classical Mechani	cs	3	3	0		B.Sc. with B. Physics Ph		c. with vsics
Course O	utcom	es:		. 1.1	NT	. • 1		
In this comment	ourse s ical fo	students rmulatior	would learn	to apply the be the motions		tonian laws	usir obi	ng various ects using
generalize	ed coord	dinates, m	nomentum, f	orces and energy	y. Th	e classical me	chai	nics would
be helpful in understanding of advanced branches of modern physics.								
UNIT		TOPIC No. of Lecture						
UNIT I	I       Mechanics of a System of Particles Constraints and generalized coordinates, D Alembert's principle, Lagrange equations for holonomic and non holonomic systems and their applications, conservation laws of linear momentum, energy and angular       10							
UNIT II	II Hamiltonian Formulation and Hamilton Jacobi Theory Hamiltonian equations of motion and their physical significance, Hamilton's principle, principle of least action, canonical transformations Hamilton-Jacobi theory, Poisson brackets, properties of Poisson bracket, Poisson's Theorem, Lagrange							
UNIT III	Dynar space Princi Euler	Dynamics of a Rigid Bodies Motion of a rigid body, body and space Reference system, angular momentum and Inertia tensor, Principle axes- Principle moments of Inertia, spinning tops, Euler angles, Infinitesimal rotations.10						
UNIT IV	Centra integr and th scatter	al Force al, small heir deduc ring cross	Problem A oscillations, ction, scatter	ction and ang Kepler's laws ing in a Central	le v of P field	ariables, pha lanetary moti , Rutherford	on	10

#### **Suggested Readings:**

- 7. H. Goldstein : Classical Mechanics
- 8. N.C. Rana & P. S. Jog : Classical Mechanics
- 9. Landau and Lifshitz : Mechanics, Pergamon Sommerfeld : Mechanics, Academic Press
- Whittaker : Analytical Dynamics of Particles and Rigid Bodies -Cambridge 10.
- Raychaudhuri : Classical Mechanics, Oxford Bhatia : Classical Mechanics, Narosa. 11.

12. H.M. Agrawal: Classical Mechanics, New Age International **Suggested Equivalent Online Courses:** 

- 1. MIT Open Learning Massachusetts Institute of Technology, https://openlearning.mit.edu/
- 2. National Programme on Technology Enhanced Learning (NPTEL),

https://www.youtube.com/user/nptelhrd

3. SwayamPrabha - DTH Channel, https://www.swayamprabha.gov.in/index.php/program/current\_he/8

DISCIPLINE SPECIFIC ELECTIVE (DSE A7)								
Programn	ne: Dis	cipline S	pecific Elect	ive	Ye	ar: IV	Seme VII	ster:
Course T Code	itle &	Credits	Credit disti course Lecture	ribution of the	<u> </u>	Eligibili Criteria	ity I	Pre-requisite of the course
DSE A7: Quantum Mechani	n cs	3	3	0		B.Sc. w Physics	B.Sc. with Physics	
<b>Course Outcomes:</b> The course provides an understanding of the behaviour of the systems at microscopic (atomic and nuclear) scale and even smaller. Students would learn basic postulates and formulations of quantum Mechanics. The course, in fact, plays an important role in explaining the behaviour of all physical systems in the universe. The course includes the study of a brief review of foundations of quantum mechanics, matrix formulation of quantum mechanics, symmetry in quantum mechanics and approximation methods for								
UNIT	ΤΟΡΙΟ						No. of	
UNIT I	NIT INon-Relativistic Quantum Mechanics and Schrödinger Equation Schrödinger's equation, Probability and current densities, continuity equation, physical interpretation of wave function, orthogonality of eigen functions, Principle of superposition, wave packet, normalization, Schrödinger's equation in three dimensions, centrally symmetric square well and harmonic potentials, harmonic oscillator and itswave functions, Hydrogen atom							
UNIT II	Operator Formulation of Quantum MechanicsState vectors and operators in Hilbert Space, Eigen values and Eigen vectors of an operator, Hermitian ,Unitary and Projection operators, commuting operators, BRA and KET Notations, Postulates of Quantum Mechanics, co-ordinate Momentum and Energy representations, dynamical behavior, Heisenberg, Schrödinger and interaction Pictures						nd on ns, <b>10</b> nd rg,	
UNIT III	Theory of Angular MomentumOrbital Angular momentum operator, its eigen value and eigenfunctions, spacequantization, spinangularmomentum,Pauli'stheoryofspin,Additionofangular momentum,ClebschGordan coefficients						en m, <b>10</b> m,	
UNIT IV	Appr Time Statio WKB	oximatio indepen nary Per approxin	n Methods dent and T turbation, f nation metho	Fime dependen Tirst and secon Tods, connection	t Per d or formu	rturbatio der cor 11a and b	n Theo rection	ory ns, <b>10</b> ary

	conditions,	Bohr	Sommerfield	quantization	rule,	Time	
i	independent	perturb	ation theory and	its applications	5.		

#### **Suggested Readings**

- 1. B. S. Rajput: Advanced Quantum MechanicsSchiff: Quantum Mechanic
- 2. Thankppan: Quantum Mechanics
- 3. Loknathan and Ghatak Quantum Mechanics

#### Suggested Equivalent Online Courses:

- 1. MIT Open Learning Massachusetts Institute of Technology, https://openlearning.mit.edu/
- 2. National Programme on Technology Enhanced Learning (NPTEL), https://www.youtube.com/user/nptelhrd
- 3. SwayamPrabha DTH Channel,

https://www.swayamprabha.gov.in/index.php/program/current\_he/8

<b>DISCIPLINE SPECIFIC ELECTIVE (DSE A8)</b>								
Programme	e: Discipli	Year: IV Sen VII	nester:					
Course Tit Code	Course Title & Code		Credits Credit distribution of the course		Eligibility Criteria	Pre-requisit of the cours		
DSE A8: Communi Electronic	cation cs	3	3	0	B.Sc. with Physics	B.Sc. with Physics		
This course systems. The transmissio Propagation transmitter, any organiz	helps the he course i n, AM de n of Rac Transmiss cation rela	e student ncludes etection, lio Way sion Lin ted to co	to gain basis Modulation AGC, Rad ves, Antenn es etc.The c ommunicatio	c ideas of the fur AM and FM (Tra lio receiver cha a, Fundamental course may provi on.	adamentals of cor ansmission and rec aracteristics, FM s of image tran- ide the opportunity	nmunication eption), SSB transmitter, smission,TV y to work in		
UNIT			,	TOPI C		No. of Lectures		
UNIT I	Modulat Modulat modulat receiver noise co tubemet discrimi	10						

UNIT II	Propagation of Radio Waves Ground wave, sky wave and	
	space	10
	wave propagation. Ionosphere (Ecclr- larmer theory, magneto	10
	ionic theory.	
UNIT III	Antenna and TV Antenna, HF antenna, Yagi antenna, loop	
	antenna, Satellite communication, parabolic reflector, dish	
	antenna, Fundamentals of image transmission, vestigial	10
	transmission, TV camera tubes, image orthicon, vidicon, TV	
	transmitter, TV receiver and picture tubes.	
UNIT IV	Transmission Lines Voltage and current relations on	
	transmission line, propagation constant, characteristic	
	impedance, impedance matching, quarter wave T/L as	
	impedance transformer, attenuation along coaxial cable, cables	
	of low attenuation, propagation of radio waves between two	15
	parallel lines, wave guide modes, TE10 mode and cut off	
	wavelength, cavity resonator, light propagationin cylindrical	
	wave guide, step index and graded index fibers,	
	attenuation and dispersion in fibers	

#### **Suggested Readings:**

- 1. George Kennedy & Davis: Electronics Communication Systems
- 2. Millar & Beasley: Modern Electronics Communication
- 3 R.R Gulani: Monochrome and colour television (Wiley Eastern Limited)
- 4. Taub and Schilling: Principle of Communication Systems (TMH)
- 5. Simon Gaykuti: Communication Systems (John Wiley & Sons Inc. 1994

- 1. MIT Open Learning Massachusetts Institute of Technology, https://openlearning.mit.edu/
- 2. National Programme on Technology Enhanced Learning (NPTEL), https://www.youtube.com/user/nptelhrd
- SwayamPrabha DTH Channel, https://www.swayamprabha.gov.in/index.php/program/current\_he/8

<b>GENERAL ELECTIVE (GE P7)</b>								
Programn	ie: Gene	ral Electiv	/e		Year: I	V Sem	ester:	
Course T Code	itle &	Credits	Credit dis course Lecture	tribution of the	Eligi Crite	Eligibility Pre- Criteria requisit the cou		
GE P7: Renewab Sources o Energy	le of	3	3	1	B.Sc. Physi	with cs	B.Sc. with Physics	
<b>Course Outcomes:</b> This course helps the student to gain basic ideas of the Renewable Sources of Energy. The course includes Fossil fuels and nuclear energy, Tidal Energy, Solar energy and its importance. The course may provide the opportunity to work in any organization related Renewable Sources of Energy.								
Unit	Торіс						No. of Lectures	
Unit I	Fossil renewa overvie	f 1 15						
Unit II	Tidal Energy, Wave energy systems, Ocean Thermal Energy Conversion, solar energy, biomass, biochemical conversion, biogas generation, geothermal energy tidal energy,15Hydroelectricity15							
Unit III	Solar energy and its importance, storage of solar energy, applications of solar pond and solar energy, solar water heater, flat plate collector, solar distillation, solar cooker, solar green houses, solar cell, absorption air conditioning. Need and characteristics of photovoltaic (PV) systems						15	
Unit IV	Fundan electric interfac charact Therma	nentals of al machi- ces, and eristics and al Energy.	Wind ener nes in wi grid int d Statistics: Osmotic Po	gy, Wind Turbi nd turbines, I erconnection t Tide Energy Tec wer, Ocean Bio-	nes and c Power ele opologies. chnologies mass	lifferen ectronio Tido , Ocear	t 2 2 1 1 1 5	

Suggested Reading1. Non-conventional energy sources, B.H. Khan, McGraw Hill

- 2. Solar energy, Suhas P Sukhative, Tata McGraw Hill Publishing Company Ltd.
- 3. RenewableEnergy,Powerforasustainablefuture,GodfreyBoyle,3rd Edn., 2012.
- 4. Renewable Energy Sources and Emerging Technologies, Kothari et.al., 2<sup>nd</sup>Edition, PHI Learning.
- 5. Solar Energy: Resource Assessment Handbook, P Jayakumar, 2009

GENERAL ELECTIVE (GE P8)								
Programme	: Gene	eral Elec	tive		Ye	ar: IV	Seme	ster:
Course Tit Code	le &	Credits	Credit distr Lecture	ribution of the co Tutorial	ourse	Eligibili Criteria	ity i	Pre-requisite of the course
GE P8: Radiation Physics		3	3	1		B.Sc. with B. Physics Ph		B.Sc. with Physics
<b>Course Outcomes:</b> This course helps the student to gain basic ideas of the Radiation Physics. The course includes Interactions of electrons with matter, fission and fusion. The course may provide the opportunity to work in any organization related Radiation Physics.								
Unit	Unit Topic							No. of Lectures
Unit I	Intera radiat curves photo	ctions o ive mod s. Interac electric e	of electrons e of energy ction of gamr effect, Comp	with matter - S loss, electron ra na rays with matt ton scattering.	Specif nge a ter - E	fic energend transf nd transf lastic sca	gy loss mission attering	r, n r, <b>15</b>
Unit II	Unit IIKlein-Nishina formula (qualitative) and pair production processes, cross section, gamma ray attenuation, linear and mass absorption coefficients. Radiation quantities and units - radiation exposure absorbed dose equivalent dose and effective dose							n s n <b>15</b>
Unit III Sources of ionising radiations in the environment – terrestrial radiation sources and radionuclides, cosmic radiations and cosmogenic radionuclides. Technologically enhanced radiation sources. Artificial radiation sources artificial radionuclides. Production of radioisotopes using reactors. Application of radioisotopes in medicine, agriculture and industry								1 1 1 1 1 1 1 1 1 1 5
Unit IV	Fissio Condi therm fuel c	on chain itions for al reacto ycle.	reaction. Slo r controlled r, Effect of r	owing down of n chain reactions i eflectors. Brief in	eutron in bar ntrodu	ns - mod re homog action of	lerators geneou nuclea	s. s r <b>15</b>

#### **Suggested Reading:**

- 1. Patel S B, "Nuclear Physics An Introduction" (Wiley Eastern, 1991)
- 2. Krane K S, "Introductory Nuclear Physics" (John Wiley, 1988)
- 3. Roy R K and Nigam P P, "Nuclear Physics Theory and Experiment" (Wiley Eastern Ltd., 1993)
- 4. Singru R M, "Experimental Nuclear Physics" (Wiley Eastern, 1972)
- 5. Zweifel P F, "Reactor Physics", International Student Edn. (McGraw Hill, 1973)
- 6. Kapoor S S and Ramamurthy V S, "Radiation Detectors" (Wiley Eastern, 1986)
- 7. Henry Semat& John R AlBright, "Introduction to Atomic and Nuclear Physics" V Edn. (Chapman & Hall, 1972).

PRACTICALS								
Programme: PRA	CTICA	LS		Ye	ear: IV	Seme VII	ster:	
Course Title & Code	e & Credits Credit distribution of the course Practicals Tutorial			Eligibility Criteria		Pre-requisite of the course		
Practicals	4	4			B.Sc. w Physics	ith	B.Sc. with Physics	
Course Outcomes Student would ga Electronicsand Op	s: in praction prics.	cal knowledg	ge by performing	g var	ious exp	erime	nts of	
List of								
$\begin{array}{ccccccc} 1. & Stu\\ & dia\\ 2. & Ab\\ & Pha\\ 3. & Yo\\ 4. & NP\\ & bas\\ 5. & Co\\ 6. & Stu\\ & Stu\\ 7. & Stu\\ & Ve\\ 8. & Ha\\ 9. & Fra\\ 10. & De\\ 11. & Ve\\ 12. & Lea\\ \end{array}$	ady of l grams. sorption otometer oung's m 'N and P Se (b) mmon er ady of R ady of B- ady of B- ady of B- rification rtmann's ank-Hert: terminati locity of acher Wi	RC circuit Spectrum dulus by In NP Transist mitter config C- coupled H curve. Amplituc n of the s Formula. z experimen on of susce Ultrasonic v re	with an AC s of KMnO4 us aterference meth or Characteristic gurations/ h – pa / Transformer ( de Modulation t.e/m by Zeema ptibility.Study o waves.Linear Ai	source sing nod. cs with trame Coup n / n / n eff of CR fr trace	e using Hilger-1 th (a) Co eter. oled Am Demodu Sect. CO. ck.	phase Nutting ommore plifien	e g 60 n	

Virtual Labs	at Amrita	Vishwa	Vidyapeetham,
https://vlab.an	nrita.edu/?sul	b=1&brch=74	•

## Semester: VIII MAJOR IN PHYSICS

DISCIPLINE SPECIFIC COURSE (DSCA8)								
Programme:	DISCIPLI	NE SPECIF	FIC COURSE	Ye	ar: IV	Seme	ester: VIII	
Subject: Phy	ysics							
Course Titl	e Credits	s Credit distribution of the course Eligib Lecture Tutorial Criter		ourse	ourse Eligibility		Pre-requis	site of the
a coue				CILICITA	riteria course			
DSC A8: Electrodyn mics	a 3	3	0		Accordin Universi Ordinan	ling to According sity University nce Ordinance		to
Course Out The study of courses of p Magnetostativector poten	tcomes: felectrodyna hysics. The ics; Maxwe tial, electron	amics provid course inclu ll's equatior magnetic fie	les basic foundati udes Basic equati 1, Four Vector F ld tensor and Qua	ion fo ions c orma antiza	r the stud f Electro lism of N tion of el	lent to magn Maxwo ectror	o understand etism, Elec ell's Equat nagnetic en	d advance trostatics; ions Four ergy
UNIT	UNIT TOPIC							No. of Lecture
UNIT I	<b>Electromagnetism:</b> Basic equations; Electrostatics; Magnetostatics; Different Systems of Units, Preliminary notations, four- vectors, Lorentz transformations, time, space and light like separations. Lorentz invariants. Energy and Momentum						10	
UNIT II	FII       Maxwell's Equations: Maxwell's equation, Displacement current, electromagnetic waves in conducting and nonconducting medium, Poynting theorem, boundary condition at the interface of conducting and non conducting media, propagation between parallel conducting plates. Electromagnetic wave equations							10
UNIT III	UNIT III Four Vector Formalism of Maxwell's Equations: Four vector potential, electromagnetic field tensor, Lorentz invariance, Lorentz force, covariant form of Maxwell's equations, four vector current, continuity equation, Gauge invariance of Maxwell equation, electromagnetic energy- momentum tensor, Motion of charge particle in electromagnetic field. Lorentz force						15	
UNIT IV	<ul> <li>in electromagnetic field, Lorentz force</li> <li><b>IV</b> Electromagnetic Radiation: Lienard-Witchert potential, conventional potential, Quantization of electromagnetic energy (virtual photon), Radiation from an Accelerated Charge, Fields of an accelerated charge; angular and frequency distributions of the emitted radiation, special cases of acceleration parallel and perpendicular (circular orbit) to velocity; Larmor's formula and its relativistic Generalization;</li> </ul>							10

#### Suggested Readings

- 1. Jackson: Classical electrodynamics; Wiley Eastern, New Delhi
- 2 Landau and Lifshitz: Classical theory of fields; Pergameon Press
- 3. Thide : Electromagnetic field Theory
- 4 Panofsky and Phillips: Classical Electricity and Magnetism
- 5. Landau &Lifshitz : Electrodynamics of Continuous Medi

#### **Suggested Equivalent Online Courses:**

- 1. MIT Open Learning Massachusetts Institute of Technology, https://openlearning.mit.edu/
- 2. National Programme on Technology Enhanced Learning (NPTEL), https://www.youtube.com/user/nptelhrd
- 3. SwayamPrabha DTH Channel, https://www.swayamprabha.gov.in/index.php/program/current\_he/8

DISCIPLINE SPECIFIC ELECTIVE (DSE A9)								
Programme: Discipline Specific Elective					Year: IV		emester: 'III	
Course Title &	Credits	Credit distribution of the cour			Eligibility		Pre-requisite	
Code		Lecture	Tutorial		Criteria		of the course	
<b>DSE A9:</b> Atomic and Molecular Spectra	3	3	0			ng to ty ce	According to University Ordinance	

#### **Course Outcomes**

The course structure includes atomic and molecular spectroscopy. As per the course structure, the students learn basics concepts of spectroscopic principles and rules. Students would learn technique in spectroscopy and know about their applications. The course is helpful for the students to explore R & D opportunities in various areas of science and technology such as biomedical, industrial and environmental fields.

