A.VEERIYA VANDAYAR MEMORIAL

SRI PUSHPAM COLLEGE (AUTONOMOUS)

POONDI-613 503, THANJAVUR (DT)

SYLLABUS

M.Sc., Physics

(From 2020 - 2021 onwards)

Programme Outcome of M.Sc. Physics

Postgraduate students attain an in-depth knowledge on the fundamental theoretical concepts, experimental methods of measurement and characterization of physical quantities and systems. They acquire competency through self-guided and continuous learning, promoting professionalism and personal development. Students acquire laboratory skills to carry out experiments make observations, analyse and interpret the results and make valid conclusions.The students acquire the acumen to combine various academic disciplines and professional specializations across borders to redefine problems and explore solutions based on the understanding of the complex situation and gain knowledge that help to develop necessary skills and has the ability to engage in independent and continuous learning, in the broader context of scientific advancements and technological developments.

Programme Specific Outcome of M.Sc. Physics

On completion of M.Sc., Physics, students will acquire knowledge in the areas which include materials science, quantum mechanics, micro controller programming etc. Students will gain practical knowledge for the theoretical concepts they study throughout the Programme. They will be capable to enter into the research field.

M.Sc., Physics (2020-2021) onwards

S. No	Semester	Category	Course Code	Title of the Course	Maximum Marks			Minimum Marks For Pass			Hours Week	Credits
					CIA	E.E	Total	CIA	E.E	Total		
1	I	Core	20P1PHC1	Classical Dynamics	25	75	100	10	30	50	6	5
2		Core	20P1PHC2	Mathematical Physics -I	25	75	100	10	30	50	6	4
3		Core	20P1PHC3	Solid State Physics	25	75	100	10	30	50	6	4
4		Core	20PIPHCP1	Practical -I	40	60	100	16	24	50	6	4
5		Elective	20P1PHEL1A/ 20P1PHEL1B	Nanotechnology /Laser and Fiber Optic Communication	25	75	100	10	30	50	6	4
6	II	Core	20P2PHC4	Electromagnetic Theory	25	75	100	10	30	50	5	5
7		Core	20P2PHC5	Mathematical Physics -II	25	75	100	10	30	50	5	4
8		Core	20P2PHC6	Electronics and Instrumentation	25	75	100	10	30	50	5	4
9		Core	20P2PHC7	Numerical Methods in Physics	25	75	100	10	30	50	5	4
10		Core	20P2PHCP2	Practical -II	40	60	100	16	24	50	6	4
11		Elective	20P2PHEL2A/ 20P2PHEL2B	Thin Films and Crystal Growth Medical Physics	25	75	100	10	30	50	4	4
		MOOC		Massive Open Online Course	-	-	-	-	-	-	-	Extra
12	III	Core	20P3PHC8	Statistical Mechanics	25	75	100	10	30	50	5	4
13		Core	20P3PHC9	Quantum Mechanics - I	25	75	100	10	30	50	5	5
14		Core	20P3PHC10	Microcontroller- Programming and Applications	25	75	100	10	30	50	5	4
15		Core	20P3PHC11	Atomic and Molecular Spectroscopy	25	75	100	10	30	50	4	4
16		Core	20P3PHCP3	Practical -III	40	60	100	16	24	50	6	4
17		EDC	20P3PHEDC	Extra Disciplinary Course	25	75	100	10	30	50	4	-
			20P3PHPD	Communicative Skill and Personality development	-	-	-	-	-	-	1	-
		MOOC		Massive Open Online Course	-	-	-	-	-	-	-	Extra

18	IV	Core	20P4PHC12	Quantum Mechanics -II	25	75	100	10	30	50	6	4
19		Core	20P4PHC13	Nuclear and Particle Physics	25	75	100	10	30	50	6	5
20		Core	20P4PHCP4	Practical -IV	40	60	100	16	24	50	6	4
21		Elective	20P4PHEL3A/ 20P4PHEL3B	Object Oriented Programming with C++/ Biomedical Instrumentation	25	75	100	10	30	50	5	4
22		CN	20P4PHCN	Comprehensive Test			100			50	2	2
			20P4PHCPD	Communicative Skill and Personality Development	-	-	-	-	-	-	1	-
23		PR	20P4PHPR	Project	40	60	100	--	--	50	4	4
			20P4PHIN	Internship/Industrial visit								Extra credit
Total					**2300**						**120**	**90**

M.Sc. Physics (2020 - 2021) onwards

Paper Code	Total No. of Papers	Total Marks	Total Credits	Classification
Core	17	1700	72	✓
Elective	03	300	12	✓
E.D.C	01	100	---	✓
Project	01	100	04	✓
Comprehensive Test	01	100	02	✓
Communicative Skill and Personality Development	---	---	---	X
Total	**23**	**2300**	**90**	

GRADING OF COURSE PERFORMANCE (10 POINT SCALE)

Aggregate Marks	Grade	Grade Point
96 and above	S+	10
91-95	S	9.5
86-90	D++	9.0
81-85	D+	9.0
76-80	D	8.0
71-75	A++	7.5
66-70	A+	7.0
61-70	A	6.5
56-60	B	6.5
50-55	C	6.0

Comprehensive Test: Objective type question pattern with 100 compulsory questions carrying 100 marks to be answered in 3 hours with 2 credits. The portion is entire core courses.

Field Visit/Industrial Visit/Hands on training programme having minimum 15 hours of contact time as Extra Credit course is introduced for I year PG students to gain experimental learning

Evaluation of the visit report will be held at the end of IInd semester

Components of Evaluation

Internal Marks 40

External Marks 60

Total 100

Internship: Students have to undergo in-plant training in industry or organization where any process related to Physics is going on. The period of training should be minimum 10 days. Students have to submit the report of the training underwent with the certificate from the concerned authority of the Industry/Organization.

Industrial Visit: Students have to attach a report on the industrial visit made with the counter signature of staff in charge for the industrial visit while submitting the industrial visit report.

MOOC: Massive open online course is introduced in the second and third semester as an extra credit course from this academic year 2020-2021. Students can avail any one or more of the courses available in MOOC to equip themselves their skill and knowledge.

A.VEERIYA VANDAYAR MEMORIAL SRI PUSHPAM COLLEGE
(AUTONOMOUS),POONDI, THANJAVUR DIST.
Question Pattern for UG and PG Programmes for students to be admitted during 2020 – 2021 and afterwards

Total Marks: 75

QUESTION PATTERN

SECTION – A
(Question 1 to 10)

10 x 2 = 20 Marks

1. Short Answer Questions
2. Two Questions from each units (All are answerable)

SECTION – B
(Question 11 to 15)

5 x 5 = 25 Marks

1. 5 Paragraph type questions with "either / or" type choice.
2. One question from each unit of the Syllabus.
3. Answer all the questions.

SECTION – C
(Question 16 to 20)

3 x 10 = 30 Marks

1. 5 Essay type questions – any three are answerable.
2. One questions from each unit of the Syllabus.

Semester	Course Code	Title of the Course	Hours of Teaching/week	No. of Credits
I	**20P1PHC1**	**Core – Classical Dynamics**	**6**	**5**

Objectives:

- To gain knowledge about Lagrangian and Hamiltonian formulations.
- To introduce the concepts of rigid body dynamics and relativisticmechanics.
- To introduce the basic concepts of nonlinear dynamics.

Unit – ILagrangian Formulation

Constraints – Generalised coordinates – Principleof Virtual work– D'Alembert's principle –Lagrange'sequations of motion – conservative and non-conservative forces – Applications: one dimensional harmonic oscillator – Conservationtheorems and symmetry properties – Centralforce and motion in a plane – Equationof motion under central force and first integrals – Differentialequation for an orbit – Inverse square law of force – Virialtheorem.

Unit –II Hamiltonian Formulation

Hamiltonian function (H) – Physical significance–Hamilton'scanonical equations of motion – Applications: Simple pendulum – Linear harmonic oscillator –Motion of a particle in a central force field – Hamilton'svariational principle – Proof – Derivation of Lagrange's equations –Principle of Least Action –deduction – Canonical Transformations – Generatingfunction –Bi-linear invariance conditions –Poisson'sand Lagrange's brackets – Hamilton's Jacobi method.

Unit –III Rigid body Dynamics and Small Oscillations

Independent coordinates– Euler'sangles – Components of Angular velocity in terms ofEuler's angles –Angular momentum of a rigid body – Moments of inertia tensor–Euler's equations of motion for rigid body – Theory of small oscillations – Frequencies of free vibration and normal coordinates –Vibrationsof a linear tri-atomic molecule.

Unit –IV Relativistic Mechanics

The basic postulates of special theory of relativity – Variation of mass with velocity – relativistic energy – Mass-energy equivalence – Force in relativistic mechanics – The Lagrangian and Hamiltonian of a particle in relativistic mechanics –Minkowski space and Lorentz transformations – Four vectors – position, momentum and acceleration four vectors.

Unit –V Nonlinear Dynamics

Dynamical systems: Linear and nonlinear forces –Mathematicalimplications of nonlinearity: Linear and nonlinear systems – Linearsuper position principle – Definition of nonlinearity – Effectof nonlinearity – Freeoscillations –Dampedoscillations –Dampedand forced oscillations –Linearvs. nonlinear oscillators –Autonomous and non-autonomous systems – Equilibriumpoints – classificationof equilibrium points – Logisticmap–Definition of chaos – Solitarywaves & solitons – KDVequation.

Course Outcomes:

On successful completion of the course students will able to

- acquire knowledge on Lagrangian and Hamiltonian formulations.
- getbetter understanding on relativistic mechanics, rigid body dynamics.
- gain the concepts of nonlinear forces, chaos and solitary waves.
- use classical concepts to solve quantitative problems in Applied Physics.

Books for Study

For unit I to IV:

1. Classical mechanics – Goldstein, Narosa Publications house, New Delhi.
2. Classical Mechanics - N. C. Rana and P. S. Joag, Tata McGraw Hill, New Delhi.
3. Classical Mechanics – J. C. Upadhyaya, Himalaya Publishing House.

For unit V

4. Nonlinear dynamics: Integrability, Chaos & Patterns - M. Lakshmanan and S. Rajasekar, Springer India,(II edition).

Books for Reference

1. T. L. Chow, classical Mechanics, John-Wiley, New York(1985)
2. R. Bhatia, classical Mechanics, Narosa publications House, New Delhi.

Semester	Course Code	Title of the Course	Hours of Teaching/week	No. of Credits
I	**20P1PHC2**	**Core – Mathematical Physics I**	**6**	**4**

Objectives:

- To introduce knowledge about vectors and tensors.
- To gain the idea about the differential equations and special functions.

Unit –I Vector Analysis

The Scalar and Vector fields – Gradient – Divergence– Curl and Laplacian in terms of orthogonal and curvilinear coordinates – Rectangular, cylindrical and spherical coordinates – Integration of vector – line integrals, surface integrals and volume integrals – Gauss divergence theorem – Stoke's theorem – Green's theorem.

Unit –II Tensor Analysis

Cartesian tensors – addition, subtraction and multiplication (inner and outer product) of tensors – Rank – Kronecker delta symbol – Covariant, Contravariant and mixed tensors – Symmetric and antisymmetric tensors – QuotientLaw – Contraction – Riemannianspaces – Christofell's three index symbols – Lawof transformation for Christofell's symbols – Examples from Physics.

Unit –III Matrices

Solution of linear algebraic equation – Rank of a matrix – Characteristic equation of a matrix – inverse of matrix – Eigen values and eigenvectors – Traceof matrix – Clayey-Hamilton theorem – Reductionof a matrix to diagonal form (Diagonalization) – Hermitian and unitary matrices – Matrices in Physics: Derivations of spin matrix and Dirac matrices.