UNIT	TOPIC	No. of Lectures
UNIT I	Fine structure of hydrogen spectrum, L-S and J-J	10
	coupling,	
	Spectroscopic terms, Hund's rule and time reversal,	
	Pauli'sexclusion principle.	
UNIT II	Alkali spectra, spin-orbit interaction and fine structure in	10
	alkali Spectra, Equivalent and non-equivalent electrons,	
	Normal and anomalous Zeeman effect, Paschen Back	
	effect,	
	Stark effect, Hyperfine structure (qualitative).	

UNIT III	Molecular spectra of diatomic molecules, Born Oppenheimer approximation, elementary idea of quantization of rotational and vibrational energy, rotational spectra for rigid and non rigid rotations, vibrational spectra (harmonic and an-harmonic), intensity and selection rules and molecular constants.	10
UNIT IV	Atomic Polarizability, Raman spectra, Quantum theory of Raman spectra, Determination of molecular structure, Electronic spectra, band system, Progression and sequences, band head formation, Condon parabola, Franck Condon Principle dissociation energy and its determination	15

#### Suggested Readings

- 1. C. B. Banwell: Fundamentals of Molecular Spectroscopy Walker and Stranghen: Spectroscopy Vol. I, II, III G.M.
- 2. Barrow: Introduction to Molecular Spectroscopy Herzberg: Spectra of diatomic molecules
- 3. Jeanne L Mchale: Molecular Spectroscopy
- 4. J. M. Brown: Molecular Spectroscopy
- 5. P. F. Bemath: Spectra of atoms and molecules
- 6. J. M. Holias: Modern Spectroscopy
- 7. K. Thyagrajan and A.K. Ghatak: Lasers: Theory and applications A Yariv: Quantum Electronic
- 8. M. D. Levenson: Intoduction to non-linear laser spectroscopy

- 1. MIT Open Learning Massachusetts Institute of Technology, https://openlearning.mit.edu/
- 2. National Programme on Technology Enhanced Learning (NPTEL), https://www.youtube.com/user/nptelhrd
  3. SwayamPrabha DTH Channel,
- **3.** SwayamPrabha DTH https://www.swayamprabha.gov.in/index.php/program/current\_he/8

DISCIPLINE SPECIFIC ELECTIVE (DSE A10)								
Programme: Disci	ipline Sp	oecific Elect	ive	Year: IV Semester: VIII				
Course Title & Credits Cre Code course		Credit dist course	redit distribution of the			Pre-requisite of the course		
		Lecture	Tutorial					
<b>DSE A10:</b> Nuclear Physics	3	3	0		According University Ordinance	to According to University Ordinance		

#### **Course Outcomes:**

In this course students would know about the general properties of nuclei, nuclear forces and detectors, radioactive decay and nuclear reactions. The course builds a foundation for the students to carry out research in the field of nuclear physics, high energy physics, nuclear astrophysics, nuclear reactions and applied nuclear physics.

UNIT	TOPIC	No. of Lectures
UNIT I	Nuclear Properties and Nuclear Models Concepts of	10
	Atomic Nuclear-Size, Shape, charge distribution, spin	
	& parity, magnetic moment; electric quadrupole	
	moment; binding energy; semi-empirical mass formula,	
	mirror nuclei, Liquid drop model, Experimental	
	evidence for shell effects, Shell model, Magic	
	numbers, Spin orbit coupling, Single particle shell	
	model-its validity and	
	limitations; collective model.	
UNIT II	Nuclear Forces and Nuclear Interactions Theory of	10
	Deuteron and nuclear level properties, nucleon -	
	nucleon interactions, low & high energy nucleon-	
	nucleon scattering, Yukawa's Meson theory of nuclear	
	forces, Spin dependence and charge independence of	
	nuclear	
	forces.	
UNIT III	Nuclear Reactions Kinds of nuclear reactions;	15
	Conservation laws; Nuclear reaction Kinematics;	
	charge particle reaction spectroscopy; neutron	
	spectroscopy; nuclear cross-section; compound	
	nucleus; Nuclear transmutations, continuum theory of	
	nuclear reaction, Nuclear fission, Chain reactions,	
	Nuclear fusion,	
	Thermonuclear reactions.	

UNIT IV	Nuclear Decays Basic understanding of $\alpha$ and $\beta$ decay,	10
	Fermi theory of beta decay, selection rules in $\gamma$ decay,	
	Neutrino hypothesis, Parity violation in beta decay, K	
	capture and internal conversion.	

#### **Suggested Readings**

- 1. E. Burcham: Nuclear Physics Ervin Kapalan: Nuclear PhysicsRoy & Nigam: Nuclear Physics
- 2. S. N. Ghoshal: Atomic and Nuclear Physics A.Enge: Nuclear Physics
- 3. D. Evans: Nuclear Physics
- 4. E. Segre: Nuclei and Particles
- 5. H.M. Agrawal: Nuclear Physics, PHI Learning

- 1. MIT Open Learning Massachusetts Institute of Technology, https://openlearning.mit.edu/
- National Programme on Technology Enhanced Learning (NPTEL), https://www.youtube.com/user/nptelhrd SwayamPrabha - DTH Channel, https://www.swayamprabha.gov.in/index.php/program/current\_he/8

DISCIPLINE SPECIFIC ELECTIVE (DSE A11)							
Programme: Discip	ester:						
Course Title & Code	Credits	Credit dist course Lecture	ribution of the Tutorial		Eligibility Criteria	Pre-requisite of the course	
<b>DSE A11:</b> Elementary Particl Physics	e 3	3	0		According to University Ordinance	According to University Ordinance	
The course is impor- matter and radiatio their behaviour. It high-energy physic	rtant for st n, the inter also provi s.	Cours tudents to lea raction amor des a platfor	e Outcomes arn about the mo ng elementary pa rm for students s	st fun article seekir	damental buil es, and hence, ng research op	ding blocks of to understand oportunities in	
UNIT		TOPIC				No. of Lectures	
UNIT I UNIT II	Elementa History o the mesor particles, particles: interaction and conse Isospin, S relation, F Parity vio invariance Particle M	ry Particles of elementary n riddle, cla Fundamenta special en s, Strange ervation law trangeness, I Parity, Time plation, CP 2. odels: g model Sa	s and Conservat y particles, pred assification sche al interactions mphasis on S particles, Reson vs, Lepton and Hypercharge, Ge e reversal and c violation in	iction L iction amon strong lances Bary II - M charge K	aws: of neutrinos, of elementary g elementary g and weak s, Symmetries yon number., lann Nishijima e conjugation, mesons, CPT	10	
n n f Z F b E	Fermi Yang model, Sakata model, shortcomings of these models, eight fold way scheme of hadrons: baryons and mesons multiplets, positive and negative aspects of eight fold way scheme, Necessity of Quark model, Gell - Mann Zweig Quark model and Quark structure of Hadrons, Positive facets of quark model, Elementary idea of charm, bottom and top quarks, Quantum number of quarks, Experimental evidence for the existence of quarks.						
UNIT III	Unitary S Symmetry unitary g representa and weigh weight dia and its phy physical fundament U, V spin standard a	ymmetries y, symmetry roups, Spec- tion of SU( ats, generato gram of the vsical interpr interpretati tal and Conj ns, Young rrangements	and Young Tab transformation a cial Unitary Gr (2) and SU(3), (2) rs of SU(2), U(2) fundamental repr retation, Weights on, Weight (2) jugate representa to Tableaux and of young tableau	leaux nd gro oups, diagon 2), SU resent s of S diagra ations unita ux, in	x: oups, basics of fundamental nal generators J(3) and U(3), ation of SU(2) SU(3) and their ams of the s of SU(3), I, ry symmetry, teger-notation	15	

	of the tableaux representing different Special Unitary Groups, Dimensionality of the representations of SU(N), Simple product representation using Young Tableaux technique	
UNIT IV	Nuclear and Particle Detectors Basic principle of particle detectors, Ionization chamber, Proportional counter, Geiger- Muller Counter, Scintillation counters and-ray spectrometer, semiconductor detector, Nuclear emulsion technique, Cloud, chamber, Bubble chamber	10

#### **Suggested Readings:**

- 1. D. H. Perkins: Introduction to High Energy Physics, CambridgeUniversity Press, 2000
- 2. S. N. Ghoshal: Atomic and Nuclear Physics, S. Chand and CompanyLtd, 1994
- 3. D. Griffiths : Introduction of Elementary Particles
- **4.** DB Lichtenberg: Unitary Symmetry and Elementary Particles, Academic Press, 1978 Hughes: Elementary Particles
- 5. Blatt and Weiskopff : Theoretical Nuclear PhysicsFE Close: Quarks and Patrons
- 6. P.P.Cheng and G.LF Li : Gauge Field Theory:
- 7. W. E. Burcham : Nuclear Physics
- 8. R. M. Singru: Introduction to experimental nuclear physics
- 9. E. Segre: Experimental nuclear physics

- 1. MIT Open Learning Massachusetts Institute of Technology, https://openlearning.mit.edu/
- 2. National Programme on Technology Enhanced Learning (NPTEL), https://www.youtube.com/user/nptelhrd
- **3.** SwayamPrabha DTH Channel, https://www.swayamprabha.gov.in/index.php/program/current\_he/8

			GENER	AL ELECTIVE	E (GF	E <b>P9</b> )		
Programme: General Elective Year: I						ar: IV	Seme VII	ester:
Course T Code	itle &	Credits	Credit dist course Lecture	ribution of the Tutorial		Eligibil Criteria	ity a	Pre-requisite of the course
<b>GE P9:</b> P of Weathe Climate	hysics er and	3	3	1		According to University Ordinance		According to University Ordinance
Course O The course atmospher atmospher	utcome e is imp e. The o ic Phys	es: ortant fo course pr ics.	or the studen covides a pla	nts to learn abou tform for the stu	t the dents	Element who hay	ary id ve inte	lea of erest in
Unit	Topic	;						No. of Lectures
Unit I	<b>Elementary idea of atmosphere:</b> physical structure and composition; compositional layering of the atmosphere; variation of pressure and temperature with height; air temperature, requirements to measure air temperature;						15	
Unit II	temperature sensors: types; <b>Atmospheric pressure:</b> its measurement; cyclones and anticyclones: its characteristics.Wind; forces acting to produce wind; wind speed direction: units, its direction; measuring						15	
Unit III	<b>Radiation:</b> absorption, emission and scattering in atmosphere;         radiation laws. Global wind systems; air masses and fronts:         classifications; jet streams; local thunderstorms; tropical						15	
Unit IV	Clima global ozone	<b>te and i</b> warmin depletio	ts classifica g and its out on, acid rain,	tion: Causes of a tcomes; air pollu environmental i	clima tion; ssues	te chang aerosols related t	e; , to	15

#### **Reference books:**

1. Aviation Meteorology, I.C. Joshi, 3rd edition 2014, Himalayan Books

- 2. The weather Observers Hand book, Stephen Burt, 2012, Cambridge University Press.
- 3. Meteorology, S.R. Ghadekar, 2001, Agromet Publishers, Nagpur.
- 4. Text Book of Agro meteorology, S.R. Ghadekar, 2005, Agromet Publishers, Nagpur .

5. Atmosphere and Ocean, John G. Harvey, 1995, The Artemis Press

- 1. MIT Open Learning Massachusetts Institute of Technology, https://openlearning.mit.edu/
- 2. National Programme on Technology Enhanced Learning (NPTEL), https://www.youtube.com/user/nptelhrd
- 3. SwayamPrabha DTH Channel, htt

GENERAL ELECTIVE (GE P10)								
Programme: General Elective Year: IV							ter: VII	
Course T	itle &	Credits	Credit dist	ribution of the	Eligibility	P t	re-requisite of	
Coue			Lecture	Tutorial	Criteria	L	le course	
GE P10 : Digital Electroni computer architectu	cs and ire	3	3	1	According to Ac University Un Ordinance Or		According to University Ordinance	
Course Ou This course architectur combinatio	tcomes: e helps t e. Stude onal circ	he studer ents will uits, mer	nts to learn a have the internet	bout foundation idea about the s and concept of	of Digital el different typ microprocess	ectronic es of sor.	cs and computer sequential and	
Unit	Topic						No. of Lectures	
Unit I	Unit IElementary idea of combinational and sequential circuits : Overview of Microcomputer organization. Microprocessor evolution(8085/8086), Architecture and its operations, Basic idea of logic devices for interfacing 8085/8086. Tri state devices, unidirectional and bidirectional buffers. Computer memory(semiconductor, magnetic and optical) cache memory, real and virtual memory15							
Unit II	Unit IIComputer Organization and Architecture: Central Processing Unit, computer operating systems. Instruction formats and instructions classification, addressing modes, Timing diagram, op code and operand. Memory mapped input/output and peripheral mapped inputs/outputs. Interrupt structures, Multi-programming.15Intro duction to micro controller							
Unit III	Application of microprocessor:assembly languageprogramming for Addition, subtraction, multiplication, upcounter, down counter, delay, stack, subroutines, nesting and timedelays. Program execution and debugging. Microprocessor based15traffic light controller. Digital to analog and analog to digitalconvertor							
Unit IV	convertor.Data Communication: Need for communication networks, Internet and World Wide Web, communication protocols, Local Area Networks, Interconnecting networks. Computer Network Characteristics of communication channels, Allocation of Channels, Physical Communication media, Public Switched Telephone Network, Cellular Communication Network, ATM networks, Future of Network Technology.							

#### **Suggested Readings:**

- 1. Mchilling and Belove: Electronic circuits Discrete and Integrated, Mcgraw Hill
- 2. Millman and Halkias: Electronic Fundamentals & Applications, TataMcgraw
- 3. K.R. Botkar: Integrated Circuits, Khanna Publishers
- 4. G.K. Mithal and Ravi Mittal: Electronic Devices & Circuits, KhannaPublishers
- 5. Malmstadt and Enke: Electronics for scientists
- 6. Taub and Schilling: Principal of communication systems
- 7. Simon Gayukti: Communication Systems
- 8. Martin S. Roden: Analog & Digital Communication Systems
- 9. V. K. Sarkar and D. C. Sarkar: Optoelectronics and Fibre OpticCommunication.

- 1. MIT Open Learning Massachusetts Institute of Technology, https://openlearning.mit.edu/
- 2. National Programme on Technology Enhanced Learning (NPTEL)
- https://www.youtube.com/user/nptelhrd 3. SwayamPrabha - DTH Channel, https://www.swayamprabha.gov.in/index.php/program/current\_he/8

PRACTICALS									
Programme: PRACTICALS					Year: IV Semester: VIII				
Course '	Title &	Credits	Credit dist	ribution of the	1	Eligibili	ity	Pre-requisite	
Code			course Practical's	Tutorial		Criteria	l	of the course	
			i i uccicui ș						
Practica	ls	4	4			Accordi Universi Ordinan	ng to ity ce	According to University Ordinance	
Course O	outcomes	;							
The stude	ent will l	have ade	quate know	ledge to perform	n the	experim	nents	of different	
fields of	physics w	vith clear	understandi	ng of the theory	behi	nd the ex	perin	ment.	
Student v	vill know	about v	arious electi	onic componen	ts and	l learn to	o des	ign some	
basicelec	tronic cir	cuits and	l study their	applications.					
UNIT		List of Experiments						No. of Lectures	
		1. Study	y of the Pha	se measuremen	t by				
		super	position of	voltages with L	ĊŔĊ	Circuits.			
		2. Study	of differen	t oscillators (H	artely	, colpit,			
		Wein	bridgeoscil	lators etc.).				60	
		3. Study supply	of an electr y.	onically regulat	ted po	ower			
		4. Study	of negative	Feed-back An	nplifi	er.			
		5. Deter	mination of	wavelength ( $\lambda$	.) and	l			
		wave	lengthdiffer	ence $(\Delta \lambda)$ by M	lichel	son			
		Interf	erometer.			1.5.			
		6. Study	of different	type of Resista	inces	and Dio	des.		
		7. Study	of Photo V	oltaic Cell.					
		o FET	1 S Collstalli phoroctoristi						
		$\frac{7.121}{10}$ Free	nel's Law	65					
		11  Cauc	chy Formula	1					
		12. Latti	ce Dynamic	: Kit					
		13. Stud	y of Logic g	ates					
		14. Dete	ction Efficie	ency of Diode					
		15. Fabr	y – Perot In	terferometer					
		16. Four	Probe meth	nod					

- Suggested Equivalent Online Courses:
  1. Virtual Labs at Amrita Vishwa Vidyapeetham, https://vlab.amrita.edu/?sub=1&brch=74
  2. Digital Platforms /Web Links of other virtual labs may be suggested /added to this lists by individual Universities

# DETAILED SYLLABUS FOR MASTER IN PHYSICS P.G. SECOND YEAR

## Semester: IX MASTER IN PHYSICS

DISCIPLINE SPECIFIC COURSE (DSC A9)								
Programme: Discipline Specific Course					Year: V Semester:			
Course Title & Code	Credits	redits Credit distribution of the Eligibility course Criteria			ty	Pre-requisite of the course		
		Lecture	Tutorial					
DSC A9: Advanced Quantum Mechanics	3	3	0		Accordin Universi Ordinand	ng to ty ce	According to University Ordinance	

#### **Course Outcomes:**

The course includes the study of scattering theory, identical particles, relativistic wave equations and quantization of wave fields. The course would describe the nature and behaviour of matter and energy at subatomic level. In particular, theory of scattering gives an understanding collision between a quantum mechanical particle and target. The study of relativistic quantum mechanics enables the students to understand the behaviour of objects moving with speeds comparable to that of light. The knowledge of this field forms the foundation for pursuing research in Quantum Field Theory and High Energy physics.