Unit –IV Ordinary differential equations

Definitions – Common differential equations in Physics – Linearfirst order differential equations – Elementarymethods – Linear second order differential equations with (i) constant and (ii) variable coefficients methods –Sturm-Liouville's differential equation.

Unit - V Partial differential equations

Linear Partial differential equations –Separationof variables – Laplace, wave and heat equations in two and three dimensions – Helmholtzequation in Cartesian, spherical polar and cylindrical polar coordinates – Choice of coordinate system and separability of a partial differential equation.

Course Outcomes:

On completion of the course, students

- acquire knowledge and problemsolving skills on vectors analysis.
- gain knowledge and problemsolving skills on tensors analysis.
- utilize the concepts of differential equations and special functions in successive courses.
- acquire concepts of vectors and tensors can be effectively used in modern continuum mechanics.

Books for Study

1. Mathematical Physics – B. D. Gupta, Vikas publishing house pvt ltd.
2. Mathematical Physics – Sathya Prakash, Sultan Chand & Sons, New Delhi.
3. Matrices and Tensors in Physics – A.W. Joshi, Wiley Eastern publishers, New York, 1975.
4. Mathematics for Physicists – Susan M. Lea, Thomson Brooks/Cole, International Students Edition.(Only for Indian subcontinent only).

Books for Reference

1. Vector Analysis – Schaum's outline series.
2. Applied mathematics for engineers and physicists (TMH, Singapore,1967)
3. Mathematical physics – A. K. Ghattak, T. C. Goyal and S. J. Chua, Macmillan, New Delhi, 1995.

Semester	Course Code	Title of the Course	Hours of Teaching/week	No. of Credits
I	**20P1PHC3**	**Solid State Physics**	**6**	**4**

Objectives:

- This course deals with theoretical aspects of band theory, lattice vibration, dielectrics, ferroelectrics and new materials
- To gain knowledge on crystal symmetry and imperfections

Unit – I Crystal Structure and Imperfections

Crystal symmetry – Bravais lattices – Miller indices –Reciprocal lattice – X-ray diffraction – Bragg's law – Experimental methods of x-ray diffraction: Rotating crystal method and Debye – Scherrer powder method – Classificationof imperfections: Point defects – Line defects – Surface defects – Volume defects – Burger's vector – Schottky defects and Frenkel defects – Derivation– colour centres.

Unit – II Conductors and Semiconductors

Conductors: Free electron theory – Classical and Quantum theory – Band theory of solids – Density of states – K-space – Bloch theorem – Kronig-Penny model – Construction of Brillouin Zones

Semiconductors: Intrinsic and Extrinsic semiconductors – Band gap –Effective mass – Carrier concentration – Electrical conductivity – Wiedmann-Franz law – Hall effect – Determination of type of conductivity – Carrier concentration – Mobility –Resistivity.

Unit –III Magnetic and Dielectric properties

Langevin's classical theory of diamagnetism and paramagnetism – Quantum theory of paramagnetism –Weiss theory of ferromagnetism – Origin of domains – Hystersis – explanation on the basis of domain theory – Curie temperature and Neel temperature.

Dielectrics– Macroscopic electric field – Local electric field – Clausius-Mosotti relation - Dielectric constant and polarizability – Types of polarization – Determination of dielectric constant – Parallel plate method.

Unit – IV Superconductivity

Zero resistance – Behaviour in magnetic field – Meissner effect – Type I and Type II superconductors – Entropy – Isotopic effect – Thermal conductivity – London equations – Penetration depth – Josephson Effect – AC and DC – Quantum tunneling – BCS theory – high Tc super conductors – Applications of superconductors –Maglev – SQUID.

Unit –V Optical properties and new materials

Photoconductivity – Simplemodel of photoconductor – Traps –Influence of traps – Luminescence and its types – Photoluminescence – Cathodoluminescence – Chemi-luminescence and Thermo-luminescence and glow curve.

Shape memory alloys – Types – crystal structure –Temperature induced transformation – Stress induced transformation – Functional properties – Shape memory effect – Super elasticity – Applications.

Course Outcomes:

On completion of the course, student would be able to

- acquire basic knowledge in crystallinematerials.
- understand the electrical and magnetic properties of materials.
- gain the knowledge in new materials.
- describe the structure and physical properties of crystalline substances.

Books for Study

1. Introduction to Solid State Physics – Charles Kittel, John Wiley,2004.
2. Solid State Physics – Gupta & Kumar, K. Nath & Co, Meerut, 2000.
3. Solid State Physics – Singhal, Kedarnath Ramnath & Co, Meerut,2005.
4. Material Science – M.Arumugam.
5. Materials Science – S. L. Kakani and Amit Kakani

Books for Reference

1. Elementary solid state physics – Ali Omar, Addison Wesley Publishing Company, 1975.
2. Elements of Solid State Physics – J.P.Srivastava, Second Edition
3. Solid State Physics and Electronics – A.B.Gupta& Nurul Islam.

Semester	Course Code	Title of the Course	Hours of Teaching/week	No. of Credits
I	**20P1PHCP1**	**Core – Practical – I**	**6**	**4**

Objective:

- To gainpracticalskills on general experiments in optics, solid state physics etc.

List of Experiments – Any10 Experiments

1. Determination of q, n, σ by forming Elliptical fringes.
2. Determination of q, n, σ by forming hyperbolic fringes.
3. Determination of Stefan's constant.
4. Hartmann's formula – Wavelength calculation.
5. Determination of Dielectric constant using Lecher wire.
6. Determination of e/m by magnetron method.
7. Determination of Polarizability of liquids using Spectrometer.
8. Determination of Charge of an electron by Spectrometer.
9. Identification of Prominent lines by Spectrum Photograph – Iron Arc Spectrum
10. Identification of Prominent lines by Spectrum Photograph – Copper arc Spectrum
11. Ultrasonic Diffraction – Velocity and Compressibility
12. Determination of Rydberg's Constant using Spectrometer.
13. Determination of e/m by Thomson method.
14. Determination of Conductivity of thin film sample – four probe method.
15. Determination of wavelength - Laser diffraction through gating.

Course Outcomes:

- Students acquire skills on carrying out general experiments in optics, solid state physics etc.
- Students can do Young's modulus experiment using elliptical and hyperbolic fringes.
- Students can determine the wavelength of prominent lines using spectrometer.

Semester	CourseCode	Title of the Course	Hours of Teaching/week	No. of Credits
I	**20P1PHEL1A**	**Elective – Nanotechnology**	**6**	**4**

Objective:

- To gain the knowledge about Nanotechnology.

Unit - I Background and emergence of Nanotechnology

Nanotechnology –Emergence of nanotechnology – Nanomaterials – Classification of nanomaterials based on composition, number of dimensions in nanoscale and morphology – Characteristics of nanomaterials – Surface to volume ratio – Its effect on properties of nanomaterials – Nanoparticles–Nanoclusters –Nanocomposites – Nanohybrids – An overview on the applications of nanomaterials.

Unit - II Quantum dots and Carbon nanotubes

Quantum dots (QDs) – Quantum confinement –Production and applications of QDs – Quantum wires – Quantum wells –Carbon allotropes – Discovery of C_{60} –Fullerenes – Types of fullerenes – Bucky balls – Carbon nanotubes (CNTs) – Single walled CNTs – Multiwalled CNTs – Properties of CNTs –Synthesis of CNTs –Plasma-arc discharge method – Laser ablation technique – Chemical vapour deposition method – Potential applications of CNTs.

Unit - III Preparation of nanomaterials

Nanomaterials – Preparation– Top-down method – Ball milling– Photolithography– Electron beam lithography – Molecular beam epitaxy – Bottom-up technique – Soft-chemical method – Sol-gel synthesis – Electro chemical deposition – Atomic layer deposition-Molecular self assembly–Langmuir-Blodgett film (2D nanostructure) preparation.

Unit - IV Analytical techniques for nanomaterials characterization

Structural characterization – Principle of X-ray powder diffraction – Determination of structural parameters – Optical studies – UV-Vis-NIR spectrometry – Band gap determination by Tauc's plot method – FTIR spectroscopy –Surface morphological analysis– Scanning electron microscopy (SEM) – Scanning tunnelling microscope (STM)– Transmission Electron Microscope (TEM)–Photoluminescence spectroscopy –X-ray photoelectron spectroscopy (XPS).

Unit - V Applications of nanomaterials

Nanoelectronics – Molecular diodes and transistors – Quantum electronic devices – Nanophotonics –Photonic crystals –Nanoelectromechanical systems (NEMS) –Nanomaterials in energy conversion and storage – Nanomaterials as antibacterial agents – Nanomaterials as photocatalysts –Energy efficient windows – Nanomaterial in industrial applications – Bio-medical applications : Targeted drug delivery –Nanomaterial based radiation therapy – Photodynamic therapy (PDT) – Tissue engineering –Bioimaging.

Course Outcomes:

After successful completion students

- acquire knowledge on fundamentals of Nanomaterials.
- gaintheknowledge in properties, preparation methods and applications of nanomaterials.
- would realize employment opportunities exist in medical, healthcare industry research, environment industries.
- will get employment opportunities on pharmaceutical, agriculture, product development and advising, communication and media.

Books for Study

1. K. Ravichandran, K. Swaminathan, P. K. Praseetha, P. Kavitha 'Introduction to nanotechnology', Jazym Publications, Tiruchirappalli.
2. Essentials of Nanotechnology, Preedep.
3. Nanostructures and Nanomaterials, synthesis, properties and applications, Imperial college press, London.
4. Nanoscience and nanotechnology K.P.Mathur, 1stEdition 2007, RajatPublications, NewDelhi

Books for Reference

1. M.Ratner,Nanotechnology; A Gentle introduction, Prentice – Hall ISBN 0-13-101400-5, 2003.
2. Nanotechnology; Basic Science and Emergining Technologies, CRC Press
3. Charles P.Poole Jr and Frank J. Owens. "Introduction to Nanotechnology" Wiley, 2003.
4. A.S.Edelstein and R.C. Cornmarata, Nanomaterials; synthesis, Properties and Applications, 2 Ed, Iop (U.K), 1996.

Semester	Course Code	Title of the Course	Hours of Teaching/week	No. of Credits
I	**20P1PHEL1B**	**Elective – Laser and Fiber Optic Communication**	**6**	**4**

Objectives:

- To give general ideas on Lasers.
- To gain the knowledge about fiber optics.

Unit-I Principles of Laser

Basic principle of laser – Laser characteristics – Coherence – Temporal coherence principles of laser – Absorption – Spontaneous emission – Stimulated emission – Einstein's theory of stimulated emission – Population inversion – Methods of achieving population inversion – Threshold condition – Pumping – Pumping methods – Pumping schemes.

Unit – II Types of Lasers

Types of lasers – solid state lasers – Ruby lasers – construction and working – Semiconductor laser – GaAslaserGas lasers: HeNe laser – working principle – energy level diagram –Argon ion laser –Heliumcadmium laser –Moleculargas laser – CO_2 laser – principle – constructionand working – Continuouswave and pulsed lasers – Nd-YAGlaser– Qswitching –Mode locking –Frequencydoubling –Tunablelaser –Liquid lasers.

Unit – III Laser Applications

Laser materials – preparationand testing – Applicationsof lasers –Interferometery – Testingof optical system –Lasersin communication – incomputers – weapons –medical applications –industrial applications.Holography – Hologram–Recordingand reconstruction of hologram – Characteristics of hologram – Classifications – Applications.

Unit – IV Optic Fibers

Fiber optic revolution – Characteristicsof optical fiber – Acceptance angle – Numerical aperture – Propagation of light through optical fiber – Theory of mode formation – Classification of fibers – Step index and graded index fibers – Single mode and multi modefibers – Losses in fibers – Fabrication techniques of fibers.

Unit – V Fiber optic communication

Source and detectors for fiber optic communication -LASER and LED – Modulation methods – Principle of optical detection – Pin and Photo detectors – Noise – Design of fiber optic communication system.

Course Outcomes:

On completion, students will

- acquire the knowledge on various types of LASERS and Fiber optic communications.
- have awareness on the operating principles of various lasers.
- get employment opportunities in industries such as Aerospace & Aviation division, Communications, Medical / Biotechnology, Military, Photonics, Chemical, Pharmaceuticals.

Books for Study

1. Laser theory and applications, K. Thyagarajan, Ajay Ghatak, Cambridge University, 1999.
2. An introduction to laser theory and applications, M. N. Avadhanulu, S. Chand and Co., New Delhi 2001.
3. Introduction to Fiber optics K. Thyagarajan, Ajay Ghatak, Cambridge University, 1999.

Books for Reference

1. Lasers and their applications- Besley- Taylor &Fancis. London
2. Lasers and their applications- J.Wilson, J.F.B.Hawkes- Prentice Hall- 1987.
3. Optical Fiber Communications, John. M. Senior, Cambridge University press, 1966.

Semester	Course Code	Title of the Course	Hours of Teaching/week	No. of Credits
II	**20P2PHC4**	**Core – Electromagnetic Theory**	**5**	**5**

Objectives:

- To acquire the knowledge in Electrostatics and Magnetostatics.
- To introduce the knowledge about the electromagnetic waves and relativistic electrodynamics.

Unit – I Electrostatics

Gauss law – Applications –Solid cylinder and sphere – Coulomb's Theorem – Electric field – Divergence of E – Curl of E – Scalar potential – Multipole expansion of electric field –Poisson's equation – Laplace's equation – Uniqueness theorem – Green's theorem – Formal solution of electrostatic field – Boundary value problems using Green's function – Method of electrical images.

Unit – II Magnetostatics

Biot-Savart's law – Application to straight conductor and solenoid –Ampere's circuitallaw – Magnetic vector potential – Magnetic scalar potential – The multipole expansion of the vector potential – Magnetization –Magnetic moment –Susceptibility and Permeability.

Unit – III Time Varying Fields

Electromagnetic induction – Equation of continuity – Displacement current – Derivation of Maxwell's electromagnetic equations –Gauge transformation – Lorentz and Coulomb's Gauge transformations – Poynting's theorem.

Unit – IV Electromagnetic waves

Plane wave in a non - conductingmedium – Boundaryconditions – Reflectionand transmission of e. m. wave at oblique incidence – Totalinternal reflection – Brewster's angle –Frequency dispersion – Characteristics of dielectrics and conductors – Retarded potentials – Lienard-Wiechart's potentials.

Unit – VRelativistic Electrodynamics

Lorentz transformation for space and time in four vector form – Invariance of D'Alembertian operator – Invariance of Maxwell's field equations in terms of four vectors – Electromagnetic field tensors – Maxwell's equations in co-variance four tensors form – Lorentz transformation of electromagnetic fields – Invariance of electromagnetic field.

Course Outcomes:

At the end of the course, students

- acquire knowledge and problem solving skills on electrostatics.
- acquire knowledge and problem solving skills on magnetostatics.
- gain knowledge in relativistic electrodynamics.
- will be able to equip their skill towards the technologies involving electromagnetic spectrum.

Books for Study

1. Introduction to Electrodynamics – David J. Griffiths, PHI learning, 2009.
2. Electromagnetic waves and radiating fields – Jordon and Balmain, Krieger publishing company, 2003.
3. Electrodynamics – Chopra and Agarwal, K. Nath & Co, Meerut.
4. Electromagnetic theory and Electrodynamics – Sathya prakash, Kedarnath Ramnath & Co,Meerut.
5. Electrodynamics – Gupta, Kumar and Singh, Pragati Prakashan Publishers, Meerut.

Books for Reference

1. Classical Electrodynamics – J. D. Jackson, Wiley Eastern publishing ltd.
2. Introduction to electromagnetic fields and waves – Corson and Lorraine, W. H. Freemanand company, New York.

Semester	Course Code	Title of the Course	Hours of Teaching/week	No. of Credits
II	**20P2PHC5**	**Core – MathematicalPhysics - II**	**5**	**4**

Objectives:

- To gain the knowledge in complex variables, matrices, vector spaces and Green's functions.
- To introduce the concepts of Fourier transform and group theory.

Unit - I Complex Variables

Functions of a complex variable – Single and many valued functions – Analytic functions – Cauchy-Riemann equation – Conjugate functions – Complex line integrals – Cauchy's integral theorem – Integral formula – Taylor and Laurent series expansion – Poles, Singularities and Residues – Cauchy's residue theorem and its applications in evaluating definite integrals andimproper real integrals.

Unit - II Vector Spaces and Green's Functions

Vector Spaces: Definition – Linear dependence and linear independence of vectors – Basis – change of basis – Inner product space – Schmidt's orthogonalisation method – Schwarz's inequality – Hilbert space.

Green's Functions: Definition, construction and uses – Symmetry properties – Expression for Green's function in terms of Eigen values – Green's functions for simple and second order operators.

Unit – IIIFourier and Laplace transforms

Fourier transform – Finite and infinite – Sine and cosine transform – complex transform – Faltung's theorem – Properties of fourier transform – Application in wave equations.

Laplace transform – Important Laplace transforms – Inverse laplace transforms - Properties – Convolution theorem – Evaluation of inverse Laplace transforms by Convolution theorem – Applications–Solution of differential equation with constant coefficients and variable coefficients.

Unit –IVSpecial functions

Gamma and Beta functions – Legendre, Bessel, Laugerre and Hermite differential equation and their solutions – Generating functions – Rodrigue formula –Important recurrence relations – Orthogonality relations.

Unit – V Group Theory

Basic definition – Multiplication table – Sub groups, cossets and classes – Direct product groups – Point groups and space groups –Isomorphism andhomomorphism – representation theory –Reducible and irreducible representations – Schurz's lemma – The greatorthogonality theorem – Character table for C_3V point groups – Rotation groups – SU(2),SU(3) andO(3) groups.

Course Outcomes:

At the end of the semester, students can

- acquire knowledge and problem solving skills in Vector spaces.
- acquire knowledge and problem solving skills in Fourier transform.
- gain the concepts of group theory and interpret in spectroscopic studies.
- effectively use complex numbers, apply the Cauchy-Riemann equations to test for differentiability, calculate with series and test for their convergence and calculate complex integrals using residues.

Books for Study

1. Mathematical physics – B. D. Gupta, Vikas publishing house Pvt ltd.
2. Mathematical physics – Sathyaprakash, Sultan Chand & Sons, New Delhi.
3. Matrices and tensors in physics – A.W.Joshi, Wiley Eastern publishers, New York, 1975.

Books for Reference

1. Advanced Engineering Mathematics, E. Kreyzig (Wiley Eastern publishers, New York,(1999).
2. Integral Transforms, J. K. Goyal, K. P. Gupta, Pragati Prakashan Publishers, 2002.
3. Applied mathematics for engineers and physicists (TMH, Singapore, 1967)

Semester	Course Code	Title of the Course	Hours of Teaching/week	No. of Credits
II	**20P2PHC6**	**Core – Electronics and Instrumentation**	**5**	**4**

Objectives:

- To gain the knowledge in analog and digital electronics
- To introduce the concepts ofinstrumentation.

Unit - I AnalogElectronics

Precision and accuracy – Introduction: Op-amp – Op-amp based circuits: Integrator– Differentiator – Summing – Differential–Logarithmic amplifier –Comparatorsand controls – Analog simulation – Wein Bridge oscillators using op-amp – Instrumentation Amplifier – Solid state switching circuits – 555 Timer – Discrete and integrated voltage regulators.

Unit – II Digital Electronics

Flip Flop: SR – JK – M/S – D – TFlip Flop– Register: Left shift and Right shift register – Counter: Modulus of a counter – MODX counter (Feedback only) – 4bit asynchronous Ripple counter – Ringcounter – A/D Convertor: Simultaneous conversion – Dualslope method – D/Aconvertor: Variable resistor network – R2Rmethod.

Unit – III Optoelectronics

Semiconductor lasers – Optical fiber and characteristics – Modes of propagation – losses in fibers–Fiberoptic communication, Optoelectronic modulation and switching devices – Photo detectors – Optocoupler and isolators – Optical data storage techniques.

Unit – IV Instrumentation - I

Static characteristics – Errorin measurement – Errors: Gross error – Systematicerror – Randomerror – Dynamiccharacteristics –Statistical analysis –Permanentmagnetic moving coil –Taut band instrument – Electrodynamometer –Movingiron type instrument –LCD – Dotmatrix display – Liquidvapour display.

Unit – V Instrumentation – II

Qualities of measurements – Digital instruments: Digital multimeter – Transducers, strain gauge, LVDT, Load cell, Piezo electric transducers, Temperature transducers, Flow meters – Recorders and transducers – Signal conditioning – Data acquisition, conversion and transmission – Digital signal processing.

Course Outcomes:

Upon completion of the course, students will be able to

- acquire knowledge analog and digital Electronics
- get better understanding in instrumentation.
- design and analyze small signal amplifier circuits applying the biasing techniques.

Booksfor Study

1. B.G. Stretman and S. Banerjee, 'Solid state electronic devices', (5th Edition), Pearson Education Inc., New Delhi, (2000).
2. A.P. Malvino, 'Electronic principles', (6th Edition), Tata McGraw Hill Publ.Co.Ltd., New Delhi (1999).
3. Robert T. Paynter, "Introductory electronic devices and circuits", Pearson Education Inc., New Delhi, (2009)
4. T.L.Floyd, Electronic Devices (6th Edition), Pearson Education Inc., New Delhi, (2003).

Booksfor Reference

1. P. Bhattacharya, Semiconductor Optoelectronic Devices, 2nd Edition, Pearson Education Inc., New Delhi, (2002).
2. H. S. Kalsi, Electronic Instrumentation, 2nd Edition, Tata McGraw Hill Publishing Co., New Delhi, (2004).
3. William David Cooper, Electronic Instrumentation and Measurement techniques – Prentice Hall of India Pvt. Ltd., (1991).
4. A. K. Sawhney, Electrical and Electronic Measurements and Instrumentation, Dhanpat Rai and Sons, New Delhi, (1990).

Semester	Course Code	Title of the Course	Hours of Teaching/week	No. of Credits
II	**20P2PHC7**	**Core – Numerical Methods in Physics**	**5**	**4**

Objective:

To gain the knowledge in Numerical methods in physics.

Unit – I Errors, Curve fitting and data analysis

Errors and their computations – General formula for errors – Errors of observation and measurement – Round of errors and Computer Arithmetic – Empirical formula – Method of group averages and problems – Principle of least squares and problems – Least square fitting – Straight line – Parabola, exponential curve.

Data analysis: Frequency table–Central tendency –Mean – Standard deviation.

Unit – II Numerical solution of Algebraic and Transcendental equations

The iteration method – The bisection method – The method of false position – Newton – Raphson method.

Simultaneous Linear algebraic equations: Direct methods – Gauss elimination method – Gauss – Jordan method – Iterative method – Jacobi's method – Gauss Seidel iterative method

Unit – III Interpolation

Finite differences – Interpolation – Gregory – Newton forward interpolation of Newton's formula – Backward differences – Newton's Backward interpolation formula – Central differences – Gauss's forward and backward formula – Stirling's formula – Divided differences – Newton's divided difference formula – Lagrange's interpolation formula – inverse interpolation.

Unit – IV Numerical differentiation and integration

Introduction – Numerical differentiation – Errors in numerical differentiation – Maximum and Minimum values of a tabulated function – Numerical integration – Trapezoidal rule – Simpson's rule – Extended Simpson's rule – Romberg integration – Gaussian integration.