UNIT	TOPIC	No. of Lectures
UNIT I	Free particle Dirac equation	
	Discrepancies faced by Schrödinger equations, Klein- Gordon	
	equation and its drawbacks, Dirac's equation for a free	
	particle, Dirac matrices, covariant form of Dirac equation,	10
	Probability and current densities, Free particle solutions of	10
	Dirac equation, Non conservation of Orbital Angular	
	momentum and idea of spin, Interpretation of	
	negative energy and hole theory	

UNIT II	Dirac particle in Electromagnetic Fields	
	Dirac equation in electromagnetic fields, Magnetic moment of	
	charged particle, Gauge invariance of Dirac equation in	
	electromagnetic fields, Non- relativistic correspondence of	10
	Dirac equation; Pauli equation, Adjoint spinors, Symmetries	10
	of Dirac Equation: Parity, Time reversal and Charge	
	Conjugation; Lorentz covariance of Dirac	
	Equation.	
UNIT III	<b>Identical Particles and Quantum Field Theory</b>	
	Identical particles, exchange degeneracy, symmetric and anti	
	symmetric functions for many particle system Classical	
	Fields, Schwinger's action principle, Lagrangian and	
	Hamiltonian densities, Field equation, quantum structure	15
	of free fields and the particle concept, Quantization	15
	relations, Quantization of non -relativisticSchrödinger matter	
	field, System of identical bosons and fermions, Commutation	
	and anti-commutation relations, Occupation number	
	representation, creation and annihilation operators.	
UNIT IV	Quantum Theory of Scattering	
	Scattering Theory, Scattering cross section, method of partial	
	wave analysis, phase shift, Optical theorem, scattering length,	
	effective range theory; low energy scattering, scattering from	
	a square potential well and a rigid sphere, Born	10
	approximation, Validity of Born approximation, Born	
	approximation through time dependent perturbation, its	
	application to square well potential.	

#### **Suggested Readings:**

- 1. Davydov : Quantum Theory Messiah : Quantum Mechanics Vols. I& I
- 2. Rajput B. S. : Advanced Quantum Mechanics
- 3. Ropman P. : Advanced Quantum Mechanics Trigg : Quantum Mechanics
- 4. ThankappanV.K. : Quantum Mechanics Sakurai J.J. : Quantum Mechanics

- 1. MIT Open Learning Massachusetts Institute of Technology, https://openlearning.mit.edu/
- 2. National Programme on Technology Enhanced Learning (NPTEL), https://www.youtube.com/user/nptelhrd
- 3. SwayamPrabha DTH Channel, https://www.swayamprabha.gov.in/index.php/program/current\_he/8

DISCIPLINE SPECIFIC ELECTIVE (DSE A12)								
Programme: Discipline Specific Elective Year: V Seme					ester:			
Course Tit Code	tle &	Credits	Credit distr course Lecture	ribution of the Tutorial		Eligibili Criteria	ity 1	Pre-requisite of the course
<b>DSE A12</b> : Plasma Ph	ysics	3	3	0		Accordi Universi Ordinan	ng to ity ce	According to University Ordinance
Course Outcomes:The course includes Magneto Hydrodynamics , Plasma Propagation and other topicsrelated to plasma. Plasma physicists study plasmas, which are considered a distinctstate of matter and occur naturally in stars and interplanetary space .The knowledgeacquired by the student can be used in various field of Physics and thus careerprospects are bright in the field of research.UNITNo. of								
UNIT I	<b>Introduction to Plasma</b> Elementary concept of plasma: Debye Shielding, Plasma parameters, Drift of guiding center, Gradient drift, Curvature drift, Magnetic mirror, Plasma confinement					10		
UNIT II	Magneto-Hydrodynamics and Fluid Plasma Plasma Oscillation, Fluid equations for a plasma, Continuity equation, Wave Propogation in unmagnetized plasma, Magneto Hydrodynamics, Hydrodynamical description of Plasma: fundamental equation, Concept of convective derivative, hydromagnetic waves, magneto- sonic and Alfven waves.					10		
UNIT III	Magneto PlasmaWave phenomena in Magneto plasma: Polarization, Phasevelocity, group velocity, cutoff, resonance forelectromagnetic wave propagating parallel and perpendicularto the magnetic field Helicon, Faradayrotation,.					10		
UNIT IV	Elect Propa Propa Deriv Equa Two-	<b>romagn</b> agation agation vation o tion, Mo fluid eq	etic Wave I at finite a through f moment omentum ba uations, Plas	Propagation in angle and CM ionosphere an Equation from lance equation, sma resistivity	Plasn A d n Bolt Equa	na diag nagnetos zmann tions of	ram, phere state,	15

Suggested Readings:1. Jackson: Classical Electrodynamics; Wiley Estern, New Delhi

- 2. Bittencourt: Plasma Physics Chen: Plasma Physics
- 3. Robert J Goldston and Paul H. Rutherford: Introduction to PlasmaPhysics

- 1. MIT Open Learning Massachusetts Institute of Technology, https://openlearning.mit.edu/
- 2. National Programme on Technology Enhanced Learning (NPTEL), https://www.youtube.com/user/nptelhrd
- 3. SwayamPrabha DTH Channel, https://www.swayamprabha.gov.in/index.php/program/current\_he/8

DIS	CIPLIN	E SPECIF	IC ELECTIVE	(DSE	A13(a1))			
Programme: Discipline Specific Elective					Year: V Semester: IX			
Course Title & Code	Credits	Credit dist course Lecture	ribution of the Tutorial	Eli Cr	igibility iteria	Pre-requisite of the course		
DSE A13 (a1): Advanced Electronics- I	3	3	0	Ac Ur Or	ccording to niversity dinance	According to University Ordinance		

#### **Course Outcomes:**

This course helps the students to gain basic ideas of the construction and working of electronic devices and circuits. The course includes the study of IC technology, Operational amplifier as linear Analog systems and non-linear analog systems. The course is of much practical purpose for the students to learn basics of integrated circuit technology which has wide applications in computing, process control, signal processing, communication systems, digital instruments etc.

UNIT	TOPIC	No. of Lectures
UNIT I	<b>Integrated Circuit Technology</b> Advantages & limitations of integrated circuits. Classification of IC's, Fabrication of IC's & components, Basic monolithic integrated circuit technology, processes used in monolithic technology, fabrication of monolithic diodes, integrated resistors, integrated capacitors, metal semiconductor contact, The Schottky transistor, thick & thin film IC's, hybrid IC's.	10
UNIT II	<b>Operational Amplifier(OP-AMP)</b> Basic OP-AMP, Ideal OP-AMP, Inverting & Non inverting OP AMP, OP-AMP internal circuit, Differential amplifier, The emmiter coupled differential amplifier, Common Mode Rejection Ratio (CMRR), Operational Amplifier characteristics, DC characteristics- Offset error voltages and currents, Temperature drift of input offset voltage and current. AC characteristics-Frequency response and stability, Frequency compensation, slew rate, Measurement of OP-AMP parameters.	10
UNIT III	<b>Operational Amplifier Applications</b> Circuit type of OP – AMP 741, Scale changer, Summing Amplifier-Inverting summing amplifier, non-inverting summing amplifier, subtractor, adder subtractor, voltage follower, current to voltage converter, voltage to current converter, OP-AMP circuits using diodes-Half wave rectifier, Full wave rectifier, Peak value detector, Clipper and Clamper, Sample and hold circuits, Logarithmic Amplifier, Antilogarithmic Amplifier, Integrator, Differentiator.	10
UNIT IV	Comparator and Waveform Generators	
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	Comparators, Applications of comparator- Zero crossing detector. Regenerative comparator (Schmitt trigger), Square and triangular, waveform generators, Discriminators, OP- AMP as astable and monostable multivibrator, IC 555 timer- Functional diagram, Monostable operation, Astable operation. Applications in monostable and astable mode-Missing pulse detector, Liner ramp generator, Frequency divider, FSK generator, Pulse-Position modulator, Schmitt Trigger.	15

- 1. Coughlin: Operational Amplifiers and Linear Integrated Circuits.
- 2. Schilling and Belove: Electronic circuits Discrete and Integrated, Mcgraw Hill
- 3. Millman and Halkias: Electronic Fundamentals & Applications, TataMcgraw Hill
- 4. Millman and Halkias: Integrated Electronics K.R. Botkar: IntegratedCircuits, Khanna Publishers G.K.
- 5. Mithal and Ravi Mittal: Electronic Devices & Circuits, KhannaPublishers
- 6. Roychaudhary and Jain: Operational Amplifier & Linear IntegratedCircuits
- 7. V.K. Mehta: Electronics for Scientists & Engineers Robert J Goldston and Paul H. Rutherford: Introduction to Plasma Physics

- 1. MIT Open Learning Massachusetts Institute of Technology, https://openlearning.mit.edu
- 2. National Programme on Technology Enhanced Learning (NPTEL), https://www.youtube.com/user/nptelhrd
- 3. SwayamPrabha DTH Channel, https://www.swayamprabha.gov.in/index.php/program/current\_he/8

DISCIPLINE SPECIFIC ELECTIVE (DSE A13(b1)) Programme: Discipline Specific Elective Year: V Semester:							
Course Title & Code	ourse Title & Credits Credit distribution of the course Lecture Tutorial				Eligibili Criteria	IX ty	Pre-requisite of the course
DSE A13 (b1) Astrophysics- I	3	3	0		Accordi Universi Ordinan	ng to ity ce	According to University Ordinance

## **Course Outcomes:**

The course would be important to understand the spherical astronomy, distance measurement in astrophysics, and physics of solar system and extra solar planets. The course provides an opportunity to understand the optics of the different astronomical instruments such as: telescopes, CCD camera etc. It has wide spared in use of R& D sector.

UNIT	TOPIC	No. of
		Lectures
UNIT I	Spherical Astronomy Celestial sphere, Celestial coordinate	10
	system (equatorial and alt-azimuth): altitude and azimuth, right	
	ascension and declination, hour angle, sidereal time, mean solar	
	time, summer and winter solstice, seasons. Distance	
	measurements: AU, parsec, standard candles, distance	
	measurement by geometric means (parallax, distances to open	
	clusters).	
UNIT II	Solar System Idea of solar system, Study of planets and their	10
	satellites, Earth-Moon system, tidal forces, asteroids, meteors,	
	comets and their origin, composition and dynamical	
	evolution.	
UNIT	Telescopes: Basic Optics, Types of telescopes. Telescope	10
III	mounting systems. Optical telescopes, Infrared, Ultraviolet, X-	
	ray and Gamma-ray telescopes. Schmidt telescopes. Solar	
	telescopes. Design and construction of a simple optical	
	telescopes. Active and adoptive optics in astronomical study.	
	Sky charts and their importance.	

UNIT	Classification of detectors, characteristics of detectors.	15
IV	Detectors for optical and infrared wavelength regions. Working	
	of Charge Coupled Device (CCD). sensitivity, noise, quantum	
	efficiency, spectral response, Johnson noise, signal to noise	
	ratio, Application of CCD for stellar imaging, photometry and	
	spectroscopy. Importance of space based astronomy.	
	Observational techniques of astronomical sources from space	
	in infrared, EUV, X-ray and Gamma ray regions of the	
	electromagnetic spectrum.	

- 1. Abhyankar K.D.: Astrophysics, Galaxies and Stars VaidyanthBasu : An Introduction to Astrophysics Motz : Astrophysics
- 2. K S Krishnaswamy : Astrophysics: A Modern Perspectiv
- 3. W. M Smart: Spherical Astronomy
- 4. Mark A. Garlick: The Story of the Solar System

- MIT Open Learning Massachusetts Institute of Technology, https://openlearning.mit.edu/
   National Programme on Technology Enhanced Learning (NPTEL), https://www.youtube.com/user/nptelhrd
   SwayamPrabha DTH Channel, https://www.swayamprabha.gov.in/index.php/program/current\_he/8

<b>DISCIPLINE SPECIFIC ELECTIVE (DSE A13(c1))</b>								
Programm	e: Disc	ipline S	pecific Elect	tive	Ye	ar: V	Seme IX	ster:
Course Ti	tle &	Credits	Credit distribution of the			Eligibili	ity	Pre-requisite
Code			course	Tutorial		Criteria	l	of the course
			Letture	Tutoriai				
DSE A13 (c1): High Energy Physics- I 3			3	0		Accordi Univers Ordinan	ng to ity ce	According to University Ordinance
Course Ou	itcome	es:						
Students we	ould be	able un	derstand the	complex proper	ties a	nd behav	10ur (	of high energy
particles at	the m	icroscop	ic level. Th	is course would	enco	ourage s	studen	ts to peruse
higher stud	y and r	esearch i	in particle ar	nd high energy P	hysic	s.		
UNIT				TOPIC				No. of Lectures
UNIT I	Quan	tization	of Scalar F	ields				
	Elements of field theory, Covariant formulation of field theory, Scalar field quantization, Lagrangian Formulation, Field Hamiltonian and field momentum densities, Neutral and Charged scalar fields and their quantization, Momentum representation and frequency splitting, Identification of various particle operators, Charge operator, various commutation relations and their properties.					1 1 1 1 10		
UNIT II	<b>Quantization of Spinor Field</b> Spinor field and associated field equations, Lagrangian formulation for Spinor field, Evaluation of conjugate momenta, Field Hamiltonian and field momentum densities, Quantization of Spinor Field, Momentum representation and frequency splitting, inclusion of spin wavefunction and description of associated properties, use of projection operators, Identification of various particle operators, Charge density for Spinor field, field momentum and charge operator, various commutation					1 1 1 1 1 15 1 1 1		
UNIT III	Quan	tization	of Electron	nagnetic Field				
	EM field as a vector field ,Classical electromagnetic field theory and its gauge formulation, Covariant Lagrangian formulation for EM field, Quantization of EM field, Evaluation of conjugate momenta, Field Hamiltonian and field momentum densities, Momentum representation and frequency splitting, , Identification of various particle operators, concept of longitudinal, temporal and transverse photons and complete quantized expression of EM field in terms of its various polarization states.						1 1 1 10 f e s	
UNIT IV	Covar Comm EM fi their covar	riant Fie nutation/ eld oper propertioniant field	eld Algebra Anticommu ators, Covar es, Invarian l	for scalar, spin tation relations f iant form of thes t Delta function	or an For sca se Fie ns an	<b>d vector</b> alar, spin ld algebr d their	<b>field</b> for and as and use in	s 1 1 1 1 10

algebra Covariant commutation relations for FM field	
algebra, covariant communication relations for Elivi field	
operators and problems with temporal photons, Lorentz	
condition and consistency with EM field algebra, Resolution	
through Gupta- Bleular formulation and evaluation of the field	
momentum and Hamiltonian.	

- 1. L. Ryder : Quantum Field Theory
- 2. B.K. Agarwal : Quantum Mechanics and Field Theory
- 3. F Mandel and Shaw: Quantum Field Theory
- 4. P. Roman: Quantum Field Theory
- 5. A. Das: Quantum Field theory
- 6. M. E. Peskin, D.V. Schroeder : An Introduction to Quantum FieldTheory
- 7. B.S.Rajput : Advanced Quantum mechanics

- MIT Open Learning Massachusetts Institute of Technology, https://openlearning.mit.edu/
   National Programme on Technology Enhanced Learning (NPTEL),
- https://www.youtube.com/user/nptelhrd
- 3. SwayamPrabha DTH Channel, https://www.swayamprabha.gov.in/index.php/program/current\_he/8

<b>DISCIPLINE SPECIFIC ELECTIVE (DSE A13(d1))</b>							
Programme:	Discip	line Spe	cific Electiv	re l	Year: V	Semo IX	ester:
Course Titl Code	e &	Credits	Credit disti course Lecture	ribution of the Tutorial	Eligibility Criteria		Pre-requisite of the course
DSE A13 (d Spectrosco	l1): py-I	3	3	0	According to University Ordinance	)	According to University Ordinance
Course Out Topics cover emitted by properties of the Molecul spectroscopy use for vario	<b>Course Outcomes:</b> Topics covered here deals with the observation and interpretation of radiation absorbed or emitted by molecules. This information can lead into the knowledge of structure and properties of the molecules. The course will enable the student to get an understanding on the Molecular spectra (rotational, vibrational and electronic spectra), NMR and ESR spectroscopy, and their applications. Knowledge acquired by the course will be of much use for various industries and R&D sector.						on absorbed or structure and derstanding on MR and ESR ill be of much
UNIT I	Rotational spectra: rotational energy level populations, linear, symmetric, spherical and asymmetric top molecules, rotational selection rules for linear molecules, Stark effect in molecular rotation spectra, Molecular rotation-nuclear spin coupling, Positive and negative character of the wave functions of linear molecules, Symmetric-antisymmetric character and statistical weight of homo-nuclear linear						<u>Lectures</u> 10
UNIT II	<b>Vibrational Spectra:</b> Vibration spectra of polyatomic molecule, coupling of rotation and vibration, perpendicular and parallel bands, Normal modes of vibration and their analysis in Cartesian coordinates, normal coordinates and their internal coordinates, calculation of vibrational frequencies and force field of H2O and CO2 molecules, anharmonicity, degenerate and non-degenerate vibrations, inversion doubling, Quantized Vibrational motion of				mic ular neir and onal les, ons, of	15	
UNIT III	<b>Electr</b> Polya Rotati structu - $1\Sigma$ Teller theory vibror in ber the of Electr	ronic S tomic I onal mo ure of 1 transit for abs nic level nzene, Ph concept onic transit	Spectra: Spectra: Spectra: Spectra: Spectra: Spectra: $\tau - 1\Sigma$ and 1 ions, Vibrosorption spectroscophotoelectron of nonradiansitions, Basilions, Basilion	pectroscopy of Coupling of tomic Molecules $\Sigma$ onic interaction ctrum of benzen y and lifetime o spectroscopy, Qu ative transitions sics of Absorptio	Diatomic Electronic and Rotatic and Herzb e vapour, Sir f vibronic lev antum yield in molecu on, Fluoresce	and and onal eerg egle vels and les, nce	10

	and Phosphorescence.	
UNIT IV	<b>NMR and ESR Spectroscopy (Resonance Spectroscopy):</b> NMR spectroscopy, Bloch Equation, Principle and working of NMR Spectrometer, Basic Principle & Theory of ESR spectroscopy, Resonance conditions, ESR spectrometer, Applications of resonance spectroscopy.	10

- 1. C.N. Banwell: Fundamentals of Molecular Spectroscopy
- 2. Walker and Stranghen: Spectroscopy Vol. I, II, & III
- 3. Herzberg: Spectra of diatomic molecules
- 4. Jeanne L. Mchale: Molecular Spectroscopy
- 5. P.F. Bemath: Spectra of atoms and molecules
- 6. J.M Holias: Modern Spectroscopy
- 7. K. Thyagrajan and A.K. Ghatak: Lasers: Theory and applications
- 8. A Yariv: Quantum Electronics

- 1. MIT Open Learning Massachusetts Institute of Technology, https://openlearning.mit.edu/
- 2. National Programme on Technology Enhanced Learning (NPTEL),
- https://www.youtube.com/user/nptelhrd
  3. SwayamPrabha DTH Channel, https://www.swayamprabha.gov.in/index.php/program/current\_he/8

#### **DISCIPLINE SPECIFIC ELECTIVE (DSE A13(e1))** Semester: **Programme: Discipline Specific Elective** Year: V ĪX Course Title & Credits Credit distribution of the course Eligibility Pre-requisite Code Criteria of the course Tutorial Lecture 3 3 0 According to According to **DSE A13 (e1):** University University Condensed Ordinance Ordinance Matter Physics-Ι

## **Course Outcomes:**

Topics covered in this paper deals about the Crystal Symmetry, Crystal structure, and idea of nano-materials. This course would encourage students to peruse higher study and research in Condensed Matter Physics.

UNIT	ΤΟΡΙΟ	No. of Lectures
UNIT I	Crystal Symmetry: Point group and space group. External symmetry elements (translational, rotational, reflection and inversion) and internal symmetry elements (screw axis and glide plane) of the crystal.Notation of symmetry elements of the crystals, structure of diamond.Non existence of fivefold symmetry in crystals.	10
UNIT II	Crystal Structure determination: Introduction and different methods of x-ray diffraction. Structure factor determination of thecrystal (SC, BCC, Base centered, FCC and diamond) and its importance in crystallography. Interpretation of diffraction pattern for determining the structure of the unknown material.Particle size and strain calculation by Williamson- Hall plot method.	15
UNIT III	I Band theory of solids: Energy bands in solid, distinction between conductor, semi conductor and insulator. Carrier concentration in intrinsic semiconductor. Energy band diagram and Fermi level. Bloch theorem, Kroning-Penny model, concept of hole. Effective mass and its physical interpretation. Tight binding approximation, motion of electrons in one dimensional and three-dimensional lattices. Brillouin zones, density of states.	10
UNIT IV	<sup>7</sup> Modification Methods : Basic idea about nanomaterials and nanotechnology.fabrication of nanomaterials (top down approach, bottom up approach). Modification of crystal properties in nanodimension.Neutron scattering and its applications. Debye Wallerfactor. Hyperfine interactions (isomer shift, quadrupole splitting and magnetic splitting),Mössbauer effect and its applications.quantum size effect,special carbon solids, carbon nano tubes and	10

Fu	Illerene.Ion irradiation properties of crystal.	

- **1.** J. Dekker: Solid State Physics
- 2. S.O. Pillai : Solid State Physics
- 3. Kittle : Introduction to Solid State Physics
- 4. Verma & Srivastava : Crystallography for Solid State Physics
- 5. D. Cullity: Elements of X-ray diffraction

#### **Suggested Equivalent Online Courses:**

- MIT Open Learning Massachusetts Institute of Technology,<u>https://openlearning.mit.edu/</u>
   National Programme on Technology Enhanced Learning (NPTEL), https://www.youtube.com/user/nptelhrd
   SwayamPrabha DTH Channel, https://www.youtube.com/user/nptelhrd

idea of digital telemetry.

https://www.swayamprabha.gov.in/index.php/program/current\_he/8

<b>DISCIPLINE SPECIFIC ELECTIVE (DSE A14(a2))</b>							
Programme: Discipline Specific Elective Year: V Semester:							
Course Title & Code	Credits	Credit distr course	ribution of the		Eligibility Criteria	Pre-requisite of the course	
		Lecture	Tutorial		-		
DSE A14 (a2): Advanced Electronics- II	3	3	0		According to University Ordinance	According to University Ordinance	
<b>Course Outcomes:</b> This course helps the students to gain basic ideas of the digital communication, optical communication, memory and optoelectronic devices. The course is of much practical purpose for the students to learn advanced concepts of digital communication systems.							
UNIT	TOPIC No. of Lectures						
UNIT I I	<b>Digital Communication:</b> Digital signal processing, Image processing (Basic ideas only), Pulse Modulation systems, Pulse Amplitude Modulation, Pulse Width Modulation						

Pulse position modulation, Pulse code modulation, Delta modulation, Frequency division multiplexing (FDM), Basic 10

UNIT II	<b>Optical communication:</b> Principle of optical communication, Light propagation through cylindrical wave guide, Ray paths of planar optical waveguide, Different modes of propagation of E. M. Wave through optical fiber, TE and TM modes, Power associated with a mode, Radiation modes, Excitation of guided modes, Advantages of multimode fibers and cladding, Optical Fiber connectors, Advantages of optical communication.	15
UNIT III	Optical Communication Transmitters, Repeaters and Receivers: Optical Fiber communication transmitters; Semiconductor lasers, Laser diodes and LEDs, Optical gain in a semiconductor, Receivers; Principle of optical detection, PIN photodetector and Avalanche photodiodes, Optical Fiber amplifiers; Optical amplification, Energy levels of erbium ions, Gaussian envelope approximation, Noise in EDFA, EDFAs for WDM transmission.	10
UNIT IV	Memory and Optoelectronic devices: Bulk and thin films, Photoconductive devices (LDR), charge coupled devices (CCDs), LCDS, Memory devices, static and dynamic random access memories SRAM and DRAM, CMOS and NMOS, nonvolatile- NMOS, magnetic, optical and ferromagnetic memories.	10

- 1. Coughlin: Operational Amplifiers and Linear Integrated Circuits.
- 2. Mchilling and Belove: Electronic circuits Discrete and Integrated, Mcgraw Hill
- 3. Millman and Halkias: Electronic Fundamentals & Applications, TataMcgraw
- 4. Millman and Halkias: Integrated Electronics
- 5. K.R. Botkar: Integrated Circuits, Khanna Publishers
- 6. G.K. Mithal and Ravi Mittal: Electronic Devices & Circuits, KhannaPublishers
- 7. Malmstadt and Enke: Electronics for scientists
- 8. Taub and Schilling: Principal of communication systemsSimon Gayukti: Communication Systems
- 9. Martin S. Roden: Analog & Digital Communication Systems
- 10. V. K. Sarkar and D. C. Sarkar: Optoelectronics and Fibre OpticCommunication.

- 1. MIT Open Learning Massachusetts Institute of Technology, https://openlearning.mit.edu/
- 2. National Programme on Technology Enhanced Learning (NPTEL), https://www.youtube.com/user/nptelhrd
- 3. SwayamPrabha DTH Channel, https://www.swayamprabha.gov.in/index.php/program/current\_he/8

	DISC	CIPLIN	E SPECIF	IC ELECTIVE	E ( <b>D</b> S	SE A14(	( <b>b2</b> ))	
Programme:	Programme: Discipline Specific Elective						Sem IX	ester:
Course Title Code	&	Credits	Credit dist course	tribution of the		Eligibil Criteria	ity a	Pre-requisite of the course
			Lecture	Tutorial			~	
DSE A14 (bź Astrophysic	2) s–II	3	3	0		Accordi Univers Ordinan	ing to ity ice	According to University Ordinance
Course Out	comes:	1						1
The Course	will pro	ovide th	e deeper u	nderstanding of	the	radiative	e trai	nsfer and the
interactionof	radiatic	n with	matter. It v	vould be importa	int to	o unders	tand	the physics of
the death of s	tars. Th	nis study	is crucial	for the deeper	know	ledge o	f the	neutron stars,
white dwarfs	andbla	ck holes	. Their stud	y provides the in	sight	for the	gravit	ational waves.
UNIT	TOPIC				No. of Lectures			
UNIT I	Radiat intensi transfe Therm charac	Radiation transfer: Definitions of specific intensity, mean intensity, flux and energy density; Equation of radiation transfer; solutions in some specific cases, optical depth; Thermal emission; Blackbody spectrum and its characteristics: Kirchoff's law; Einstein coefficients						10
UNIT II	Interior Properties of Stars Hydrostatic equilibrium, Virial theorem, Polytrophic indices, Lane – Emden equation LTE, Radiative equilibrium, stabilitycondition of convective and radiative equilibrium, Continuous spectra of stars, Stellar opacity, limb darkening, line blanketing, theory of Fraunhofer lines, gurrue of growth and line broadening						15	
UNIT III	Elementary theory of white dwarfs, Chandrashekhar's limit for white dwarf stars, neutron stars their birth and properties, Pulsars, black holes, low medium mass star and high mass stars, death of high mass stars, supernova remnants.						10	
UNIT IV	AGNs quasar Differ bursts	and Qurs and the ont AG	asi-stellar eir energy N models,	Objects Theory generation and radio lobes and	of A redsl l jets	GNs, Sy nift anon , Gamm	ferts, maly. a ray	10

- 1. Abhyankar K.D.: Astrophysics, Galaxies and Stars
- 2. Vaidyanth Basu: An Introduction to Astrophysics
- 3. Motz: Astrophysics A. R. Choudhuri : Astrophysics for Physicists
- 4. B. D. Abhyankar : An Introduction to Astrophysics
- 5. T. Padmanabhan : Astrophysical Processes

- Suggested Equivalent Online Courses:
  1. MIT Open Learning Massachusetts Institute of Technology, https://openlearning.mit.edu/
  2. National Programme on Technology Enhanced Learning (NPTEL), https://www.youtube.com/user/nptelhrd
- **3.** SwayamPrabha DTH Channel, https://www.swayamprabha.gov.in/index.php/program/current\_he/8

	DISC	CIPLIN	E SPECIF	IC ELECTIVE	C (DS	E A14(	:2))	
Programme	: Discip	line Spe	cific Electiv	'e	Ye	ar: V	Seme	ester:
Course Tit	le &	Credits	Credit dist	ribution of the		Eligibili	ity	Pre-requisite
Code			course	Trutorial		Criteria	1	of the course
			Lecture	1 utoriai				
<b>DSE A14</b> ( High Energy Physics-II	<b>c2):</b> gy	3	3	0		Accordi Univers Ordinan	ng to ity ce	According to University Ordinance
The course complex pr Higgs mech year 2012.	e would operties hanism v [t would	provide The stu which le open do	Cou the knowle dents will a d to the dete pors for the	rse Outcomes: edge of basic builso be able to be ection of God pa students who w	uildir cnow article ant to	ng block the con e in LHC o work in	s of 1 nplica C expe n the 1	natter and its ted theory of eriment in the field of HEP.
UNII				IOPIC				Lectures
UNIT I	Lie Groups and Lie Algebra: Symmetries, Groups and conservation laws, Definition of Lie groups, U(N), SU(N) groups as Lie Groups, , generators of the groups, Lie Algebra, Different dimensions and parameter groups-their generators and algebra, Simple and semi-simple Lie groups, Standard form of Lie Algebras Boot diagrams for groups of different ranks					1 7 10		
UNIT II	Special I, U, commu represe fundam applica for the SU(3) identifi group a SU(4), represe Kronec	I Unitar V spin ntations nental tri tion of V (1 0), (( , physic cation c and its g reduct ntations	y Groups a subgroups relations of SU(3), plet of SU(3) Young table 0 1), (3, 0), al interpreta of the partic generators, p ion of th of special sy luct of three	nd hadrons : SU of SU(2) in of shift oper application of ) and for baryon aux for finding (1 1) and (2 1 ation of these we eles of the weig obysical meaning the Kronecker ymmetry groups the particle state ve	J(3) s SU( rators shift octet out w ) rep eight g of t proc by Y ectors	shift ope 3) mult operato operato decupl veight di resentativ diagram, the weig luct of oung tab S.	rators iplets ucible rs for et etc agram ons of as and SU(4) hts of two leaux	10 10
UNIT III	Gauge connec space, j invaria symme SU(2) isospin Gauge	Symm tions: co principle nce, Glo try of gauge gauge group	etry: Conc upling of ph of Gauge in bal U(1) Ga QED , Nor symmetry, SU(2), Nor stry, Yang	ept of gauge ysical space with nvariance, Globa auge Invariance, n –Abelian Gau conserved iso oether's Theor Mill's Field an	field n inte al an U(1 ge th ospin cem, d its	s and ( rnal sym d local g ) Local heory, G curren SU(2) ] propert	Gauge metry gauge gauge lobal t for Local	15
UNIT IV	Sponta Sponta SSB, S SSB of	neous S SB of C Abelian	Symmetry ymmetry B Global Gaug	<b>Breaking</b> (S reaking, Mass e Symmetry, e Symmetry and	SB): gener Gold mass	Concept cation the stone Boostone Boostone Boostone Boostone Boostone	pt of rough osons, ion of	10

Gauge fields, elimination of Goldstone Bosons Higgs Mechanism with physical examples and mass generation for	
gauge fields, Higgs bosons.	

- 1. E. Close : Quarks and Patrons
- 2. D.C. Cheng and O Neil : Elementary Particle Physics P.Cheng and G.LF Li : Gauge Field Theory
- 3. I.J. Aitchison and A.J. Hey : Gauge theories in Particle Physics
- 4. H. Georgi : Lie Algebras in particle Physics
- 5. D. B. Lichtenberg : Unitary Symmetry and Elementary Particles, Academic Press, 1978

- 1. MIT Open Learning Massachusetts Institute of Technology, https://openlearning.mit.edu/
- 2. National Programme on Technology Enhanced Learning (NPTEL), https://www.youtube.com/user/nptelhrd
- 3. SwayamPrabha DTH Channel, https://www.swayamprabha.gov.in/index.php/program/current\_he/8

DIS( Programme: Disci	CIPLIN	E SPECIFIC	C ELECTIVE	C (DS Yea	SE A14() ar: V	d2)) Seme	ester:
Course Title & Code	Credits	Credit distri course <mark>Lecture</mark>	bution of the Tutorial		Eligibili Criteria	ty	Pre-requisite of the course
DSE A14 (d2): Spectroscopy -II	3	3	0		Accordir Universi Ordinano	ng to ty ce	According to University Ordinance

## **Course Outcomes:**

Laser, the light extraordinary, has so many applications in various field even having further potential and hence it has vital need to familiarize lasers & their technical advances to the students so that students be ready to apply coherent light to solve various problems in areas such as scientific, industrial, healthcare etc. Through this course students will learn about light matter interaction, basic principles of stimulated emission, fundamentals of lasers, types of laser, and applications of lasers in various fields including scientific research to common use. Also, it provides a good understanding of the critical laser parameters important for their use in various real-world applications such as: quantum optics, quantum technologies, telecommunications, and industrial material processing, sensing, biomedicine, imaging, ranging and automobile industry.