Unit – V Numerical solutions of ordinary differential equations

Solution by Taylor's series – Picard's method of successive approximation – Euler's method – Modified Euler's method – Runge Kutta method – Second and fourth order – Predictor – Corrector method – Milne's method.

Course Outcomes:

On completion of this course the students will

- acquire knowledge to solve algebraic and transcendental equations.
- have the ability to solve problems related to numerical integration anddifferentiation.
- gain the concepts of interpolation.
- have the potential to do computational mathematics for specialized studies and research.

Books for Study

1. Unit I-IV – Numerical methods in Science and Engineering - G. Venkatraman, National Publishing Co., Chennai, 2001.
2. Unit V - Numerical methods - E. Balagurusamy, McGraw HillPublishing Company.
3. Introductory methods of Numerical Analysis – S.S. Sastry, IV Ed, PHI learning pvt ltd, 2006.
4. Numerical methods – Maccormic, Prentice hall.

Books for Reference

1. Numerical Methods for Scientific and Engineering Computation – M. K. Jain, S. R. K. Iyengar, R. K. Jain, New age international, New Delhi, 1983.
2. Numerical Methods – P. Kandasamy, K. Thilagavathi and Gunavathy S. Chand & Co, New Delhi, 2010.

Semester	Course Code	Title of the Course	Hours of Teaching/week	No. of Credits
II	**20P2PHCP2**	**Core – Practical – II**	**6**	**4**

Objective:

- To gainpracticalskills on analog and digital electronics.

List of Experiments – Any10 Experiments

1. Characteristics of JFET
2. FET Amplifier
3. Phase – shift oscillator
4. Characteristics of UJT
5. Relaxation oscillator – UJT
6. Operational Amplifier- applications (inverting, Non inverting, unit gain and closed loop gain)
7. Operational Amplifier – Summing and Difference amplifiers
8. Operational Amplifier – Differentiating and integrating circuits
9. Solving linear equations using Op- amp.
10. Dual Power Supply- construction
11. 4-bit Parallel Binary Adder.
12. Feedback amplifier
13. Half adder and full adder
14. Half subtractor and full subtractor
15. 555 Timer – Monostable multivibrator.

Course Outcomes:

- Students acquire skills in doing experiments in analog and digital electronics.
- Students will be able to handle passive and active components effectively on doing the experiments.

Semester	Course Code	Title of the Course	Hours of Teaching/week	No. of Credits
II	**20P2PHEL2A**	**Elective – Thin Filmsand Crystal Growth**	**4**	**4**

Objectives:

- To understand the basic ideas of thin film technology
- To introduce the knowledge of crystal growth and characterization

Unit – I Fundamentals and Applications of thin films

Introduction – Advantages of thin film devices over their bulk counterparts – Thin film growth stages: Nucleation stage – Island stage – Coalescence stage – Channel, hole and continuous film stage – Properties of thin films: Sheet resistance – Porosity – Surface roughness – Adhesion – Applications of thin films: Thin films in photovoltaic technologies – dye sensitised solar cells – Thin films in electronic devices – Thin films in disinfectant technologies – Optical coatings – Chemical and mechanical applications.

Unit – II Physical Deposition Methods

Basics of vacuum – Physical Vapour Deposition (PVD) – Thermal evaporation – Electron beam evaporation – Pulsed Laser Ablation – Molecular Beam Epitaxy – Hot Wall Epitaxy – Sputtering techniques - DC and RF sputtering – Ion plating – Ion-beam assisted deposition – Applications – Atomic layer Deposition.

Unit – III Chemical deposition methods

Chemical methods – Electrodeposition and electroless plating – Chemical bath deposition – Spray pyrolysis – Spin coating – Dip coating – SILAR – Electro spinning – Hydrothermal – Sol - gel synthesis – Slurry coatings – Screen printing – Langmuir - Blodgett film – Chemical vapor deposition (CVD) – Classification of techniques – Metal organic type, plasma assisted, laser assisted – Applications.

Unit – IV Materials Properties Measurement

Thickness of coatings, structural, microstructural, compositional, electrical and optical characterizations: Surface Profilometry – Multiple beam interferometry (Fizeau method) Energy dispersive analysis of X-ray (EDAX) – Atomic force microscopy (AFM) – Four-point probe technique for sheet resistance measurement.Mechanical properties : adhesion, micro and nano hardness, wear, roughness – Vickers hardness test – Determination of hardness coefficient – Thermo gravimetric analysis (TGA) – Differential thermal analysis (DTA)

Unit – V Crystal Growth

Nucleation – Classical theory of nucleation – Low temperature solution growth: solubility –Saturation – Supersaturation – Expression for super saturation – Miers T-C diagram – Slow cooling method – Slow evaporation method –Gel method –Chemical reaction method – Advantages of gel method – Bridgman technique – Czochralski technique – Verneuil method –Merits and demerits.

Course Outcomes:

Upon successful completion, students will definitely

- acquire knowledge in the fields of thin films technology.
- understand the materials properties and measurements.
- get the ideas of crystal growth technology.
- have the potential to do research on crystal growth and thin films.

Books for Study

1. J.C. Brice, Crystal Growth Processes, John Wiley and Sons, New York (1986).
2. K. Ravichandran, K. Swaminathan, B. Sakthivel, Introduction to Thin Films, Research India Publications,New Delhi (2013) - ISBN: 978-93-841444-05-0.
3. R. F. Bunshah, "Handbook of deposition technologies for films and coatings, science, technology and applications", New York Noyes publications, 1994

Books for Reference

1. P. SanthanaRagavan and P. Ramasamy, Crystal Growth Processes and Methods, KRU Publications, Kumbakonam (2001)
2. Goswami, Thin Film Fundamentals, New Age International (P) Limited, NewDelhi (1996).
3. T. S. Sudarsan, "Surface Modification Technologies", Editor: Marcel Dekker INC, 1989.

Semester	Course Code	Title of the Course	Hours of Teaching/week	No. of Credits
II	**20P2PHEL2B**	**Elective – Medical Physics**	**4**	**4**

Objective:

- To gain the knowledge about Medical Physics

Unit – I Terminology, Modeling and Measurement

Terminology, Modeling and Measurement – Applications of Electricity and Magnetism in Medicine – Electrical Shock, High frequency Electricity in Medicine – Low – frequency Electricity and Magnetism in Medicine.

Unit – II Light in Medicine

Measurement of light and its units, Application of visible light in Medicine, Applications of Ultraviolet and Infrared light in Medicine, Lasers in Medicine –Physics of diagnostic X Rays – Making an X-ray image – Radiation to patient from X-rays –Producing live X- ray images – Fluoroscopy.

Unit – III Radio isotopes in Medicine (Nuclear Medicine)

Sources of Radioactivity for Nuclear Medicine – Basic Instrumentation and its clinical applications – Nuclear Medicine imaging devices – Therapy with radioactivity – Radiation doses in Nuclear Medicines.

Unit – IV Radiation Protection in Medicine

Biological effects of ionizing radiation – Radiation protection in Diagnostic Radiology – Radiation protection in Radiation therapy – Radiation protection in Nuclear Medicine – Radiation Accidents.

Unit – V Computers in Medicine

History taking – Laboratory Automation – Electrocardiogram interpretation – Patient monitoring– Drug-test interactions – prescribingdrug dosage – Pulmonary function testing – Medical record systems – Hospitalsbook keeping – Otheruses of computers in medicine.

Course Outcomes:

On completion, students will

- acquire basic knowledge in Medical physics.
- have sound knowledge on the impact of light, radioisotope and radiation hazards in medicine.

Books for Study

1. Medical Physics: by John R. Cameron & James G. Skofronick, A Wiley – Interscience Publication, John Wiley & Sons.

Semester	Course Code	Title of the Course	Hours of Teaching/week	No. of Credits
III	**20P3PHC8**	**Core – Statistical Mechanics**	**5**	**4**

Objectives:

- To introduce the knowledge about the statistical description of particles.
- To introduce the concepts of Quantum statistics and phase transitions.

Unit – I Review of thermodynamics

Energy and first law of thermodynamics – Entropy and second law of thermodynamics – Nernst heat theorem and third law of thermodynamics – Consequences of Nernst heat theorem – Heat capacity and specific heat – Maxwell's thermodynamic relations – Chemical potential – Gibbs'function – Helmholtz relations – Thermodynamic equilibrium.

Unit – II Statistical description of system of particles

Statistical formulation of a state system – Calculation of pressure using time independent scenario –Phase space – Density distribution in phase space – Liouville's theorem – Ensembles – Types and ensemble average – Equal apriori probability – Statistical equilibrium – Isolated system –Calculation of mean values in a canonical ensemble and connection with thermodynamics.

Unit-III Simple Applications

Concept of partition function – Properties –Ideal monatomic gas–Calculation of thermo dynamic quantities – Gibb's paradox – Equi-partition theorem – Proof – Simple application – Harmonic oscillator – Characteristics of crystalline solids – Specific heat by Einstein model – Debye's modification.

Unit-IV Quantum statistics of Ideal gases

Identical particles – Symmetryrequirements – Formulation of statistical problems – quantum distribution functions from partition function: Photon – Fermi - Dirac and Bose - Einstein statistics– Bose-Einstein condensation.

Unit-V Phase Transitions

General remarks on phase transitions – Firstand Second order – Non ideal gas – calculation of partition function for low densities – Equation of state and Virial coefficients – Derivation of Vander Wall's equation – Spin-spin interaction – One dimensional Ising model.

Course Outcomes:

At the end of the course, studentswill be able to

- acquire knowledge on statistical description of particles.
- acquire knowledge on Quantum statistics and its applications.
- gain knowledge in phase transitions.
- understand statistics of particles and fields, perform mean field calculations and understand various models in statistical mechanics.

Books for Study

1. Fundamentals of statistical and thermal Physics - Frederick Reif, (McGraw – Hill, New York,1965).
2. Statistical mechanics –B. K. Agarwal and Meisner, New age international Publishers,2003.
3. Elementary Statistical mechanics – S.L.Gupta and V. Kumar, Pragati Prakashan Publishers, Meerut.

Books for Reference

1. Thermodynamics, kinetic theory and statistical thermodynamics - F.W. Searsand G.L.Salinger, Narosa publishing House.
2. Statistical Mechanics – Huang, Wiley India Publishers, 2nd Ed, 2005.

Semester	Course Code	Title of the Course	Hours of Teaching/week	No. of Credits
III	**20P3PHC9**	**Core – Quantum Mechanics I**	**5**	**5**

Objective:

- To gain the knowledge about quantum mechanics.

Unit – I Formalism of Quantum Mechanics

Time dependent Schrodinger equation – Interpretation of the wave function – Ehrenfest's theorem – Time independent Schrodinger equation – Stationary states – Admissible condition on the wave function. Linear vector space – Linear operator – eigenfunctions and eigenvalues – Hermitian operator – Postulates of quantum mechanics – measurability of observables – Uncertainty relation – Dirac's notation – Equations of motion – Momentum representation.

Unit – II One Dimensional Systems

Square well potential: rigid walls, finite walls. Square potential barrier – Alpha emission – Block waves in a periodic potential – Kronig-Penney square well periodic potential. Linear harmonic oscillator: Schrodinger method, operator method. Free particle – box normalization – Delta function normalization.

Unit – III Three Dimensional Systems

Particles moving in a spherically symmetric potential – Systems of two interacting particles – Rigid rotator – Hydrogen atom – Hydrogenic orbitals. Free particle: Plane wave solution – Spherical wave solution. Three dimensional square well potential – Deuteron.