UNIT	TOPIC	No. of
		Lectures
UNITI	<b>Radiation and Matter:</b> Interaction of radiation with matter, Einstein quantum theory of radiation, Einstein's coefficients, Momentum Transfer, Lifetime, Theory of optical frequencies, Coherence Spatial and temporal and Monochromaticity, kinetics of optical absorption, line width, line broadening mechanisms.	10
UNIT II UNIT III	<b>Basic Elements of Lasers:</b> Laser fundamentals and fabrication – active medium, pumping source and the optical resonator, phenomenon of population Inversion, characteristic of laser light, Spontaneous emission, Stimulated emission, Possibility of amplification, laser pumping and population inversion in three and four level laser, rate equations, Threshold condition, Active resonators & laser modes, gain saturation, Saturable absorption. <b>Type of Lasers:</b> Different types of lasers, Principle and working of gas lasers, He-Ne laser, N <sub>2</sub> & CO <sub>2</sub> lasers, dye lasers, solid state lasers. Nd, XAG, semiconductor lasers. Excimer laser, Tunability.	15 10
	of lasers	
UNIT IV	Applications of Lasers: Basic application of laser spectroscopy, laser cooling and trapping of atoms, Isotope separation, Plasma, Laser Induced Breakdown Spectroscopy (LIBS), Lasers in material processing, laser barcode scanner, Pattern formation by laser etching, LIDAR, lasers in Holography, Interferometry and Microscopy, Communication by Laser, Lasers in Astronomy, Biology, Chemistry, Medicines, Atmospheric optics, optical tweezers	10

- 1. K. Thyagarajan and A.K. Ghatak: Lasers: Theory and applications
- 2. B.B. Laud: Lasers and Non-linear optics
- 3. Orazio Svelto: Principles of Lasers
- 4. Wolfgang Demtröder: Laser Spectroscopy
- 5. M Hollas: Modern Spectroscopy

- MIT Open Learning Massachusetts Institute of Technology, https://openlearning.mit.edu/
   National Programme on Technology Enhanced Learning (NPTEL) https://www.youtube.com/user/nptelhrd
   SwayamPrabha DTH Channel, https://www.swayamprabha.gov.in/index.php/program/current\_he/8

<b>Programme</b> .	Discinl	ine Spec	ific Electiv	re l	Year: V	Sem	ester:
Course Title & Cuedite Credit distribution of the Flightitte					ĨX		
Course Title	&	Credits	Credit dis	tribution of the	Eligibility		Pre-requisit
		Lecture	Tutorial	Criteria		of the course	
			Lecture	Tutoriai			
DSE A14 (e2 Condensed M Physics –II	): Aatter	3	3	0	According University Ordinance	to	According to University Ordinance
Course Outco	mes:						
Topics covered Crystal Symme students to pe	l in thi etry, Cr ruse hi	s paper d ystal stru igher stud	leals about cture, and i ly and resea	thermal, magnetic dea of nano-mater arch in Condensec	, and optical ials. This cou l Matter Phys	l prop 1rse w sics.	erties of solid ould encourag
Unit				Торіс			No. of
Omt I	therma electro transit (Dulor Debye	al conductions and properties and properties and properties of the	etivity in m bhonons w eory of spe etit law), Ei of specific	solus: Thermal letals, anharmonic ith photons (dire cific heat of solids nstein's theory of heat.	expansion ity interactio ect and ind : classical the specific heat	n of irect eory and	10
Unit II	Magn magne antifer magne Magne interac CMR) applic	etic Protectism (dia rromagne etic parameter) etiometer) etion, Intro- ction, Intro- ction, Intro- ction, Intro- ctions.	operties of amagnetism tism, ferrin meters (Ga b. Structur roductoryid Effect (in	of Matter: Det a, paramagnetism, magnetism) and r muss meter and V re of ferrites., lea of magneto res nteger and frac	ailed study ferromagnet neasurement ibrating Sar superexcha istance (GM tional) and	of ism, s of nple ange R & its	15
Unit III	Optical lumino Franch spectro spectro detern	al propessence, c-Condor oscopy, oscopy a nination (	erties of thermolum principle, energy band its app of mode of	solids: Lumineson ninescence, electron luminescence effi and gap determon lications. FTIR s vibrations.	cence (chen columinescer ciency. UV- ination, Ra pectroscopy	nical nce), VIS man and	10
Unit IV	Super pheno theorid type-I cohere capaci ring. F	conduct menologi es of su Isupercor ence leng ty, energ	ivity: Intri ical, semi p perconduct nductors, L gth, Joseph y gap. Flux ry idea of h	roduction of supplementation of supplementation of supplementation, Possible of the second se	iperconducti andmicrosc ect, Type-I enetration de ope effect. I superconducto	vity, opic and epth, Heat eting ors.	10

- **1.** A. J. Dekker: Solid State Physics
- 2. S.O. Pillai : Solid State Physics
- 3. C. Kittle : Introduction to Solid State Physics
- 4. B. D. Cullity: Introduction to Magnetic Materials.

## **Suggested Equivalent Online Courses:**

- 1. MIT Open Learning Massachusetts Institute of Technology, https://openlearning.mit.edu/
- 2. National Programme on Technology Enhanced Learning (NPTEL), https://www.youtube.com/user/nptelhrd
- **3.** SwayamPrabha DTH Channel, https://www.swayamprabha.gov.in/index.php/program/current\_he/8

## **GENERAL ELECTIVE (GE P11(a))**

Programme: Genera	Yea	ar: V	Seme IX	ester:			
Course Title & Code	Credits	Credit distribution of the Eligibility Pre-requisi course Criteria of the cour		Eligibility Criteria		Pre-requisite of the course	
		Lecture	Tutorial				
GE P11: Bio- Physics	4	3	1		Accordir Universi Ordinanc	ng to ty ce	According to University Ordinance

## **Course Outcomes:**

The course is important for the students to learn about the Basic Concepts in Biophysics. The course provides a platform for the students who have interest in Biophysics.

Unit	Торіс	No. of Lectures
Unit I	Basic Concepts in Biophysics, Elementary ideas about the DNA structure, Forces stabilizing DNA and protein structure, sugar-phosphate backbone, nucleosides and nucleotides, three-dimensional DNA structure, RNA. Proteins: primary, secondary, tertiary and quaternary structures.	15
Unit II	Application of experimental techniques of light scattering (tomography), FTIR and Raman spectroscopy, absorption and fluorescence spectroscopy/ microscopy, anisotropy, optical activity, circular dichroism, electrophoresis,.	15
Unit III	Photobiology: interaction of light with cell and tissues, Photosynthesis, human eye and vision optical biopsy, optical biosensors, Laser tweezers and Laser scissors Photo-dimerization, Photodynamic therapy	15
Unit IV	High doses received in a short time, Low-level doses limits, direct ionization of DNA, radiation damage to DNA, Biological effects (Genetic, Somatic, Cancer and sterlity). Bioimaging: Ultrasound, MRI imaging, confocal fluorescence imaging and X-ray.	15

- 1. Essentials of Biophysics: P. Narayanan.
- 2. Basic Molecular Biology: Price.
- 3. Quantum Mechanics of Molecular Conformations: Pullman (Ed.).
- 4. Non-linear Physics of DNA: Yakushevich.
- 5. Biological Physics: Nelson.
- 6. Spectroscopy of biological systems Modern Spectroscopy: J.M. Hollas.
- 7. Transmission Electron Microscopy of Metals: Gareth Thomas
- 8. Elements of X-ray Diffraction: Bernard Dennis Cullity.
- 9. Atomic Force Microscopy/Scanning Tunneling Microscopy: M.T. Bray, Samuel H. Cohen and Marcia L

## OR

<b>GENERAL ELECTIVE (GE P11(b1))</b>								
Programm	e: General El	ective		Year: V	Seme	ster: IX		
Course Tit & Code	le Credits	litsCredit distribution of the courseEligibilityPre of the CriteriaLectureTutorial						
(GE P11(b1)): PHOTONI - I	CS 4	3	1	According to University Ordinance	Acc Univ Ordi	ording to versity inance		
Course Out 1. To Un 2. To Ex 3. To Cl of wa 4. To Di 5. To Su 6. To stu 7. To ex	<ul> <li>Course Outcomes: <ol> <li>To Understand the concept of superposition of waves</li> <li>To Explain the concept of coherence</li> <li>To Classify interference phenomenon based on division of amplitude and division of wavefront</li> <li>To Differentiate between Fresnel and Fraunhofer diffraction</li> <li>To Summarize the idea of polarized light, its generation and detection</li> <li>To study randomness in optical waves</li> </ol> </li> </ul>							
Unit	Торіс	•				No. of Lectures		
Unit I	Unit IWave Optics: Interference by division of wavefront and division of amplitude; Phase change on reflection, Stoke's relations; Reflecting and non reflecting films; Colors of thin films. Michelson interferometer; Fabry-Perot interferometer, Fresnel and Fraunhofer diffraction. Single slit, Double slit, Diffraction grating, Resolving power. Fresnel half-period zones and the zone plate Diffraction of a Gaussian beam							
Unit II	Crystal Op propagation refraction of and evanesce Anisotropic	of waves of waves e. m. wave ent waves Media:	view of Maxwell's Plane polarized light Brewster angle; total Reflection by a con Plane waves in a	s equations ht. Reflection l internal refle nducting med nisotropic m	and and ction lium. edia,	15		

	Birefringence, Uniaxial crystals; Analysis of polarized light; some polarization devices.	
Unit III	<b>Statistical Optics:</b> Introduction to Probability theory, random variables and probability distribution, Gaussian probability distribution, Wiener–Khinchin theorem, Second order coherence theory of scalar fields, Complex degree of coherence, cross spectral density, Spectral degree of coherence, Wigner function	15
Unit IV	<b>Fourier Optics:</b> Fourier transform operation spatial frequency and transmittance function, spatial-frequency filtering, Phase contrast microscope. Holography: Principle of holography, On- axis and Off-axis hologram recording and reconstruction, types of hologram and some applications.	15

- 1. Optics, Ajoy Ghatak, 6<sup>th</sup> edition, Tata McGraw Hill, (2017)
- 2. Optics, Eugene Hecht and A R Ganesan, 4<sup>th</sup> Edition, Pearson Education (2008) (Text)
- 3. Basics of Interferometry P Hariharan, Academic Press(2006)(Text)
- 4. Fundamentals of Optics, Jenkins and White, McGraw Hill Education, 4<sup>th</sup> edition (2017)
- 5. Introduction to optics and optical imaging C.Scott, Wiley-IEEE Press (1998)
- 6. Optical Electronics Thyagarajan and Ghatak, Cambridge University Press (1997)
- 7. Polarization of light S. Huard, John Wiley and Sons (1997)
- 8. Fundamentals of photonics : Bahaa E.A. Saleh and Malvin Carl Teich, New York: John Wiley, (2007)
- 9. Introduction to Fourier Optics : Joseph W. Goodman
- 10. The Fourier Transform And its Applications to Optics-P M Duffieux, John Wiley Sons 2nd Ed, (1983)

- MIT Open Learning Massachusetts Institute of Technology, https://openlearning.mit.edu/
   National Programme on Technology Enhanced Learning (NPTEL),
- https://www.youtube.com/user/nptelhrd
- 3. SwayamPrabha DTH Channel, https://www.swayamprabha.gov.in/index.php/program/current\_he/8

Programme: GENERAL ELECTIVE						ar: V	Semes	ter: I	X	
Course T Code	itle &	Credits	Credit dist course	tribution of the	<u> </u>	Eligibility Criteria		Pre-1 of th	Pre-requisite	
			Lecture	Tutorial						
GE P 12: Nanoscie Nanotech	nce and mology	4	3	1		Accord Univers Ordinar	ing to sity nce	Acco Univ Ordii	ording to ersity nance	
The coun Nanotech Nanotech	se is in nology. T nology.	portant The cours	for the s se provides	tudents to learn a platform for t	n ab he st	out the udents v	e Nano who ha	ve in	nce and terest in	
Unit	Topic							1 I	No. of Lectures	
Unit I	Emerg Carbo Introd prope semic	gence of on age–No luction to rties of onductin	Nanotechno ew form of nanomater nanomater g nanoparti	ology – Challeng carbon (From Gr rials, evolution o ials, role of si cles,	es in apher f nan ize ii	Nanotec ne sheet oscience n nanor	hnolog to CN , gener nateria	y, T), ral Is,		
<b>T.T. 1. TT</b>			1 1 5				•		15	
Unit II	One-, Influe magne wires,	two- a ence of etic and of electror	nd three-D Nano size chemical pr nic transport when of CN	on mechanica on mechanica operties of quan t in quantum w	ostruc l, op tum c vires a	ctured r tical, el lots and and cart	nateria lectron: quantu oon nai	ls. ic, m no	15	
	lubes	((), (	Thes of CLA	i, magnetie belle	101 101	or mano	paracit	0		

	······································								
	tubes (CNT), types of CNT, magnetic behavior of nano particles								
Unit III	Optical Microscopy, Scanning Electron Microscopy, Transmission Electron Microscopy, HRTEM, Atomic Force Microscopy, Scanning Tunneling Microscopy, Optical Absorption and Emission Spectroscopy, X Ray Diffraction, Raman and FTIR Spectroscopy.	15							
Unit IV	Molecular electronics and nanoelectronics, Quantum electronic devices, Carbon Nano Tube based transistor and Field Emission Display, Biological applications, Biochemical sensor, medical applications and Membrane based water purification	15							

- 1. C. Kittle: Introduction to Solid State Physics (John Wiley)
- 2. C.Poole and F.J.Owens: Introduction to Nanotechnology (John Wiley)
- 3. T.Varghese and K.M.Balakrishna: Nanotechnolgy: An Introduction to Synthesis, properties and Application of Nanomaterials. (Atlantic)
- 4. G. Schmidt: Nanoparticles: From theory to applications (Wiley Weinheim)

## Suggested Equivalent Online Courses:

- 1. MIT Open Learning Massachusetts Institute of Technology, https://openlearning.mit.edu/
- 2. National Programme on Technology Enhanced Learning (NPTEL) https://www.youtube.com/user/nptelhrd

**3.** SwayamPrabha – DTH Channel, https://www.swayamprabha.gov.in/index.php/program/current\_he/8

					PRA	CTICAI	LS			
rogram	ne: PR	AC	TICALS	5				Year: V	Seme	ester: IX
Course Code	Title	&	Credits	Credit course Practic	distrib als	oution of Tutoria	of the	Eligibility C	riteria	Pre-requisit of the course
Practical	ls	2	4	4	0			According to University Ordinance	I	According to University Ordinance
Course (	Dutcon	nes:	1	. 1	1 1		.1	•	c 1'(	C ( 11
The stude	ent will	ha	ve adequ	late kno	wledge	to perfor	rm the	experiments	of dif	terent fields
pnysics w	ith clea	ar ui	nderstand	ung of t	ne theor	y behind	the ex	periment. Stu	dent v	vill know abou
various el	ectroni	cs e	xperime	nts and s	some ad	vanced e	xperim	ents in Physic	S	
Unit	1			T ic	t of Ev	norimon	te			No of
Omt						permen	15			Lectures
	1.	Ve	rificatio	n of Ric	hardson	's law.				
	2.	Stı	udy of E	SR spec	tra of a	given sa	mple.			
	3.	Ha	all Effect	-						
	4.	RC	CS Spect	rometer						
	5.	ga	mma ray	spectro	meter					
	6.	Ra	dio Rece	eiver						
	7.	e t	oy Millik	an's oil	drop m	ethod.				
	8.	Te	mperatu	re deper	idence c	of diode of	charact	eristics.		60
	9.	Ela	astic con	istants o	f a cubi	c crystal	by ul	trasonicwaves	5.	
	10.	Stı	udy of M	Iultivibr	ators .					
	11.	Stu fee	udy of edbackar	tran: nplifiers	sistor	ampli	fier	cum		
	12.	Stı Sp	udy of ectropho	abso otometer	orption	of	KMr	iO4		
	13.	Stı	udy of di	fferent l	FETs an	d MOSF	ETs.			
	14.	Stı	udy of T	hermo lu	uminanc	e.				
	15.	Sti	ıdv of V	TVM.						

## Suggested Equivalent Online Courses:

1. Virtual Labs at AmritaVishwa Vidyapeetham https://vlab.amrita.edu/?sub=1&brch=74

2. Digital Platforms /Web Links of other virtual labs may be suggested/added to this lists by individual Universities

## Semester: X MASTER IN PHYSICS

# DISCIPLINE SPECIFIC COURSE (DSC A10)

Programme:	Discipline Sp	pecific C	ourse		Ye	ar: V	Sem	ester: X	
Subject: Phy	vsics								
Course Title	e & Code	Credits	Credit dist course	tribution of the		Eligibili Criteria	ity 1	Pre-requ course	isite of the
			Lecture	Tutorial					
DSC A10: Solid State I	Physics	3	3	0		Accordi Universi Ordinan	ng to ity ce	Accordir Universi	ng to ty Ordinance
Course Out The students symmetries. crystals. Thi superconduc	comes: will be able The student w s course also tivity. The cou	to develo vould gai include urse form	op an under in insight al s elastic w ns a theoreti	estanding of the loout the interior aves, phonons, a local basis of expe	lattic of the and l prime	e, differe e substan lattice vi ntal mate	ent tyj ces u bratic erial s	pes of cry sing X-ra onal prop cience an	ystal structures, y diffraction in erties and also d technology.
Unit	]	lopic							Lectures
Unit I	Unit ICrystal Structure: Crystalline and non-crystalline solids. Lattice, basis, unit cell, co-ordination number, lattice planes and Miller indices. Interplanner spacing, seven crystal system. Interaction of radiation with matter (for elastic and inelastic scatterings of x- ray). X ray diffraction, Bragg's law. Diffraction conditions, Fourier analysis. Concept of reciprocal lattice point, calculation of regimensed lattice paint of SC PCC and ECC lattices. Application of15							15	
	reciprocal lat applications.	tice poir	nt in diffrac	ction technique.	Neut	ron scat	tering	and its	
Unit II	<b>Bonding in S</b> Vander Waal	Solids : I , hydrog	Different tyj en bonding	pes of bonding in & ionic bonding	n soli g, Cal	ds, coval lculation	lent, 1 of M	metallic, adelung	10

Vander Waal, hydrogen bonding & ior	nic bonding, Calculation of Madelung	10
constant of ionic crystals, Determinat	ion of cohesive energy. Born-Haber	
cycle of NaCl molecule. Properties of c	ovalent compounds and hybridization.	
Dispersion and dipole bonds. Thermal	expansion and thermal conductivity,	
anharmonicity interaction of electrons	and phonons with photons (direct and	
indirect transitions).		
Unit III Lattice Vibrations: Vibrations of cry	stals with monoatomic and diatomic	
basis. Concept of dispersion relation	n, optical and acoustical branches.	10
Quantization of lattice vibrations (P	honons), normal modes & normal	
coordinates, longitudinal and transve	erse modes of vibration, modes of	
vibration of monatomic and diatomic	lattices. Density of states, Phonon	
momentum, Inelastic scattering by photo	nons. Theory of specific heat of solids	
: classical theory, Einstein theory an	d Debye theory .Theory of metals :	
Classical theory, free electron theory	and F-D distribution function, Hall	
effect and its applications.		