Unit – IV Time Independent Perturbation Theory

Basic concepts. Non-degenerate energy levels: first order correction to the energy and the wave function, second order correction to the energy and the wave function. Anharmonic oscillator: First order correction. The ground state of helium – Effect of electric field on the ground state of hydrogen – Degenerate energy levels – Effect of electric field on the n=2 state of hydrogen – spin orbit interaction.

Unit – V Variation and WKBApproximation Methods

The variational principle – Rayleigh-Ritz method – Variation method for excited states – The Hellmann-Feynman theorem – Ground states of helium and deuteron. WKB method – Cconnection formulae – Validity of WKB method – Barrier penetration – Alpha emission – Bound states in a potential well.

Course Outcomes:

On successful completion students will

- acquire knowledge and problem solving skills in quantum mechanics.
- be able to carry out spectroscopic studies of different subjects and interpret the results in quantized units.

Book for Study

1. Aruldhas, G., "Quantum Mechanics", Second Edition, PHI Learning Pvt. Ltd., New Delhi, 2013.

UNIT – I: Chapter 2 2.5 – 2.10 and Chapter 3
UNIT – II: Chapter 4
UNIT – III: Chapter 5
UNIT – IV: Chapter 9
UNIT – V: Chapter 10, 11

Book for Reference

1. Griffiths, D. J., "Introduction to Quantum Mechanics", Second Edition, Pearson Education Inc., New Delhi, 2015.
2. Kar, R. K., "Quantum Mechanics", First Edition, Books and Allied (P) Ltd., Kolkata, 2018.
3. Liboff, R. L., "Introductory Quantum Mechanics", Fourth Edition, Pearson Education, New Delhi, 2012.
4. Mathews, P.M., and Venkatesan, K., "A Text Book of Quantum Mechanics", Second Edition, Tata McGraw Hill Publishing company Ltd., First Edition, New Delhi, 2017.
5. Rajasekar, S. and Velusamy, R., "Quantum Mechanics I-The Fundamentals", First Edition, CRC Press, New York, 2015.

Semester	Course Code	Title of the Course	Hours of Teaching/week	No. of Credits
III	**20P3PHC10**	**Core – Microcontroller-Programming and Applications**	**5**	**4**

Objectives:

- To introduce the concepts of microcontroller programming.
- To gain the knowledge about microcontroller based applications.

Unit – I Microcontroller Architecture

Microprocessor and Microcontrollers comparison – The Z80 and the 8051 – Amicrocontroller survey – The 8051 architecture – 8051 oscillator and clock – Program counter data pointer – CPU registers – Flags and the program status word (PSW) – Internal memory – Internal RAM and ROM – The stack and the stack pointer – Special function registers.

Unit – II I/OPorts, Interrupts and Introduction to Assembly Language

Input/output pins, ports and circuits –External memory – Counter and timers – Timer mode of operation – Serial data input/output: serial data interrupts – Serial data transmission modes – Interrupts:Timer flag interrupt – Serial port interrupt – Eexternal interrupts – Interrupt control – Interrupt priority – Assembly language: The mechanics of Programming – high level and low level assembly languages – Why use assembly language? – The assembly language programming process.

Unit – III Assembly language Programming Concepts

Programming tools and techniques – Understanding the problem to be solved – designing a program – Flow charts – Writing and testing the program – Programming the 8051: 8051 instruction syntax – Moving data: Addressing modes – External data moves – code memory – read only data moves – Push and pop opcodes – Ddata exchanges – Example programs – Logical operations: Bytelevel logical operations – Bit level logical operations – Rotateand swap operations – Example programs.

Unit –IVArithmetic Operations

Flags –Incrementing& decrementing – Addition –Subtraction – Multiplicationand Division –Decimalarithmetic –Programs – Arithmeticoperations – Finding smallest and greatest in array – Ascending and Descending order – Jumpand call instructions:Jump and Call program range –Jumps – Bitjumps –Bytejumps – Callsand subroutines –Interruptsand returns –Programs –Patterncomparison – Delay routines.

Unit – V Applications

Key boards –Displays – Pulsemeasurement – D/A & A/D conversions – Multipleinterrupt – Stepper motor interfacing –Trafficlight control –Waterlevel indicator – Temperaturemeasurement and control –Frequencymeasurement.

Course Outcomes:

On completion of the course, students can

- acquire knowledge in architecture of 8051 microcontroller and skills in assembly language program writing.
- independently select data types and algorithms suitable for the architecture and instruction set of given microcontrollers.
- have in-depth knowledge of the advance microcontrollers in the field of embedded systems and exposure to embedded C programming
- have definite potential to be employed to work on the architecture, pin diagram, input / output interfacing and also to set up & customize a microcontroller development environment.

Books for Study

1. The 8051 Microcontroller – Architecture, Programming and Applications, Kenneth J. Ayala.
2. The 8051 Microcontroller and Embedded Systems Using Assembly and C. Muhammad Ali Mazidi, Janice Gillespie Mazidi, Rolin D. Mckinlay– Chapter- V and VI.
3. Microprocessors and microcontroller - Krishna Kant-Chapter XIII

Books for Reference

1. Introduction to microprocessor – Aditya, P. Mathur
2. Programming and customizing the 8051 microcontroller- Myke Predco, Tata McGraw Hill Publishing company ltd, New Delhi.

Semester	Course Code	Title of the Course	Hours of Teaching/week	No. of Credits
III	**20P3PHC11**	**Core – Atomic and Molecular Spectroscopy**	**4**	**4**

Objectives:

- To have a knowledge on the applications of Spectroscopy.
- To understand spectroscopy on the basis of quantum mechanics.

Unit – I Atomic and Molecular Structure

Central field approximation – Thomas - Fermi statistical model – Spin - orbit interaction – Alkali atoms – Doublet separation – Intensities – Complex atoms – Coupling schemes – Energy levels – Selection rules and intensities in dipole transition – PaschenBack effect – Hitler London theory – Atomic and molecular hybrid orbital's – HarteeFock equation – Method of self consistent field.

Unit – II Raman Spectroscopy

Raman scattering- Basic principle – Classical and quantum theory of Raman effect-Emission and absorption coefficients – Experimental techniques of Raman spectroscopy – spontaneous and induced emission of radiation – Rayleigh scattering – Raman Scattering – Basic principles– Determination of molecular structure –XY, XY_2, XY_3 type molecules.

Unit – IIIInfrared and Microwave Spectroscopy

Characteristic features of pure rotation – Pure vibration – Rotation vibration of a diatomic molecule – Theory – Evaluation of molecular constants – IR spectra of polyatomic molecules – Experimental techniques of IR – Dipole moment studies – Molecular structure determination– Microwave spectra of polyatomic molecules – Experimental techniques of microwave spectroscopy – Inversion spectrum of ammonia.

Unit – IV NMR & ESR Spectroscopy

NMR spectroscopy – Basicprinciples –Classical and quantum mechanical techniques – Blochequations – Spin-spinand spin-lattice relaxation times – Experimental technique– singlecoil and double coil methods –ESR spectroscopy – Basicprinciples – ESR spectrometer – Nuclearinteraction and hyperfine structure – Relaxationeffects-'g' factor – Biological applications –Eexperimental set up for ESR.

Unit – V NQR & Mossbauer Spectroscopy

NQR spectroscopy: Basicprinciples – QuadrupleHamiltonian – Nuclearquadruple energy levels – Foraxial and non axial symmetry – NQR spectrometer – Chemicalbonding – Molecularstructure – Mossbauerspectroscopy: Principle – Experimental arrangement – Chemicalshift – Quadrupolesplitting – Nuclear splitting – Applications.

Course Outcomes:

After successful completion of this course, students shall be able to

- acquire problem solving skills in atomic and molecular spectroscopy.
- understand quantum behavior of atoms in external electric and magnetic fields.
- gain knowledge in Raman and Mossbauer spectroscopy.

Books for Study

1. Basic principles of spectroscopy – R. Chang.
2. Introduction to Atomic Spectra – White.
3. Fundamentals of Molecular spectroscopy - C.N. Banwell, McGraw Hill Education, Europe, 1994.
4. Molecular structure and spectroscopy, G. Aruldhas, PHI learning private limited, New Delhi.
5. Atomic spectra & Chemical bond - Manes Chandra.

Books for Reference

1. Quantum mechanics – Schiff.
2. Molecular spectra and molecular structure – G. Herberg.
3. Quantum mechanics – Pauling & Wilson, McGraw Hill Education, 1935. Chap – 3.
4. High resolution NMR- people Schneider and Bernstein.
5. Nuclear quadruple resonance spectroscopy - T.P. Das and E. L. Hahn, Academic Press, 1958.

Semester	Course Code	Title of the Course	Hours of Teaching/week	No. of Credits
III	**20P3PHCP3**	**Core – Practical – III**	**6**	**4**

Objective:

- To gainpracticalskills on experiments related with Op-amp.
- To gainpractical skills in doing advanced experiments

List of Experiments – Any10 Experiments

1. Op. Amp- Solving linear equations.
2. Op. Amp- Waveform generation- sine, square and ramp.
3. Solving Boolean expressions using gate circuits.
4. Counters construction and 99
5. Op. Amp - Wien's Bridge Oscillator.
6. 555timer –Astablemultivibrator and VCO
7. Determination of Thickness of transparent sheet using Michelson interferometer.
8. Determinationof wavelength of monochromatic source using Michelson interferometer.
9. Determination of Magnetic Susceptibility of a liquid by Guoy method.
10. Determination of Magnetic Susceptibility of a liquid by Quincke's method.
11. Spectrograph - ALO band/ Iodine absorption spectrum.
12. Design of arithmetic and logic unit.
13. Construction -1x1 RAMS.
14. Construction of A/D converter.
15. Construction of D/A converter.
16. Op Amp – low pass and high pass filters.
17. Hall effect- Determination of Hall coefficient and carrier concentration.
18. Determination of g- factor using Electron spin Resonance spectrometer
19. Magneto- resistance of power samples.
20. Laser- Grating- Determination of wavelength.
21. Fiber optics experiments.
22. Determination of wavelength and thickness using Biprism
23. Resistivity of semiconductor.
24. Study of Transducers.
25. Multiplexer and Demultiplexer using gates.

Course Outcomes:

On completion of the course, students can

- acquire skills in doing advanced experiments.
- effectively handle op-amps for the applications need

Semester	Course Code	Title of the Course	Hours of Teaching/week	No. of Credits
III	20P3PHEDC	Extra Departmental Course Fundamentals of Nanotechnology	4	

Objective:

- To introduce the concepts of Nanotechnology

Unit – I Introduction to Nanotechnology

Nanotechnology – Definitions - History of nanotechnology – Nanomaterials: classification – zero, one and two dimensional nanomaterials – Classification based on the composition of materials (metal, semiconductor, ceramic, polymeric and carbon-based nanomaterials) - Properties of nanomaterials – Surface area to volume ratio (S.A/V) – Quantum dots - Challenges in nanotechnology.

Unit – II Preparation Methods

Top-down and Bottom-up approaches – Top down methods: Ball milling - Electron beam lithography – Advantages – Limitations.

Bottom-up methods: Vacuum evaporation - Sputter deposition process - Laser ablation – Advantages – Limitations.

Unit – III Fullerenes

Fullerenes – Types of fullerenes – Bucky ball/Buckminster fullerene - Carbon nano tubes (CNTs) - Single walled CNTs – Multi walled CNTs – Differences – mechanical and electrical properties of CNTs - preparation of CNTs – Plasma discharge method – Applications.

Unit – IV Characterization Techniques

Construction, working principle, merits and demerits of X-ray diffractometer - Scanning Electron Microscope (SEM) – Atomic Force Microscope (AFM) - UV-Vis–NIR double beam spectro photometer – Energy dispersive X-ray analysis (EDAX).

Unit – V Applications

Nanoelectronics – Nanophotonics – Nanomaterials in energy conversion and storage – Nanomaterials as antibacterial agents – Nanomaterials as photocatalysts – Nanomaterial in industrial applications – Bio-medical applications: Targeted drug delivery – Nanomaterial based radiation therapy – Photodynamic therapy (PDT) – Bio imaging.

Course Outcomes:

After successful completion students

- gaintheknowledge in properties, preparation methods and applications of nanomaterials.
- would realize employment opportunities exist in medical, healthcare industry research, environment industries.
- will get employment opportunities on pharmaceutical, agriculture, product development and advising, communication and media.

Books for Study

1. K. Ravichandran, K. Swaminathan, P.K. Praseetha, P. Kavitha, Introduction to Nanotechnology, JAZYM publications.
2. M.Ratner.et al., Nanotechnology; A Gentle intro Practices – hall ISBN 0-13-101400-5, 2003.
3. Nanotechnology; Basic Science and Emergining Technologies, CRC Press

Books for Reference

1. Charles P.Poole Jr and Frank J.Owens. “Introduction to Nanotechnology” Wiley, 2003.
2. A. S. Edelstien and R.C. Cornmarata, Nanomaterials; synthesis, Properties and Applications, 2ed, Iop (U.K), 1996.

Semester	Course Code	Title of the Course	Hours of Teaching/week	No. of Credits
IV	**20P4PHC12**	**Core – Quantum Mechanics II**	**6**	**4**

Objective:

- To introduce the ideas of relativistic quantum mechanics.

Unit – I Matrix Formalism of Quantum Mechanics

Heisenberg Method – Matrix representation of wave function and matrix representation of operator – Properties of matrix elements – Schrodinger equation in matrix form – Eigenvalue problem – Unitary transformations – Change of basis – Linear harmonic oscillator by matrix method.

Unit – II Angular Momentum and Spin

Angular momentum operators – Angular momentum commutation relations – Eigenvalues and eigenfunctions of L^2 and L_z – General angular momentum – Eigenvalues of J^2 and J_z – Angular momentum matrices – Spin angular momentum – Spin vectors for spin ½ systems. Addition of angular momenta: Clebsh - Gordan coefficients – Selection rules – recursion relations – Computation of Clebsh - Gordon coefficients.

Unit – III Time Dependent Perturbation Theory

First order perturbation – Harmonic perturbation – Transition to continuum states. Absorption and emission of radiation: Electromagnetic field – Hamiltonian operator – Electric dipole approximation – Transition probability. Einstein's A and B coefficients – Selection rules – Rayleigh scattering – Raman scattering.

Unit – IV Non Relativistic Scattering Theory

Scattering cross sections – Scattering amplitude – Partial wave. Scattering by a central potential: Partial wave analysis – Optical theorem – Ramsaur-Townsend effect. Significant number of partial waves – Scattering by an attractive square well potential – Breit-Wigner formula – Scattering length – Phase shifts – Integral equation – Born approximation – scattering by screened coulomb potential – Validity of Born approximation – Laboratory and centre of mass coordinate systems.

Unit – V Relativistic Quantum Mechanics

Klein-Gordon equation – Interpretation of Klein-Gordon equation – Particle in a coulomb field – Dirac's equation for a free particle – Dirac matrices – Covariant form of Dirac equation – Probability density – Plane wave solution – Negative energy states – Spin of the Dirac's particle – Magnetic moment of the electron – Spin orbit interaction – Radial equation for an electron in a central potential – Hydrogen atom – Lamb shift.

Course Outcomes:

On successful completion

- Students acquire knowledge and problem solving skills in quantum mechanics.
- Students can carry out spectroscopic studies of different subjects and interpret the results in quantized units.

Book for Study

1. Aruldhas, G., "Quantum Mechanics", Second Edition, PHI learning Pvt. Ltd., New Delhi, 2013.

UNIT – I: Chapter 6
UNIT – II: Chapter 8
UNIT – III: Chapter 12
UNIT – IV: Chapter 14
UNIT – V: Chapter 15

Books for Reference

1. Ghosh, P. K., "Quantum Mechanics", First Edition, Narosa Publishing House Pvt. Ltd., New Delhi, 2014.
2. Kar, R. K., "Quantum Mechanics", First Edition, Books and Allied (P) Ltd., Kolkata, 2018.
3. Mathews, P. M. and Venkatesan, K., "A Textbook of Quantum Mechanics", Second Edition, Tata McGraw Hill Publishing Company Ltd., New Delhi, 2017.
4. Rajasekar, S. and Velusamy, R., "Quantum Mechanics-I - The Fundamentals", First Edition, CRC Press, New York, 2015.
5. Thankappan, "Quantum Mechanics, Third Edition, New Age International Publishers, New Delhi, 2012.

Semester	Course Code	Title of the Course	Hours of Teaching/week	No. of Credits
IV	**20P4PHC13**	**Core – Nuclear and Particle Physics**	**6**	**5**

Objectives:

- To understand the basic properties of nucleus.
- To have an idea on the nature of nuclear forces.
- To gain the knowledge on elementary particles.

Unit – INuclear Structure

Basic properties: size, shape Mass, charge distribution, spin and parity – Magnetic dipole moments – Electric quadrupole moments – Binding energy – Semiempirical mass formula – Nuclearstability – Liquiddrop model – Shell model – Collective Model – Unified model(Nilsson Model).

Unit – IINuclear Forces

Nature of nuclear forces – Form of Nucleon – Nucleon Potential – Spin dependence – Charge Independence and charge symmetry of nuclear forces – Repulsion at short distances – Exchange forces – Meson theory – Ground state of deuteron – Magnetic dipole moment of deuteron – Proton – Neutron scattering at low energies – Scattering amplitude –Scattering length and effective range – Phase shift.

Unit – IIIRadioactivity

Alpha particle emission – GeigerNuttal law – Gamow's theory of alpha decay – Finestructure of alpha spectra – Bbetadecay – Neutrinohypothesis – Fermi's theory of beta decay – Curie plot – Energies of beta spectrum – Fermi and G.T.Slection rules –Non-Conservation of parity in gamma decay – Gamma emission –Selectionsrules – Transitionprobability –Internalconversion –Nuclearisomerism.

Unit – IV Nuclear Reactions

Energies of Nuclear reaction –Level widths – Crosssections –Compoundnucleus model –Resonancescattering –Breit-Wigner one level formula –Opticalmodel – Directreactions – Strippingand pick-up reactions – Fission and fusion reactions –Theory of fission–Controlledthermonuclear reactions –Ideasof nuclear reactors –Plasma confinement – Fusionpower.

Unit – VElementary Particles

Classification of fundamental forces – Elementaryparticles and their quantum numbers(Charge, Spin, Parity, Isospin, Strangeness) –GellMannNishijima's formula – Multiplets – Invariant under time reversal (T), Charge conjugation (C) and parity (P) – CPT Theorem – Parity Non – conservation in Weak interactions – Eight – Fold way SU(3) symmetry– Quark model–Baryons and Mesons.

Course Outcomes:

On the course completion, students

- acquire knowledge and problem solving skills in various aspects of nuclear physics.
- gain the knowledge in radioactive theory.
- have an idea on elementary particles.
- understand the structure and properties of atomic nuclei, and their energetics.

Books for Study

1. Nuclear Physics- D.C. Tayal, Himalaya Publishing house, New Delhi.
2. Nuclear Physics – An introduction – S. B. Patel, Wiley Eastern Limited.
3. Nuclear Physics – S.N.Ghoshal, S.Chand& Co., New Delhi.

Books for Reference

1. Basic Nuclear Physics - D.N. Srivatsava, Pragati Prakashan publishers, Meerut.
2. Nuclear Physics - Roy & Nigam, Wiley Eastern Publishers.
3. Nuclear Physics – V.Devanathan.Narosa Publishing house, New Delhi.
4. Concepts of Nuclear Physics – B.L.Cohen. Tata –McGraw Hill, New Delhi.

Semester	Course Code	Title of the Course	Hours of Teaching/week	No. of Credits
IV	**20P4PHCP4**	**Core – Practical – IV**	**6**	**4**

Objectives:

- To get knowledge in writing and executing assembly language programs (microcontroller) and C++ programs.

List of Experiments – Any12 Experiments

1. Microcontroller- Addition, subtraction (8 bit)
2. Microcontroller- Addition, subtraction (array)
3. Microcontroller- Multiplication 8 bit by 8 bit & 16 bit by 8 bit.
4. Microcontroller- Division 8 bit by 8 bit & 16 bit by 8 bit.
5. Microcontroller- To find the largest and smallest number in an array
6. Microcontroller- Pattern comparison
7. Microcontroller- wave form generation
8. Microcontroller – Interfacing – Stepper Motor
9. Microcontroller – Interfacing – Traffic light Control
10. Program for arranging in ascending and descending order
11. Program to find the sum and difference of two matrices
12. Program to find the product of two matrices
13. Program to find the solution using Newton -Raphson method.
14. Program for Numerical Integration – Simpson Rule
15. Program for Lagrange's interpolation.
16. Program for R-K fourth order method.

Course Outcomes:

- Students acquire skills in writing and executing assembly language programs (microcontroller) and C++ programs.
- Students will be equipped with microprocessor and microcontroller experiments and can effectively perform interfacing experiments.

Books for Reference

1. Introduction to microprocessor – Aditya P. Mathur.
2. Programming and customizing the 8051microcontroller- Myke predco, Tata McGraw Hill Publishing company ltd, New Delhi.
3. Hardware reference manual for, micro controller Intel Corporation- San Francisco

Semester	Course Code	Title of the Course	Hours of Teaching/week	No. of Credits
IV	**20P4PHEL3A**	**Elective – Object Oriented Programming with C++**	**5**	**4**

Objectives:

- To gain knowledge in OOPs concepts
- To develop skills in C++ programming

Unit – I Fundamentals of OOPs and C++ language

Software Evolution – Procedure Oriented Programming – Object Oriented Programming paradigm – benefits of OOP – applications of OOP – encapsulation – polymorphism.

What is C++ - applications of C++ - structure of C++ program – tokens – keywords – identifiers and constants – basic data types – user defined data types – special operators in C++ - scope resolution operator – member dereferencing operator.

Unit – II Control Structures and Functions

Control structures – sequence structure – selection structure:- if - if-else – nested-if - switch statements – loop structure:- while – do-while – for statements

Functions – main function – function prototyping – call by reference – return by reference – default arguments – function overloading.

Unit – III Classes and Objects

Classes and objects – specifying a class – creating objects – accessing class members – defining member functions – outside the class definition – inside the class definition – simple C++ programs with class – inline function – nesting of member functions – arrays of objects – objects as function arguments – friendly functions – returning objects.

Unit – IV Overloading and Inheritance

Constructors – destructors – operator overloading – overloading unary operators – overloading binary operators – Example programs- rules for overloading operators – defining derived classes – inheritance – single – multilevel – multiple – hierarchical and hybrid inheritance.

Unit – VProgramming using C++

Algorithm, flowchart and program to

1. Calculate the total and average of a set of numbers in an array.
2. Add/ subtract /two matrices using classes and objects.
3. Multiply two matrices using operator overloading.
4. Find the smallest and largest elements in an array
5. Sorting a set of numbers in ascending/ descending order
6. Find the solution using Newton Raphson method.
7. Interpolate using Lagrange's interpolation method.
8. Integrate using Simpson's rule
9. Find solution using R-K fourth order method.

Course Outcomes:

On successful completion, students

- acquire knowledge and understanding on OOPs concepts and modular programming and skills in C++ program writing
- can find job opportunities when equipped with program writing skills.