Unit IV	Crystal Defects: Lattice vacancies, Fick's law, color centers and its	
	production method in crystal, Point defects (Schottky & Frankel Defects)	
	Imperfections, Line defects (Edge& Screw dislocations), slip, Burger vector	
	& Burger Circuit, Role of dislocation in plastic deformation and crystal	
	growth. Strength of alloys. Elementary idea of superconductivity, Meissner	
	effect, Type-I and type-II superconductors, BCS theory. Theory of	
	ferrimagnetism. ferromagnetism and antiferromagnetism.	

10

#### Suggested Readings:

- 1. A. J. Dekker: Solid State Physics
- 2. S.O. Pillai : Solid State Physics
- 3. C. Kittle : Introduction to Solid State Physic
- 4. Verma & Srivastava : Crystallography for Solid State Physics

- 1. MIT Open Learning Massachusetts Institute of Technology, https://openlearning.mit.edu/
- 2. National Programme on Technology Enhanced Learning (NPTEL), https://www.youtube.com/user/nptelhrd
- **3.** SwayamPrabha DTH Channel, https://www.swayamprabha.gov.in/index.php/program/current\_he/8

	<b>DISCIPLINE SPECIFIC ELECTIVE (DSE A15)</b>								
Programme	e: Disc	ipline S	pecific Elect	tive	Ye	ar: V	Seme	ester: X	
Course Title & Code		Credits	Credit dist course	ribution of the	1	Eligibili Criteria	ty	Pre-requisite of the course	
			Lecture	Tutorial					
<b>DSE A15:</b> Statistical Physics		3	3	0		Accordin Universi Ordinan	ng to ty ce	According to University Ordinance	
<b>Course Ou</b> This course properties a types of ens	tcome helps and dif semble	es: the stud fferent st es and dif	ents to learr tatistical mo fferent statis	n about foundati dels. Students tics namely M-1	ion of will h B, B-I	statistic ave the i E and F-l	al me idea a D stat	chanics, statistical bout the different istics.	
Unit	Торі	с						No. of Lectures	
Unit I	Four Micro canor enser partit quan syste	Foundation of Statistical MechanicsMicroscopic and macroscopic states, density of states, micro- canonical, canonical and grand canonical ensembles, canonical ensemble and Gibb's distribution, Boltzmann–Planck method, partition function and statistical definition of thermodynamic quantities, computation of partition functions of some standard systems						D- al d, <b>10</b> ic rd	
Unit II	Stati Syste	<b>stical Pr</b> em of l nble; gra	<b>operties</b> linear harm and canonica	onic oscillator	rs in its pa	the car rtition fu	nonic	al n;	

	chemical potential; Partition function and distribution for	15
	perfect gas; Gibb's paradox; Free energy, entropy, equation of	
	state and specific heat determination of perfect gas.	
Unit III	Statistical Models	
	Theory of phase transitions, First order phase transition,	
	Second order phase transitions and higher order phase	
	transitions ( elementary discussion), Ising model, one	10
	dimensional (with exact solution), Two dimensional (with	
	exact solution ) & three dimensional model (elementary idea),	
	Landau theory of phase transition, Weiss theory of Ferro-	
	magnetism, Heisenberg model. Virial equation of states.	
Unit IV	Quantum Statistics	
	Bose-Einstein and Fermi- Dirac distributions, degeneracy, gas	
	degeneration, degenerate Bose gas, Bose Einstein	
	condensation, highly degenerate B-E and F-D gases; examples	10
	of Molecular Hydrogen, liquid helium and electron gas in	
	metals.	

- 1. A.S. Davidov: Quantum Mechanics
- 2. Paul Roman: Quantum Mechanics
- 3. Glastohn Theoretical Chemistry
- 4. Landau and Lifshitz: Statistical Mechanics
- **5.** Pathira: Statistical Mechanics
- **6.** Huang: Statistical Mechanics

- MIT Open Learning Massachusetts Institute of Technology,<u>https://openlearning.mit.edu/</u>
   National Programme on Technology Enhanced Learning (NPTEL), https://www.youtube.com/user/nptelhrd
- **3.** SwayamPrabha DTH Channel, https://www.swayamprabha.gov.in/index.php/program/current\_he/8

Description of the Vacuum V Somestow V									
Frogramme: Discipline Specific Elective									
Course 1 Code	itle &	Credits	Credit dist course	ribution of t	he	Eligibi Criteri	lity a	Pre-re the cou	quisite of 1rse
			Lecture	Tutorial					
DSE A16 (a3): Advanced Electronics- III		3	3	0		Accord Univers Ordinas	ing to sity nce	Accord Univer Ordina	ling to sity nce
Course O	utcomes:								
This cour microwav	ese helps the production of Research	e studen n and m	ts to gain a icrowave ge	advanced co eneration whi	ncep .ch h	ots of po as wide	ower s applic	supply a cations	regulation in moderr
Unit	Topic	1.							No. of Lectures
Unit I	<ul> <li>I Power Supply regulation with Series Regulators: Servomechanism, regulation using Operational Amplifier, Zener reference source, The 723 regulator, current regulator, short circuit and over load protection, Current Foldback, Current Boosting, Precision rectifier, Three terminal voltage regulations, dual Polarity regulated power supplies using 78 XX and 79 XX series regulators (Basic ideas only).</li> <li>II Switching Regulators and Active Filters: Switched mode power supply (SMPS), Active filters; advantages and limitations of Active filters, RC Active filters, First order, second order and higher order Low pass and High pass active filters, Voltage transfer function, frequency response and Gain roll-off, Narrow and wide band pass</li> </ul>					10			
Unit III	amplifier Microwa devices a modulation klystron, focusing tube (TW Diodo D	ve Proc ve Proc at UHF, on and c Theory effect, f /T), Sen	controlled of luction: Lin Microwave urrent modu and uses of requency pu- niconductor	<u>oscillator (VC</u> mitation of e frequencie ulation, Mult cavity mag ulling and pu microwave	<u>CO).</u> conv s, P icav netro ushin devi	vectiona rinciple ity Klys on, Straj ng, Trav ces; PII	l elect of ve stron, l oping, velling- N & C	ronics elocity Reflex Phase Wave GUNN	10
Unit IV	Microwa Microwa microwa problem, in micro reflectors	ve Com ve trans ves, atmo ground r wave co . Horn at	munication mission, lo ospheric eff reflection, Fa ommunication tennas. Len	Advantage ss in free fects on pro ading, Anten on system; A s antennas.	es ar spa roga na ao Anter	nd Disad ce, pro tion , I ction, A nnas wi	dvantaş pagatio Fresnel ntenna th par	ges of on of zone s used abolic	10

- 1. Coughlin: Operational Amplifiers and Linear Integrated Circuits.
- 2. Schilling & Belove: Electronic circuits Discrete and Integrated, Mcgraw Hill
- 3. Millman & Halkias: Electronic Fundamentals & Applications, Tata Mcgraw Hill
- 4. Millman & Halkias: Integrated Electronics
- 5. R. Botkar: Integrated Circuits, Khanna Publishers
- 6. V.K. Mithal& Ravi Mittal: Electronic Devices & Circuits, Khanna Publishers
- 7. Malmstadt &Enke: Electronics for scientists
- 8. Taub & Schilling: Principal of communication systems
- 9. Simon Gayukti: Communication Systems
- 10. Martin S. Roden: Analog & Digital Communication Systems
- 11. Terman: Electronic & Radio Engineering

- 1. MIT Open Learning Massachusetts Institute of Technology, https://openlearning.mit.edu/
- 2. National Programme on Technology Enhanced Learning (NPTEL)
- https://www.youtube.com/user/nptelhrd
  SwayamPrabha DTH Channel, https://www.swayamprabha.gov.in/index.php/program/current\_he/8

	D	ISCIPL	INE SPEC	IFIC ELECTI	VE (DSE A16	(b3))		
Programme:	Programme: Discipline Specific Elective Year: V Semester							
Course Title Code	&	Credits	s Credit distribution of the		Eligibility Criteria	Pre-recours	equisite of the e	
			Lecture	Tutorial				
Astrophysics DSE A16 (b3	-III 3)	3	3	0	According University Ordinance	to Accor Unive Ordin	ding to ersity ance	
Course Outo	comes:	•				•		
This course p	rovides	the basi	c physical m	nechanisms abou	t the solar activ	vities, whi	ch will help to	
probe the	Sun-	Earth	connectio	n. This stud	ly provides	the ki	nowledge of	
Astroseismolo	ogy, cla	assificati	on of stars a	nd the distribution	on in Galaxies.			
UNIT				TOPIC			No. of Lectures	
UNIT I	Sun a photos time s scatter photos Quiet Solar (CME	s a star spheric a scale, nu ting, me sphere, c and Acti flares, S s), Sola	Solar spec bsorption lin clear fusion ean free pa hromosphere ive Sun, Sun Solar filame r wind, Dir	trum, effective nes, limb darkeni a; energy transp ath, photon dif e, transition regionspots, their form nts/prominences, fferent type of	temperature, fing; energy sour ort in the sun, fusion inside on, corona. nation and magi , Coronal mass solar eruption	the Sun s models	, 10 , 15	
	Coron Astros Introd	al heating al heating	ng, Solar C gy, Descripti variable sta	ycle, General id ion about p-mod- rs and their loca	tea of Helios e and g-mode og tions in H-R dia	esmology scillations igram.	,	
UNIT III	IThe Milky way and Other Galaxies Distributions of stars in the Milky way, Morphology, Kinematics, Interstellar medium, Galactic center. External galaxies, Types of galaxies: spirals, ellipticals and irregulars, Hubble classification for galaxies, 21cm line, rotation10						10	
	cure, c	lark mat	ter.		<u> </u>	•		
UNIT IV	Princi Princi Geode tensor Einste spheri	ple of pal of g esics, Chr , Riema in's field cally syr	equivalence eneral gravi ristoffel sym nn curvatur d equations nmetric space	and principle tational field, M bols, Space- tim e tensor, Biancl , Centrally Syn ce-time (Schwarz	of general c letric tensor an le curvature and hi identity, Ric nmetric Fields, schild metric).	ovariance od gravity curvature cci tensor Metric ir	, 10 ,	

- 1. Stix: The Sun: An Introduction
- 2. K. D. Abhyankar : Astrophysics: Stars and Galaxies
- 3. T. Padmanabhan : Galaxies and Cosmology Motz : Astrophysics
- 4. I. Zhelyazkov and R. Chandra : Kelvin\_Helmholtz Instability In Solar Atmosphere Jets, Word Scientific
- 5. R. K. Pathria, The Theory of Relativity, Hindustan Publishing Corpn, (India

## **Suggested Equivalent Online Courses:**

- 1. MIT Open Learning Massachusetts Institute of Technology, <u>https://openlearning.mit.edu/</u>
- 2. National Programme on Technology Enhanced Learning (NPTEL), https://www.youtube.com/user/nptelhrd
- 3. SwayamPrabha DTH Channel, https://www.swayamprabha.gov.in/index.php/program/current\_he/8

## **DISCIPLINE SPECIFIC ELECTIVE (DSE A16 (c3))**

Programme: Discipli	ne Spec	ific Elective	;	lear: V	Semester: X
Course Title & Code	Credits	Credit disti course Lecture	ribution of the Tutorial	Eligibility Criteria	Pre-requisite of the course
DSE A16 (c3): High Energy Physics-III	3	3	0	According to University Ordinance	According to University Ordinance

## **Course Outcomes:**

The course would provide the knowledge of advanced concepts of HEP. The students will be able to know the complicated theory of Relativistic propagators, S matrix expansion and S matrix formulation of QED. It would open doors for the students who want to work in thefield of HEP.

UNIT	TOPIC	No. of Lectures
UNIT I	Relativistic Propagators Relativistic propagators using quantized formulation of free fields, Properties of quantized scalar fields(Real and complex cases), Algebra of field operators, covariant form of the field operators algebras, (Covariant commutation relations), Meson propagator and its characteristics, Properties of quantized spinor fields, Algebras of spinor field operator, Covariant form of anti-commutation relations, Fermion propagator and its characteristics, properties of quantized EM field, Covariant commutation relations of EM field operators, Photon propagator and its characteristics, EM interaction in terms of radiation field and instantaneous coulomb fields.	15
UNIT II	Operator Products, Feynman Propagators and S-matrix Expansion Various type of operator products (Normal, Dyson products and Chronological T-products), Wick's theorem, Feynman propagators and its physical interpretation, Interacting fields, S-Matrix formulation as a perturbative series solution of collision processes, Dyson expansion of S-matrix.	10

UNIT III	S-matrix Formulation of QED Interaction Hamiltonian in QED, Reduction of S-matrix for the case of QED, Representation and description of various first and second order processes in QED using S-matrix expansion.	10
UNIT IV	Compton scattering, Moller scattering, Bhabha scattering, Electron self energy, Photon self-energy, vacuum configuration in QED, Feynman diagrams and Feynman Rules in QED.	10

- **1.** Ryder : Quantum Field Theory
- 2 B.K. Agarwal: Quantum Mechanics and Field Theory
- 3. F Mandel and G. Shaw: Quantum Field Theory
- 4. Roman: Quantum Field Theory
- 5. A. Das: Quantum Field theory
- 6. M. E. Peskin, D.V. Schroeder: An Introduction to Quantum FieldTheory

- 1. MIT Open Learning Massachusetts Institute of Technology, https://openlearning.mit.edu/
- 2. National Programme on Technology Enhanced Learning (NPTEL), https://www.youtube.com/user/nptelhrd
- 3. SwayamPrabha DTH Channel, https://www.swayamprabha.gov.in/index.php/program/current\_he/8

	D	ISCIPL	INE SPEC	IFIC ELECTIVE	E (DSE A16 (d3	<b>3))</b>	
Programn	ne: Discipli	ne Spec	ific Elective	;	Year: V	Semes	ter: X
Course T	itle &	Credits	Credit disti	ribution of the	Eligibility	Pre-re	equisite of the
Code			course	Tutorial	Criteria	course	9
			Lecture	Tutoriai			
DSE A16 (d3): Spectroscopy-IIIAccording to UniversityAccording to University330OrdinanceOrdinanceOrdinance						ding to rsity ance	
Course Ou	itcomes:						
Through t	his coursew	ork stud	lents will get	t a deep knowledge	e about the mole	cular sy	ymmetries and
group the	ory, mechai	nism beł	ind the abso	orption and emission	on of photon and	l relate	d phenomena.
Also, afte	r attending	the cou	irse a stude	nt will be acquain	nted with fluore	scence	measurement
techniques	s and recent	t advance	es in fluores	cence spectroscopy	· · · · · ·		
Knowledg	e acquired	by the c	ourse will b	be of much use for	various industrie	s and F	R&D sector
UNIT				TOPIC			Lectures
UNIT I	Molecula	r Symm	etries and (	Group Theory: S	ymmetry Proper	ties of	
	molecule:	symme	try element,	, symmetry operation	tion and point	group,	
	character t	table, Gi	oup theory:	representation of	a group, reducib	le and	10
	irreducible	e represe	ntations, LC	AO coefficient of a	a polyatomic mol	ecule,	
	Huckel ap	proxima	tion, overlap	o and resonance in	tegrals.		
UNIT II	Mechanis	m of A	bsorption a	nd Fluorescence:	Theory of abso	rption	
	spectrosco	py, diffe	erential abso	rption spectroscop	y(circular Dichro	oism),	
	Mechanism	n of	fluorescence	emission and	decay, radiativ	ve &	
	nonradiati	ve proce	esses, Jablor	nski diagram, Kasl	ha rule, Mirror	image	15
	rule, Osc	illator s	strength, Sto	oke's shift, Fluor	escence lifetime	e and	15
	quantum y	yield, Er	vironmenta	l effects on absorp	ption and fluores	scence	
	spectra, T	ime sca	le of molect	ular processes in s	solution, Fluores	scence	
	sensing an	d quenc	hing, Fluore	scence polarisation	and Anisotropy	•	
UNIT	Instrume	ntation	for Absorp	ption and Fluore	escence Spectro	scopy:	
III	Absorption	n, Exc	citation an	d Emission sp	ectra, UV -	- Vis	
	spectropho	otometer	, Basic ins	trumentation of	steady state and	d time	
	resolved f	luorome	eter, An idea	al spectrofluorome	eter, Principle of	f Time	
	Correlated	l Singl	e Photon	Counting (TCS	PC), Light s	ources,	10
	Monochro	mator,	Optical filte	ers, Photomultiplie	r tubes, Distribu	tion in	
	Excitation	& Emis	sion spectra.	, Photon counting v	versus Analog de	tection	
	of Fluores	scence (	Corrected Fl	uorescence spectr	a, Circular Dich	nroism,	
	Applicatio	ons of ste	eady state an	d time resolved me	easurements,.		
	Advances	in Flu	orescence S	Spectroscopy: Con	ncept of fluore	scence	
1 V	Spectrosec	maging,	Theory and	a principle of Flue	uorescence Corr	elation	10
	Applicatio	opy an	u Siligie	noiecule nuore	scence spectro	scopy,	
	присано	115 01 110	orescence s	peeuoscopy.			