Books for Study

1. Object – Oriented Programming with C++ -E. Balagurusamy (2017).
2. The C++ Programming Language – Stroustrup (2002) – Third Edition.
3. C++: The Complete Reference, 4th Edition – Herbert Schildt (2017).

Books for Reference

1. Object Oriented Programming in C++ - Robert Lofose (2008), 4th Edition.
2. Object Oriented Programming in C++ - Reema Thareja (2015).
3. Let Us C++ - KantkarYashavant (2019).

Semester	Course Code	Title of the Course	Hours of Teaching/week	No. of Credits
IV	**20P4PHEL3B**	**Elective – BiomedicalInstrumentation**	**5**	**4**

Objective:

- To introduce the knowledge in Biomedical Instrumentation.

Unit - I Human Physiological Systems and Biopotential electrodes

Human physiological systems: Cells and their structure – Nature of Cancer cells – Transport of ions through the cell membrane – Resting and action potentials – Bio-electric potentials – Nerve tissues and sense organs – Different systems of human body (outline only).

Design of Medical instruments – components of the biomedical instrument system – Half cell potential –Types of electrodes –Microelectrodes – Depth and needle electrodes – Surface electrodes – Transducers – Active transducers – magnetic induction type transducers (only).

Unit - II Biosignal Acquisition and Physiological Assist Devices

Required conditions for physiological signal amplifiers – Isolation amplifiers – ECG Isolation Amplifier Circuit – Medical preamplifier design – Bio-signal analysis – Analog and digital methods.

Physiological Assist Devices :Pacemakers – Typical ranges of pacemaker parameters - External and implanted pacemakers(comparison) –Ventricular asynchronous pacemakers - Defibrillators – DC Defibrillator – Oxygenators – Bubble oxygenators–Dialysis – Hemodialysis – Peritonial dialysis

Unit - III Biopotential Recorders

BiosignalRecorders:Characteristics of the recording system – Electrocardiography (ECG) – Physiological nature of ECG waveform – ECG Recording setup - Echocardiography– Electroencephalography (EEG) – Origin of EEG – Simple block diagram of EEG recording setup – Electromyography (EMG) recording setup – Electroretinogrphy (ERG) and Electroculography (EOG) .

Unit – IV Operation Theatre Equipment

Surgical diathermy- Shortwave diathermy – Microwave diathermy – Ultrasonic diathermy – Range and area of irritation of different techniques – Ventilators – Pressure limited ventilators – Anesthesia machine – Blood flow meters – Electromagnetic blood flowmeter – Cardiac Output measurements – Fick's method – Spirometer – Gas analyzers – Infrared CO_2 analyzer – Blood gas analyzers – pH meter –Oxymeters – Vivo oximetry.

Unit - V Specialized Medical Equipments

Blood Cell counters – Automatic blood cell counter – Laser based blood cell counting –Radiation detectors – G-M counter – Photometers – Filter photometer (colorimeter) –Digital thermometer – Audiometers – X-rays tube – X-ray machine – Radiography and Fluoroscopy –Image intensifiers – Angiography – Bio-telemetry – Elements of Bio-telemetry system – Design of Bio-telemetry system– Single channel radio telemetry system – Effects of ionizing radiation on human beings – Physiological effects of 50Hz current passage – Micro shock and macro shock – Magnetic Resonance Imaging – principle – MRI Instrumentation.

Course Outcomes:

At the end of the course, the students

- acquire knowledge on the fundamentals of biomedical instrumentation.
- will be aware of different biochemical measurement techniques.

Books for study

1. Dr. M. Arumugan – Biomedical instrumentation, Anurada Agencies Publishers,1992.
2. R.S Khandpur, "Handbook on Biomedical Instrumentation", Tata McGraw Hill Company, New Delhi, 1989
3. Ohn G Webster, Ed., "Medical Instrumentation Application and Design", Third edition, John Wiley & Sons, Singapore, 1999

Books for Reference

1. L. Cromwell,F. J. Weibell, E. A. Pfeiffer – Biomedical instrumentation and Measurements, PHI second edition, 1993.
2. Joseph J. Carr and John M. Brown, "Introduction to Biomedical Equipment Technology", Pearson Education Asia, New Delhi, 4th Edition, 2001.

COMMUNICATION SKILL AND PERSONALITY DEVELOPMENT

SEMESTER	SUBJECT CODE	TITLE	HOURS OF TEACHING/ WEEK	NO OF CREDITS
IV	20P4-CPD	Communication Skill and Personality Development	1	

COURSE OBJECTIVES:

- To cultivate positive personality traits for successful life.
- To groom Winning Attitude among the learners.
- To assist the learners to identify their own potential and realize their aspirations.
- To enable a holistic development.
- To facilitate optimum means of improving personal performance.

UNIT 1

1. Personality- Definition.
2. Determinants of Personality.
3. Perceptual Process.
4. Personality Traits.
5. Developing Effective Habits.
6. Self Esteem (Freud and Erikson).
7. Self Appraisal and Self Development.
8. Dos and Don'ts to develop positive self esteem.
9. Interpersonal Relationship.
10. Difference between Aggressive, Submissive and Assertive behaviour.
11. Mind Mapping, Competency Mapping, 360 degree assessment.
12. Presentation Skills – Opening, ending, Handling nerves, Handling audience, Power Storytelling, Visual aids, Question and answer session

UNIT 2

1. Projecting Positive Body Language.
2. Conflict Management.
3. Change Management.
4. Stress Management.
5. Time Management.
6. Goal Setting.
7. Assertiveness and Negotiating Skill.
8. Problem Solving Skill.
9. Decision Making Skills.
10. Leadership Qualities of a Successful Leader.
11. Attitudes – Positive Attitudes.
12. Public Speaking – Engaging, Connecting, and Influencing the audiences.
13. Employability Skill – Group Discussion, Interview Questions, Psychometric analysis.

COURSE OUTCOMES:

After completion of the course, Students will be able to:

- Gain self confidence and broaden perception of life.
- Maximize their potential and steer that into their career choice.
- Enhance one's self image&self esteem.
- Find a means to achieve excellence and derive fulfilment.

References:

Hurlock.E.B (2006) : Personality Development, 28th Reprint. New Delhi: Tata McCraw Hill.

Stephen.P.Robbins and Timothy. A.Judge (2014) : Organisation Behaviour.16thEdition.Prentice Hall.

Andrews, Sudhir. How to Succeed at Interviews. 21st (rep) New Delhi.Tata McGrew Hill 1988.

Lucas, Stephen. Art of Publication. New Delhi. Tata McGrew Hill. 2001.

Kumar, Pravesh. All about Self Motivation. New Delhi. Goodwill Publication House. 2005.

EXTRA DISCIPLINARY COURSES

Sl. No.	Subject Code	Title of the Paper	Department
1.	20P3HYEDC	**INDIAN ADMINISTRATION**	History
2.	20P3ECEDC	**ISSUES IN INDIAN ECONOMY**	Economics
3.	20P3TAEDC	***தமிழ்மொழி வரலாறு***	Tamil
4.	20P3ENEDC	**SHAKESPEARE STUDIES**	English
5.	20P3CMEDC	**ENTREPRENEURIAL DEVELOPMENT**	Commerce
6.	20P3MAEDC	**APPLICABLE MATHEMATICAL TECHNIQUES**	Mathematics
7.	20P3PHEDC	**FUNDAMENTALS OF NANOTECHNOLOGY**	Physics
8.	20P3CHEDC	**CHEMISTRY IN EVERY DAY LIFE**	Chemistry
9.	20P3BOEDC	**MEDICAL BOTANY AND PHARMACOGNOSY**	Botany
10.	20P3MBEDC	**MUSHROOM TECHNOLOGY**	Microbiology
11.	20P3ZOEDC	**CLINICAL LAB TECHNOLOGY**	Zoology
12.	20P3BTEDC	**RECENT TRENDS IN BIOTECHNOLOGY**	Biotechnology
13.	20P3CSEDC 20P3ITEDC	**E-LEARNING TECHNOLOGIES**	Computer Science
14.	20P3LSEDC	**DOCUMENTATION CENTERS IN INDIA**	Library and Information Science

Semester	Course Code	Title of the Course	Hours of Teaching /Week	No. of Credits
III	**20P3HYEDC**	**Extra Disciplinary Courses – Indian Administration**	**5**	**--**

Objectives:

1. To know the evolution of Indian Administration.
2. To prepare the students for the competitive examination.
3. To give up-to-date knowledge on Indian administration.
4. To trace economic planning of India, through which the students may get practical knowledge on budget, etc.
5. To expose the state administration and the latest issues like Lok Ayukt and LokPal through which the students may get awareness about the latest issues.

Unit I ***Hrs 15***

The evolution of Indian administration: Structure and Functions–Mauryan and Mughal legacy; British Indian system: Company's experiments–Warren Hastings, Lord Cornwallis, Lord Hastings and Lord Dalhousie; Administrative consolidation since 1861 – Famine policy - Financial, Police and judicial administration.

Unit II ***Hrs 15***

Indian Administration since 1950: Parliamentary Democracy–Federation–Structure of Central Administration–Central Secretariat–Cabinet Secretariat, Ministries–Department of Boards.

Unit III ***Hrs 15***

Machinery for planning: Plan formulation at the National level – National Development Council – Planning Commission – Public undertaking – Controls of Public expenditure.

Unit IV ***Hrs 15***

State Administration–Executives–Secretariat–Chief Secretary–Directorates–District and Local Administration–District Rural Development Agency–Special development programmes.

Unit V ***Hrs 15***

Center-State relations – Public services – Police and Judicial administration – Lok Ayukt – Lok Pal – issues on Indian administration – Integrity in administration – Administrative reforms.

General References:

1. Altekar, A.S., State and Government in Ancient India, 1958.
2. Bhambri, C.H., Public Administration in India.
3. Vidya Bhushan, Indian Administration, Delhi, 2000.
4. Vishnoo Bhagawan & Vidhya Bhushan., Indian Administration, New Delhi, 1996.

Course Outcome: The students have clearly understood about the evolution of Indian Administration, State and Central administration, police and judicial administration, Centre State relations, etc.

Semester	Subject code	Title of paper	Hours of Teaching / Week	No. of Credit
III	**20P3ECEDC**	**Extra Disciplinary Courses – Issues in Indian Economy**	**4**	**-**

Objective:

- This Elective paper is offered to the Non-Economics Students to make them familiar with the recent trends in Indian Economy. The syllabus is framed accordingly with the Civil Service Examination.

Course Outcomes

- To understand the status of Indian economy before the reforms
- To assess the rationale of introducing reforms in India
- To familiarize with the package of LPG
- to get insight on the recent trends in EXIM policy

Unit I **Hrs 15**

Economic development and growth – determinants of growth and development – Market Economy – Indian Economy – a shift form mixed economy to Market economy – Reform measures introduced in India – First and second generation reforms – (Brief out line)

Unit-II **Hrs 15**

Economic reforms in India – background, rational – implementation – Trade policy – Industrial policy – exchange rate and capital market reforms

Unit-III **Hrs 15**

Dis-investment of public enterprises – rational – changing profile of PSUs comparison of public and private sector

Unit-IV **Hrs 15**

Privatization – Meaning and scope – Globalization – impact on India – foreign capital – Types FDI and FII, Policies and pattern.

Unit-V **Hrs 15**

Foreign Trade – Exim Policies – Recent exim policy – BOP- Trends in BOP – Economic reforms and BOP.