- 1. Barrow G.M: Introduction to Molecular spectroscopy; McgrawHill
- 2. Herzberg G: Infrared and Raman Spectra of Polyatomic Molecules;
- 3. Von Nostrand Herzberg G: Spectra of Polyatomic Molecules;
- 4. J. R. Lackowicz: Principle of Fluorescence
- 5. Bernard Valeur and Mário Nuno Berberan-Santos: Molecular fluorescence (Principles and Applications)
- 6. King G.W: Spectroscopy and Molecular Structure

- 1. MIT Open Learning Massachusetts Institute of Technology, https://openlearning.mit.edu/
- 2. National Programme on Technology Enhanced Learning (NPTEL), https://www.youtube.com/user/nptelhrd
- 3. SwayamPrabha DTH Channel, https://www.swayamprabha.gov.in/index.php/program/current\_he/8

	DIC	TDI IN	E SDECIE			$16(a^2)$		
	DISC	JIPLIN	E SPECIF	IC ELECTIVE	(DSE A	(es))		
<b>Programme:</b>	: Disci <sub>l</sub>	pline Sp	ecific Elect	ive	Year:	V Sem	ester:	
						IX		
Course Titl	e &	Credits	Credit disti	ribution of the	Elig	gibility	Pre-requisite of the course	
Code			course		Cri	teria		
			Lecture	Tutorial				
DSE A16(e Condensed Matter Phy III	3): /sics –	3	3	0	Acc Uni Ord	cording to versity inance	According to University Ordinance	
			Co	ourse Outcomes:				
Topics covered	ed in tl	his pape	r deals abou	it dielectric prop	erties of	matter, C	rystallography,	
and Microsco	py & S	Surface 7	<b>Fopography</b> .	. This course wor	uld encou	rage stud	lents to peruse	
higher study a	and res	earch in	Condensed	Matter Physics.		C	*	
TINIT				TODIC				

UNIT	TOPIC	No. of Lectures
UNIT I	<b>Dielectric properties of matter:</b> Polarization (ionic, electronic, orientation) Dielectric and ferroelectric properties of matter, polarizability, Clauses-Mossotti relation. Temperature dependence and frequency dependence of dielectric constant, dielectric loss and dielectric strength, Piezoelectricity. Langevin's theory of polarization.	15

UNIT II	Advance Methods of Crystallography: Different sources of error in Powder method of X-ray photography, Determination of errorfunction for powder method, Accurate determination of lattice parameter, Applications of powder method, Moving film methods and advance methods of crystallography	10
UNIT III	Methods of Microscopy and Surface Topography: Observation of surface imperfections using X-ray, Electron microscopy: Transmission Electron Microscopy, Surface Scanning Electron Microscopy and Scanning- TunnelingElectron Microscopy, Atomic force microscopy (AFM).	10
UNIT IV	<b>Discarded Systems:</b> Concept of order, long range and short- range order, Concept of impurity states in condensed matter system, Shallow impurity states in semi conductor, deep traps in condense matter systems, colourcentre of an ionic crystal system, Disorder in condensed Matter system: substitutional positional and topological disorders.	10

- 1. C. S. Kittel: Introduction to solid state Physics.
- 2. C. S. Kittel: Quantum theory of Solids.
- 3. Verma and Srivastava: Crystallography for solid state Physicists.
- 4. Madelung: Solid State Physics.

- 3. SwayamPrabha DTH Channel, https://www.swayamprabha.gov.in/index.php/program/current\_he/8

<b>DISCIPLINE SPECIFIC ELECTIVE (DSE A17 (a4)</b>										
Programme: Discipline Specific Elective Year: V Semester: X										
Course Title & Code		Credits	its Credit distribution of the course			Eligibilit Criteria		Pre-requ course	uisite of the	
			Lecture	Iutorial						
DSE A17 (a4): Advanced Electronics-IV		3	3	0	According University Ordinance		ng to .ty ce	to According to University Ordinance		
Course Ou	itcomes:									
This course	e helps the	e student	s to gain ba	sic ideas of the	const	truction	and v	vorking c	of electronic	
devices and	d circuits.	The cou	rse includes	the study of co	mbin	ational c	ircuit	s, sequer	ntial circuits	
and analog	computati	on. The o	course is of r	nuch practical pu	ırpos	e for the	stude	nts to lear	rn the basics	
of digital e	lectronics.	The digi	tal electroni	cs have wide app	olicat	ions in co	ompu	ting, proc	cess control	
signal proc	essing, cor	nmunica	ation systems	s, digital instrum	ents	etc.	-	• •		
UNIT				TOPIC					No. of Lectures	
UNIT I	Analog Computation Solution of ordinary linear differential equations with constant coefficients, Operation modes of analog computers, repetitive operation of computers, Time scaling, amplitude scaling, Combined time and amplitude scaling, Generation of functions, Simulation of time varying systems						constant ration of me and varying	10		
<ul> <li>UNIT II Logic Circuits and Logic Families         <ul> <li>Canonical and standard forms of Boolean functions, Algebraic simplification of Boolean equations. Karnaugh maps, Construction of K-maps from truth tables, don't care conditions, NAND and NOR implementations. The Tabulation method, Determination and selection of prime implicants, Classification of Digital logic families. Digital to Analog and Analog to Digital converters</li> </ul> </li> </ul>						15				
UNIT III	Combina	ntional (	Circuits							
	Adders &	Subtrac	ctors, Magnit	tude comparator	, Cod	e conver	ters;			
	Parallel a	dders, E	ncoders, Deo	coders, Multiple	xers, 1	Demultip	olexei	s, Parity	10	
	bit genera	ator and	cnecker, Re	and only memory	y (PR	UM, EP	KON	i), KOM		
UNIT IV	bit generator and checker, Read only memory (PROM, EPROM), ROM applications, Programmable Logical Array(PLA). Sequential Circuits Sequential logic- Memory element, RS, JK, JKMS, T type and Edge triggered Flip flop; Registers; Shift register; Counters— synchronous and Asynchronous; The memory unit; Semiconductor Random Access Memory; Inter-register transfer; Arithmetic; Logic and Shift Micro-operation; Fixed point and floating point data.								10	

- 1. Morris Mano: Digital Logic & Computer Design
- 2. Rajaraman: Introduction to Digital Computer design
- 3. Malvino& Leech Sloan: Computer Hardware & Organization
- 4. V. Rajaraman: Analog Computation & Simulation Integrated Circuits.
- 5. Schilling & Belove: Electronic circuits Discrete and Integrated, Mcgraw Hill
- 6. Millman & Halkias: Electronic Fundamentals & Applications, TataMcgraw Hill

- 7. Millman & Halkias: Integrated Electronics
- 8. K.R. Botkar: Integrated Circuits, Khanna Publisher
- 9. G.K. Mithal& Ravi Mittal: Electronic Devices & Circuits, KhannaPublisher

- 1. MIT Open Learning Massachusetts Institute of Technology, https://openlearning.mit.edu/
- 2. National Programme on Technology Enhanced Learning (NPTEL), https://www.youtube.com/user/nptelhrd
- 3. SwayamPrabha DTH Channel, https://www.swayamprabha.gov.in/index.php/program/current\_he/8

<b>DISCIPLINE SPECIFIC ELECTIVE DSE A17 (b4)</b>										
Programme: Discipline Specific Elective Year: V Semester: X									X	
Course Title & Code		Credits	Credit disti course <mark>Lecture</mark>	ribution of the Tutorial		Eligibili Criteria	ity Pre-r a cours		requisite of the se	
DSE A17 (b4): Astrophysics-IV		3	3	0	According to University Ordinance		Accor Unive Ordin	According to University Ordinance		
Course Out	comes:	vida dha 1		tion of store hint	ام مع ما	41.0.00001		of sto	na In addition	
of this it r	will prov rovides	the dee	basic properi	ding about the	n and star	clusters	ution and t	OI Sta beir r	rs. In addition	
luminosity a	nd mass	function	, mass-lumir	nosity relations e	tc.	clusters		nen p	noperties, e.g.	
UNIT			- -	ΤΟΡΙΟ					No. of Lectures	
UNIT I	Basic Properties of Stars: Mass, radius, distance, luminosity, temperature, magnitude system, Wien-displacement colour indices, filters, H-R diagram, classification of stellar spectra, luminosity classification stellar motion stellar populations							osity, lices, osity	10	
UNIT II	Star Formation and Stellar Evolution: Birth of stars, protostar, Pre- main sequence evolution: Jeans instability, star formation, Hayashi track, Zero age main sequence (ZAMS), Post-main sequence evolution: Core He burning, shell burning, red giant phase, planetary nebulae, white dwarf physics, electron degeneracy pressure, energy generation in stars – gravitational contraction, pp chain, CNO cycle and triple alpha process, stellar life, cycles-Premain sequence, main sequence, giants.							15		
UNIT III	Star Clu the gal mean p equatio angular	uster and axy itsel otential a on of more c momen	their Proper f are examp and total pote otion of N- ntum and e	ties : Open cluster ples of 'stellar s ential energy in a body stellar systemergy as const	ers, g ysten cons stem; ants	lobular cl ns'; cros tant dens total m of motio	luster sing ity sp omer on, s	s and time; here; ntum, tellar	10	

	population, population I and II type objects, inter-stellar extension,	
	reddening determination from color color diagram, age and distance	
	determination of star clusters, luminosity function, mass function,	
	mass segregation, mass-luminosity relation.	
UNIT IV	Cosmological Models: Universe at large scales - Homogeneity and	
	isotropy - distance ladder - Newtonian cosmology - expansion and	
	redshift - Cosmological Principle - Hubble's law - Robertson-Walker	
	metric - Observable quantities - luminosity and angular diameter	10
	distances - Horizon distance- Dynamics of Friedman- Robertson-	
	Walker models: Friedmann equations, Weyl's postulate, Big-bang	
	and steady state models of the universe.	

- 1. Abhyankar K.D. : Astrophysics, Galaxies and Stars
- 2. Vaidyanth Basu : An Introduction to Astrophysics
- 3. Motz : Astrophysics
- 4. T. Padmanabhan : Stars and Stellar Systems
- 5. L Kutner: Astronomy: A Physical Perspective

## Suggested Equivalent Online Courses:

- 1. MIT Open Learning Massachusetts Institute of Technology, https://openlearning.mit.edu/
- 2. National Programme on Technology Enhanced Learning (NPTEL),
- https://www.youtube.com/user/nptelhrd
- 3. SwayamPrabha DTH Channel,

https://www.swayamprabha.gov.in/index.php/program/current\_he/8

	DI	SCIPLIN	NE SPEC	IFIC ELECTIV	/ <b>E</b> (]	DSE A1'	7 (c4)	)		
Programme: Discipline Specific Elective Year: V Semester:							X			
Course Title & Code		Credits	edits Credit distribution of the course		;	Eligibility Pre- Criteria cour		Pre-r cours	requisite of the se	
DSE A17 (c4): High Energy Physics-IV		3	3	0		Accordi Univers Ordinan	ng to ity ce	Acco Univ Ordir	rding to ersity nance	
Course Ou The course will also be strong intera	<b>tcomes:</b> would pro able to lea actions.	vide the l rn the det	cnowledge ailed theo	e of some more a ry of weak intera	dvan ction	ced cond s, electro	cepts o omagi	of HE netic i	P. Thestudents nteractions and	
UNIT				TOPIC					No. of Lectures	
UNIT I	<b>Quarks and Gluons:</b> Quark-Lepton Symmetry, Theoretical and experimental need of charm quark, J/p and Charm, Three generations of quark and leptons: from bottom to Top quark, Positive facets of quark model, Paradoxes of the Naive Quark Model, Need of color quantum number for Quarks, Gluons, Standard Model and Fundamental Particles, Symmetry and Quark model, Color octet and singlet of Gluons, diquark and exotic hadrons, Color SU(3), SU(3) color ladder operators, concept of colorless hadrons						10			
UNIT II	Strong Interaction : The basic difference between QED and QCD,         QCD Lagrangian, SU(3) global color gauge invariance and concept         of 8 conserved currents, SU(3) local color gauge symmetry and         QCD ,basic idea of Asymptotic freedom and Perturbative QCD,         Experimental indication for quarks and gluons, String model of         hadrons and concept of confinement of Quarks, Classification of					10				
UNIT III	<ul> <li>Hadrons and Regge Trajectories.</li> <li>Weak Interaction: Classification of weak interaction in terms of Leptonic, Semi-leptonic and non-leptonic weak Decays, Fermi Non relativistic theory of beta decay, Fermi &amp;Gammow Teller transitions and their selection rules, Parity violation in weak interaction, Helicity of particle, Helicity operator, Two component theory of Neutrinos, Fermi's relativistic theory of beta decay, concept of weak hadron current and lepton current, Current- Current Interaction and V-A theory.</li> </ul>						15			
UNIT IV	Weak ( interacti theory, lepton U bosons a Conserv Idea of standard	Gauge Bo ons, Inte Cabibbo Jniversali as weak g ation of Unification I model o	psons & rmediate angle, Co ty, Weak I auge boso Vector C on of Fund f electro w	Weak currents: Vector Boson (I' onsequences of C Isospin and weak ons, Charged and current (CVC) H damental Interact yeak unification	Uni VB) Cabib hype neut ypot	versality concept, bo theor ercharge, ral weak hesis, El with ref	of v Cabi ry, Q W ar curre lemen ference	veak ibbo uark nd Z ents, itary e to	10	

Suggested Readings:1. E Close : Quarks and Patrons2. I.J. Aitchison and A.J. Hey : Gaugetheories in Particle Physics
- 3. F. Haltzin& A.D. Martin : Quarks and Leptons
- 4. D.H. Perkins : Introduction of High Energy Physics, Cambridge University Press 2000
- 5. P.Cheng and G.LF Li : Gauge Field TheoryED Commins : Weak Interactions
- 6. D.C. Cheng and O Neil : Elementary Particle Physics

### **Suggested Equivalent Online Courses:**

- 1. MIT Open Learning Massachusetts Institute of Technology, https://openlearning.mit.edu/
- 2. National Programme on Technology Enhanced Learning (NPTEL), https://www.youtube.com/user/nptelhrd
- 3. SwayamPrabha DTH Channel, https://www.swayamprabha.gov.in/index.php/program/current\_he/8

<b>DISCIPLINE SPECIFIC ELECTIVE DSE A17 (d4)</b>									
Programme	e: Disciplin	ne Specifi	ic Elective	•	Ye	ar: V	Sem	ester: X	
Course Tit Code	tle &	Credits	Credit di course	stribution of the	9	Eligibili Criteria	ity	Pre-require	uisite of the
			Lecture	Tutorial					
DSE A17 ( Spectrosc	(d4): opy-IV	3	3	0		Accordi Univers Ordinan	ng to ity ce	Accordin Universi Ordinan	ng to ty ce
			Co	ourse Outcomes	:				
The course	content co	overs the	propagati	on of electroma	gneti	c waves	in n	onlinear	media. The
course prov	vides studer	nts with k	nowledge	of laser physics	and i	ntroduce	s the	m to nonl	inear optics
and spectro	oscopy app	lications.	Students	will be learnin	ig dit	ferent n	onlin	ear proc	esses as an
outcome un	nder light	matter in	nteraction	in nonlinear me	edia.	In addi	tion,	they wil	l also have
knowledge	about holo	graphy, n	nultiphoto	n processes, Ran	nan se	cattering	, Ran	nan spect	roscopy etc.
Knowledge	acquired b	by the cou	rse will be	e of much use for	vari	ous indu	stries	and R&I	D sector.
UNIT	ТОРІС						No. of Lectures		
UNIT I	Ultrasho	rt Pulses	s and Dy	namics of Lase	r Pro	cesses:	Produ	uction of	
	giant pul	lse, Q-sw	vitching b	y different type	es of	shutters	s, gia	nt pulse	
	dynamics	s, laser an	plifiers, m	ode locking, mo	de pu	lling, ult	ra sho	ot pulses,	15
	hole burn	ning, Prin	nciple and	theory of Hole	ograp	hy, Cha	ractei	ristics of	
	Non Lin	asr Ont		advances in Ho	nogra	piry.	hing	second	
	harmonic	general	tion, third	d harmonic ge	, pria	ion, op	tical	mixing.	
	parametri	ic generat	tion of ligh	nt,		· · · I		6,	10
	Self focu	sing of lig	ght.						
UNIT III	Multi Pl	noton Pro	ocesses:	Multi quantum	ph	otoelecti	ric ef	fect, two	
	photon pr	rocesses,	experimen	its in two photon	proc	esses, pa	arame	tric light	10
	oscillator	, frequ	ency up	-conversion, p	ohase	conju	gate	optics,	Ĩ
	Femtosec	cond laser	•		1 5	-	<b>c</b> .	1	
	Kayleigh	and Ra	man scatt	ering, Stimulate	a Ka	iman ef	tect,	coherent	
	surface e	enhanced	Raman S	Spectrosconv. H	vper	Raman	effec	t. Photo	10
	acoustic l	Raman Sp	pectroscop	y, Spin – flip lase	er, Fr	ee electro	on las	er, Laser	
	stark spec	ctroscopy							

# Suggested Readings:

- 1. Marc D. Levenson: Introduction to non-linear laser spectroscopy
- 2. B.B. Laud: Lasers and Non-linear optics
- 3. Orazio Svelto: Principles of Lasers
- 4. Wolfgang Demtröder: Laser Spectroscopy

# Suggested Equivalent Online Courses:

1. MIT Open Learning - Massachusetts Institute of Technology, https://openlearning.mit.edu/

- 2. National Programme on Technology Enhanced Learning (NPTEL), https://www.youtube.com/user/nptelhrd
- 3. SwayamPrabha DTH Channel, https://www.swayamprabha.gov.in/index.php/program/current\_he/8

<b>DISCIPLINE SPECIFIC ELECTIVE (DSE A17(e4))</b>									
Programme: Discipline Specific Elective Year: V Semeste									
Course Tit Code	e Title & Credits Credit distribution of the Eligibility Pr course Criteria of Lecture Tutorial				Pre-requisite of the course				
DSE A17 ( Advanced Condensed Matter Ph IV	e4): l ysics —	3	3	0		Accordi Universi Ordinan	According to University Ordinance		
Course Ou Topics cover States. This	tcomes: red in thi course	s paper o would en	leals about e	xotic solids, soft udents to purs	t matt sue l	er, and T higher st	'hin fil udy a	m and Surface	
Condensed N UNIT	Matter Pl	nysics.		TOPIC				No. of	
UNIT I	Exotic solids, solutio disorde Transit of amo	Exotic solids:Structure and symmetry of liquids, Amorphoussolids, Quasicrystals, Glass transition temperature.Alloys, solidsolutions, substitutional solid solutions, Kondo effect, orderdisorder trandformation, theory of order eutectic phase diagrams.Transition metal alloys.Heat capacity and thermal conductivityof amorphous solids.							
UNIT II	Soft Matter: Definition of Soft matters, Properties, phases and applications of liquid crystals, Polymer, Polymer systems and its Physical aspects, Universal Properties of a single polymer chain, Bio-polymers and applications of Polymer systems.							d s n, <b>10</b>	
UNIT III	Thin film and Surface States: Definition and proprieties of thin films, Difference in the properties of a thin film from it'scorresponding bulk material, Boltzmann Transport equation for diffused Scattering ofelectron in the thin film, surface states, and surface reconstruction, metallic surface.							n n s, <b>10</b>	
UNIT IV	Relaxa spin re hyperfi resonan princip	n a, c 10 g,							

# **Suggested Readings:**

- 1. C. S. Kittel: Introduction to solid state Physics.
- 2. C. S. Kittel: Quantum theory of Solids.

- 3. Poole: Nanotechnology
- 4. K. L. Chopra: Thin Film
- 5. Steinhardt and Ostulund: The Physics of Quasicrystals
- 6. Chandrasekhar: Liquid-Crystal

# Suggested Equivalent Online Courses

- 1. MIT Open Learning Massachusetts Institute of Technology, <a href="https://openlearning.mit.edu/">https://openlearning.mit.edu/</a>
- 2. National Programme on Technology Enhanced Learning (NPTEL), https://www.youtube.com/user/nptelhrd
- 3. SwayamPrabha DTH Channel, https://www.swayamprabha.gov.in/index.php/program/currenthe/8

<b>GENERAL ELECTIVE (GE P 13(a))</b>									
Programme: GENERAL ELECTIVE Year: V Semester: X									
Course T Code	fitle &	Credits	edits Credit distribution of the course Lecture Tutorial			Eligibility Criteria		Pre-requisite of the course	
(GE P13 Medical	(a)): Physics	4	3	1		Accordin Universi Ordinan	ng to ty ce	According University Ordinance	g to y e
Course (	Dutcomes								1 . •.1
The cour	se content co	overs the	e concepts of cs and intr	of Medical Phys	achar	The cour	se pro	ovides stue	dents with
Respirato	orv and Card	iovascul	ar System.	Diagnostic X-R	avs a	nd Nucl	ear N	fedicine P	roduction.
Knowled	ge acquired l	by the co	ourse will be	e of much use in	Med	ical field	and I	R&D secto	or.
Unit	Topic	•							No. of
								Lectures	
Unit I	Mechanics	of Hum	an Body St	tatic, Dynamic	and I	Frictiona	l forc	es in the	
	Douy, Col Temperatur	inpositio .e Temi	n, properi	ales Clinical th	ons ermo	01 D011 meter T	e, п berm	ography	
	Heat theran	v. Crvo	genics in m	edicine. Heat los	sses f	From Boo	lv. Pr	essure in	
	the Body, F	Pressure i	in skull, Ey	e and Urinary Bl	adde	r.	,,		
				-					15
Unit II	Physics of	Respira	tory and C	ardiovascular Sy	ystem	, Body	as a	machine,	
	Airways, E	Blood an	d Lungs ir	iteractions, Mea	suren	nent of	Lung	volume,	15
	Structure an	nd Physi	cs of Alveo	li, Breathing me	chani	sm, Airv	vay re	by Hoort	
	Component	$\frac{1}{5}$ and $\frac{1}{10}$	flow of Bl	ood Laminar a	and 7	is, work o Furbulen	t flov	w blood	
	Pressure, di	rect and	indirect me	ethod of measuring	ng, H	eart sour	nds.	w, 0100 <b>u</b>	
Unit III	Electricity	in the Bo	ody and So	und/Light In Me	dicin	e, Nervo	us sy	stem and	
	Neuron ,Ele	ectrical p	ootentials of	f Nerves, Electric	c sigr	nals from	Mus	cles, Eye	
	and Heart,	Block di	agram and	working to recor	d EN	IG, Norn	nal E	CG wave	15
	torm, Elect	rodes for	r ECG, Am	plifter and Recon	rding	device, l	Block	diagram	
Unit IV	Diagnostic	$g lo recoX_Rave$	and Nuclea	ar Medicine Proc	, Pac	e maker.	onert	ies of X-	<b>`</b>
	Diagnostic	2 <b>1-1</b> 1.ay 5			iucut	n ang pi	open	105 01 A-	

rays, Basic Diagnostic X-ray Machine, X-ray image, Live X- ray image, X-	
ray computed Tomography, Characteristics of Radio activity, Radioisotopes	1
and Radio nuclides, Radioactivity sources for Nuclear medicine.	15

# **Suggested Readings**

- 1. Medical Physics by Department of Physics, St. Joseph's College, Trichy-
- 2. Medical Physics by John R. Cameron and James G. Skofronick, John Wiley & Sons.
- 3. Hand book of Biomedical Instrumentation : R.S.Khandpur, Tata McGraw Hill Publication Co., Delhi, 1987.

#### **Suggested Equivalent Online Courses:**

- 1. MIT Open Learning Massachusetts Institute of Technology, https://openlearning.mit.edu/
- 2. National Programme on Technology Enhanced Learning (NPTEL), https://www.youtube.com/user/nptelhrd
- 3. SwayamPrabha DTH Channel, https://www.swayamprabha.gov.in/index.php/program/current\_he/8

#### OR

	GENERAL ELECTIVE (GE P 13(b2))									
F	Programme: GENERAL ELECTIVE Year: V Semester: X									
	Course Title & Code	Credits	Credit dist course	tribution of the	]	Eligibility Criteria		Pre-requisite of the course		
			Lecture	Tutorial						
	(GE P13 (a)): Photonics-II	4	3	1		Accordir Universi Ordinanc	ng to ty ce	According to University Ordinance		

#### **Course Outcomes:**

- 1. To Gain sufficient knowledge in the area of laser technology
- 2. To Classify optical fibers based on their refractive index profiles
- 3. To Examine the loss mechanisms in optical fibers and to compute various losses
- 4. To Understand the non-linear coefficient and conversion efficiency for various nonlinear phenomena
- 5. To Understand and visualise the different quantum states of light for their applications in the field of quantum technology

Unit	Topic (Theory / Experiments/hands on training)	No. of Lectu res
Unit I	<b>Lasers:</b> interaction of radiation and matter, Einstein coefficients, condition for amplification. Optical resonators, Condition for laser oscillation. Longitudinal and transverse modes of a laser. Some Laser	12
	oscillation. Longitudinal and transverse modes of a laser. Some Laser	12

<b></b>		
	Systems.	
Unit	Fiber Optics: Light propagation in optical fibers, Attenuation and	
II	dispersion; Single-mode fibers, material dispersion. Optical fiber	
	communication, Fiber amplifiers and lasers. Optical fibers in sensing.	12
Unit	Electro-Optic (E.O) Effect: Phase-and amplitude modulators. E.O.	12
III	effect in liquid crystals; LCDs and SLMs. Magneto-optic effect:	
	Faraday rotation. Acousto-Optic (A.O.) Effect: Raman-Nath and	
	Bragg diffraction; A.O. modulators and deflectors.	
Unit	Nonlinear Optics: Second order and third order effects, Phase-	12
IV	matching schemes. Self-phase modulation and optical solitons; Cross	
	phase modulation and four wave mixing. Stimulated Raman scattering	
	(SRS) and stimulated Brillouin scattering (SBS)	
Unit	Quantum Optics: Quantum states of light and their properties,	12
V	Generation and detection of quantum light Entanglement and its	
	applications: quantum computing, cryptography and teleportation.	

#### **Suggested Reading**

- 1. Optics, Ajoy Ghatak, 6<sup>th</sup> edition, Tata McGraw Hill, (2017)
- 2. Optics, Eugene Hecht and A R Ganesan, 4<sup>th</sup> Edition, Pearson Education (2008) (Text)
- 3. An introduction to Fiber Optics, Ghatak and Thyagarajan, Cambridge University Press, 1998.
- 4. Fundamentals of Fibre Optic Telecommunication -B. P. Pal., Wiley Eastern (1994)
- 5. Fibre optic sensors principles and applications B.D.Gupta, New India Publishing, (2006).
- 6. Lasers: Fundamentals and Applications, K. Thyagarajan and Ajoy Ghatak, Springer, 2<sup>nd</sup> edition (2011)
- 7. Nonlinear optics- Robert W Boyd, Academic Press, Elsevier, Inc (Third Edition) (2008),
- 8. Physics of nonlinear optics-Guang S He and Song H Lie, world scientific , London (1999)
- 9. Quantum Optics an Introduction Mark Fox Oxford University press Press (2004)
- Optical Coherence and quantum optics, Leonard Mandel, Emil Wolf, Cambridge University Press, 2<sup>nd</sup> Edition (2013)

<b>GENERAL ELECTIVE (GE P 14)</b>									
Program	rogramme: GENERAL ELECTIVE Year: V Semester: X								
Course Title & Code		Credits	Credit dis course Lecture	tribution of the Tutorial	the Eligibility Pre-1 Criteria cour:		Pre-requi course	e-requisite of the urse	
GE P 14: Basics of Astrophysics		4	3	1	According to University Ordinance		According to University Ordinance		
Course O This cour understar	outcomes: rse will provi nding about t	ide the ba he sun ar	asic propert nd solar sys	ties of stars. In a stem and their pr	dditio operti	n of this es.	, it p	rovides th	e
Unit	Торіс								No. of Lecture
Unit I	Introduction to Astronomy: History of astronomy, Overview of the night sky, basic concepts of positional astronomy: celestial sphere, astronomical coordinate systems, circumpolar stars; sidereal and solar day, Size and time scales in astronomy, Stars physical parameters: Temperature, distance,1515								15
Unit II	The Sun: Solar parameters, Sun's internal structure: Core, Radiative, and converctive zone, Sun's outer structure: photosphere, chromosphere, and corona, Quiet Sun: granulations, supergranulations, plages, faculae, Active Sun: Sunspots, filaments/prominences, solar flares and coronal mass15								
Unit III	Our Solar System: Overview of Solar system, Solar system planets, Formation of Solar System, Planetary Atmospheres: Structure, Composition, planet atmospheres, extrasolar planets, Earth-Moon System,15Comets Meteorites Interplanetary dust15								
Unit IV	Comets, Meteorites, Interplanetary dust <b>Telescopes and instrumentation :</b> Telescope mounting, plate scale, resolving power, and diffraction limits of telescopes. Optical telescopes: Galilean, Newtonian, Cassegranian, Hubble space telescope, Photo- multiplier tube, charge-coupled devices (CCDs)							15	

# **Suggested readings**

1. Fundamental Astronomy, H. Karttunen et al., Springer Berlin, Heidelberg

- 2. Modern Astrophysics, B. W. Carroll and D. A. Ostlie, Addison-Wesley Publishing Co.
- 3. Introductory Astronomy and Astrophysics, M. Zeilik and S. A. Gregory, Saunders
- 4. College Publishing.
- 5. Astronomy in India: A Historical Perspective, T. Padmanabhan, Springer

#### **Suggested Equivalent Online Courses:**

- MIT Open Learning Massachusetts Institute of Technology, <u>https://openlearning.mit.edu/</u>
  National Programme on Technology Enhanced Learning (NPTEL),
- https://www.youtube.com/user/nptelhrd
- 3. SwayamPrabha DTH Channel,
- 4. https://www.swayamprabha.gov.in/index.php/program/current\_he/8

	PRACTICALS									
Progra	Programme: PRACTICALS Year: V Semester: X									
Cours Code	se Title &	Credits	Credit disti course Practicals	ribution of the Tutorial	of the Eligibility Criteria ial		ity a	Pre-re course	quisite of the	
Practio	cals	4	4	0		Accordi Univers Ordinar	ng to ity ice	Accore Univer Ordina	ling to rsity ance	
Course The st physic advance	se Outcomes: audent will hav as with clear un- ced experiment	e adequ derstand s based	ate knowled ing of the th on their spe	ge to perform t leory behind the cialization paper	he ex exper	perimen riment. S	its of Studer	differen nt will h	nt fields of know about	
UNI T			,	ГОРІС					No. of Lectures	
	List of Exper 1. Study of re 2. Study of of 3. Study of T 5. 1 of 16 De 6. Study of M 7. Study of L 8. Study of C 9. Study of a 10.Study of a 10.Study of d Master slav 11.Study of M 12.Study of M 14.Study of IC 15.Microwave 16.Shift Regis 17.Fiber Option	riments: egulated perationation imer (55 coder/En fultiplex ogic gat comparation comparation different ve). licroproo C- Based e experin sters cs comm	(a) Advance power supp al amplifier (5). 4. A to I ncoder (5). 4. A to I ncoder (6). 4. A to I ncoder (7). 4. A to I ncoder (7). 4. A to I ncoder (7). 4. A to I ncoder (8). 4. A to I (8). 4. A to I (8). 4. A to I (8). 5. A to I (8). 5	ced Electronics ly (723). (741). D and D to A co blexer t types) oder ency modulation ircuits (RS, JK, and sequential ) 13. Study of Si ply	nverto ns an , Dk circui CR, I	er ddemod type, T- its DIAC,TF	ulatio type, RIAC	ns.	60	
	List of Exper 1. Study of H 2. Study of co 3. Study of t square dent 4. Study of st 5. Study of E 6. Study of va 7. Study of so 8. Study of so 9. Measuring	riments: Subble's constant of he station sity distring ar clusted xtinction wriability lar limb lar diffent extension	(b) Astrop law and age lensity neutr c parameters ibution er from a given coefficient of stars Darkening rential rotati n of the atm	hysics of Universe (fro on star s of a Neutron ven data s on. osphere in B, V	om gi Star and R	ven data model	) withir	nverse	60	

- 10. Measuring the colour of star using differential photometer data
- 11. Determination of age star cluster
- 12. Determination of reddening in a star cluster.

# List of Experiments: (c) High Energy Physics

- 1. Characteristic curve of a GM Detector and verification of inverse square law .
- 2. Characteristic curve of a GM Detector and Absorptioncoefficient of a using aluminum GM Detector.
- 3. Energy spectrum of gamma rays using gamma rayspectrometer.
- 4. Absorption coefficient of aluminum using gama-rayspectrometer.
- 5. Characteristics of Scintillation Detector.
- 6. Study of gama-gama unperturbed angular correlations.
- 7. Study of particle tracks using a Nuclear Emulsion Detector.
- 8. Classification of tracks in interaction with Nuclear Emulsion and determination of excitation energy.

# List of Experiments: (d) Spectroscopy

1. Study of the vibrational levels of Iodine.

- 2. Evaluation of wavelength of He- Ne laser (green/ red) by constructing diffraction pattern with the help of (a) diffraction grating and (b)vernier callipers.
- 3. Measurement of absorptivity coefficient oscillator strength of a known sample using UV-Visible spectrum.
- 4. Determination of the non-radiative decay rates and intrinsic life-time of a given fluorescent molecule.
- 5. Determination of Stoke shift and change in dipole moment using Solvatochromic shift method.
- 6. Determination of the quantum yield of known samples using Steady state measurements.
- 7. To determine the slit width with the help of double slit experiment.

# List of Experiments: (e) Condensed Matter Physics

- 1. Determination of elastic constant of crystals by optical methods.
- 2. Study of fluorescence spectra of a given compound.
- 3. Study of colour centers.
- 4. Determination of lattice parameters using powder method.
- 5. Determination of hall coefficient using Hall effect.
- 6. Determination of Energy gap of a semiconductor by four probe method.