References:

Uma kapila – Indian Economy (Issues in Development and Planning and Sectoral aspects) Fifth Edition, 2006-07, Academic Foundation, New Delhi

Datt Ruddar &

Sundharam K.P.M. - Indian Economy (2007)

Misrapuri - Indian Economy

Semester	Subject Code	Title of the Paper	Hours of Teaching/Week	No. of Credits
III	**20P3TAEDC**	**கூடுதல் சிறப்புப் பாடம்: தமிழ்மொழி வரலாறு**	**4**	**-**

கூறு: 1 இந்திய மொழிக் குடும்பங்கள் நேரம்: 12

இந்தோ ஆரிய மொழிகள் - ஆஸ்டிக் மொழிகள் - சீன திபெத்திய மொழிகள் - திராவிட மொழிக் குடும்பம் - டாக்டர் கால்டுவெல், திராவிட மொழிகளின் சிறப்பியல்புகள் - தென் திராவிட மொழிகள் - தென் திராவிட மொழிகளில் தமிழ் - நடுத்திராவிட மொழிகள் - வட திராவிட மொழிகள்.

கூறு: 2 தமிழ் நேரம்: 12

தமிழ் என்பதன் வடிவம் பற்றியும் பொருள் பற்றியும் பல்வேறு செய்திகள் - பெயரெச்சங்கள் - வினையெச்சம் - சங்க இலக்கியத்தில் வினையெச்சங்கள் - தொல்காப்பிய உரைகாரர்களும் வினையெச்சங்களும்.

கூறு: 3 நேரம்: 12

தமிழ் எழுத்தின் தோற்றமும் வளர்ச்சியும் - ஆய்வெழுத்து இராசியெழுத்து, நாள், எழுத்து - ஓவியம், பானை ஓடுகள், இலங்கை முத்திரை முதலானவற்றில் காணப்படும் உருவ எழுத்துகள் - வட்டெழுத்து, பண்டைத் தமிழ் எழுத்து. தமிழ்மொழி வரலாறு: தமிழின் தொல் வரலாறு, தமிழ்மொழி வரலாறு - பழந்தமிழ்க் காலம், இடைத்தமிழ்.

கூறு: 4 நேரம்: 12

தொல்காப்பியமும் ஒலியியலும் - தொல்காப்பியமும் சொல்லியலும் - தமிழ் ஒலிகளின் பிறப்பு விளக்கம் - புணர்ச்சி வகை. தமிழ் உருபனியலும் தொடரியலும் - தலைமை இலக்கணக் கூறுகள் - தொடரமைப்பு இலக்கணம். பெயர்த்தொடர் அமைப்புகள்: மொழியின் பெருமை - எழுத்தும் பேச்சும் - கிளை மொழிகள் தோற்றம் - இலக்கியக் கிளைமொழி- வட்டாரக்கிளை மொழிகள்.

கூறு: 5 நேரம்:12

தமிழ் வளர்ச்சி - தமிழ் ஆட்சிமொழி வரலாறு - தமிழ் கல்விமொழி வரலாறு - கலைச் சொல்லாக்கம் - அறிவியல் தமிழ் வளர்ச்சி-உலகத் தமிழ் மாநாடுகள்- உலக அரங்கில் தமிழ் - தமிழ் அமைப்புகள்- உலகத் தமிழாராய்ச்சி நிறுவனம் - தமிழ்ப்பல்கலைக் கழகம்-செம்மொழி ஆய்வுமையம் - அயல் மாநிலங்களில் தமிழ்.

பார்வை நூல்கள்:

1. *தமிழ் வரலாறு - தேவநேயன். ஞா.*
2. *தமிழ் மொழி வரலாறு - பரிதிமாற்கலைஞர்*
3. *பழந்தமிழ் - இலக்குவனார் . சி*
4. *தமிழ் வரலாறு - குணா*
5. *தமிழ் மொழி வரலாறு - தமிழ் வளர்ச்சி இயக்ககம்*
6. *ஆட்சித் தமிழ் - புதுவை மொழியியல் பண்பாட்டுக் கழக வெளியீடு*
7. *இந்திய ஆட்சிப்பணி வழிகாட்டி - முனைவர் ெர. குமரன்.*
8. *உலகத்தமிழ் மாநாடுகள் - சாலை இளந்திரையன்*
9. *தாய்மொழியில் படிக்க வைப்போம் - NCBH வெளியீடு.*
10. *தமிழ் ஆட்சி மொழி வரலாறு - தமிழ்ப்பல்கலைக்கழகம்.*
11. *தமிழ் ஆட்சிமொழி வரலாறு - தெ.பொ.மீ.*
12. *தமிழ் மொழி வரலாறு - சக்திவேல்*

Semester	Course Code	Title of the Course	Hours of Teaching / Week	No. of Credits
III	**20P3ENEDC**	**Extra Disciplinary Course - Shakespeare Studies**	**4**	

Objective

- To initiate the non English majoring students to study Shakespeare's plays, and his sonnets.

Outcome

- Gaining appreciative and analytical understanding of Shakespeare's dramas and sonnets.
- Achieving potentiality to situate and relate Shakespeare's wisdom in various current disciplines and media cultures.
- Obtaining a profound perspectives on handling racism, class divisions, gender roles, crime, love, war, death betrayal, hope, loyalty etc., derived from the works

Unit – I

Shakespeare's Sonnets 1, 18, 29, 33, 35, 65 and 130

Unit – II

The Merchant of Venice

Unit – III

Henry IV, Part I

Unit – IV

Othello

Unit – V

Antony and Cleopatra

References:

- Bates, Jonathan. *The Genius of Shakespeare.* London: Picador, 1997.
- Leishman, J.B. *The Theme and Variation in Shakespeare's sonnets.* London: Routledge, 2005.

Semester	Subject Code	Title of the paper	Hours of Teaching/ Week	No. of Credits
III	**20P3CMEDC**	**Entrepreneurial Development**	**4**	**-**

Objective:

- To make the students to become a successful entrepreneur and to know the process involved in entrepreneurship.

Course Outcome:

- Learn the incentives and subsidies provided to budding entrepreneurs and Become familiar with institutions offering various forms of assistances.

Unit - I

Entrepreneurship - Nature and Characteristics of an Entrepreneur - Difference between Entrepreneur and Manager - Qualities, Types, and Functions of an Entrepreneur - Role of Entrepreneur in Economic Development.

Unit - II

Business Ideas - Sources of Idea - Idea Processing and Selection - Start up Process - Project Identification and Selection - Project Formulation - Project Appraisal.

Unit - III

Factory Design and Layout - Importance - Factors affecting Factory Design - Factory Layout - Objectives - Types - Consideration in Designing Layout - Design Requirements.

Unit - IV

Institutions Assisting to Entrepreneurs - NSIC - SIDCO - SSIB - DIC – TIIC – KVIC – TCO – ITCOT - Commercial Banks and New Entrepreneurial Development Agency.

Unit - V

Entrepreneurship Development Programmes - Need - Objectives - Institutional efforts in Developing Entrepreneurship – Evaluation of EDPs – Problems in the conduct of EDPs – Suggestions to make EDPs effective – Planning EDPs - Role of SISI, SIPCOT and SIDBI – Recent Development in Small Enterprises in India – Government rules and regulations – Rural Entrepreneurship – Need for Rural Entrepreneurship Problems – SHGs and Rural Development – MUDRA Banking /MSME Loans.

Text book:

1. C.B.Gupta., N.P.Srinivasan, (2018), Entrepreneurial Development, Sultan Chand & Sons, New Delhi.

Reference Books

1. Khanka S.S., (2019) Entrepreneurial Development, S.Chand & Co, New Delhi.
2. Saravanavel, P. (2016), Entrepreneurial Development, Principles, Policies and Programmes, Ess Pee Kay Publishing House, Tanjore.
3. Renu Arora, Sood S.K., (2018)Fundamentals of Entrepreneurship and Small Business, Kalyani Publications, Ludhiana.
4. Jayashree Suresh, (2019)Entrepreneurial Development, Margham Publications, Chennai.

Semester	Subject Code	Title of the Paper	House of Teaching / Week	No.of Credits
III	**20P3MAEDC**	**Extra Disciplinary Course- Applicable Mathematical Techniques**	**4**	**-**

Objectives:

- To discuss various methods of Interpolation

Out comes: After studying this course the student will be able to

- Student will demonstrate the ability to solve financial math problem.

Unit I **12 Hrs**

Interpolation with unequal intervals: Newton's divided difference formula - Lagrange's interpolation formula and inverse interpolation. (Only simple Problems)

Unit II **12 Hrs**

Assignment problems

Unit III **12 Hrs**

Replacement problems (Only simple Problems)

Unit IV **12 Hrs**

Decision Analysis

Unit- V **12 Hrs**

Game Theory

Text Book:

1. *For unit I,* ***Numerical Methods*** *– P. Kandasamy, K. Thilagavathy, K. Gunavathy, S.Chand*
2. *For units II to V,* ***Operation Research 12th Edition 2004:****KanthiSwarap, P.K. Gupta and Manmohan, Sultan Chanda and sons, New Delhi.*

   Unit I : Chapter - 8 (Sec: 8.5, 8.7)

   Unit II : Chapter - 11 (Sec: 11.1 to 11.4)

   Unit III : Chapter - 18 (Sec: 18.1 to18.3)

   Unit IV : Chapter - 16 (Sec: 16.1 to 16.5)

   Unit V : Chapter - 17 (Sec: 17.1 to 17.6)

General Reference:

1. *S.S. Sastry Introductory Methods of Numerical Analysis Prentice Hall of India 2000.*
2. *H.A. Taha Operation Research Prentice Hall of India 1995.*

Semester	Subject Code	Title of the paper	Hours of Teaching / Week	No. of Credits
III	**20P3PHEDC**	**Extra Disciplinary Course- Fundamentals of Nanotechnology**	**4**	**-**

Unit – I Introduction to Nanotechnology

Nanotechnology – Definitions - History of nanotechnology – Nanomaterials: classification – zero, one and two dimensional nanomaterials – Classification based on the composition of materials (metal, semiconductor, ceramic, polymeric and carbon-based nanomaterials) - Properties of nanomaterials – Surface area to volume ratio (S.A/V) – Quantum dots - Challenges in nanotechnology.

Unit – II Preparation Methods

Top-down and Bottom-up approaches – Top down methods: Ball milling - Electron beam lithography – Advantages – Limitations. Bottom-up methods: Vacuum evaporation - Sputter deposition process - Laser ablation

– Advantages – Limitations.

Unit – III Fullerenes

Fullerenes – Types of fullerenes – Bucky ball/Buckminster fullerene - Carbon nano tubes (CNTs) - Single walled CNTs – Multi walled CNTs – Differences – mechanical and electrical properties of CNTs - preparation of CNTs – Plasma discharge method – Applications.

Unit – IV Characterization Techniques

Construction, working principle, merits and demerits of X-ray diffractometer - Scanning Electron Microscope (SEM) – Atomic Force Microscope (AFM) - UV-Vis–NIR double beam spectro photometer – Energy dispersive X-ray analysis (EDAX) .

Unit – V Applications

Nanoelectronics – Nanophotonics – Nanomaterials in energy conversion and storage – Nanomaterials as antibacterial agents – Nanomaterials as photocatalysts – Nanomaterial in industrial applications – Bio-medical applications : Targeted drug delivery – Nanomaterial based radiation therapy – Photodynamic therapy (PDT) – Bio imaging.

Books for Study

1. K. Ravichandran, K. Swaminathan, P.K. Praseetha, P. Kavitha, Introduction to Nanotechnology, JAZYM publications.
2. M.Ratner.et al., Nanotechnology; A Gentle intro Practices – hall ISBN 0-13-101400-5, 2003.
3. Nanotechnology; Basic Science and Emergining Technologies, CRC Press

Books for Reference

1. Charles P.Poole Jr and Frank J.Owens. "Introduction to Nanotechnology" Wiley, 2003.
2. A. S. Edelstien and R.C. Cornmarata, Nanomaterials; synthesis, Properties and Applications, 2ed, Iop (U.K), 1996.

Semester	Subject code	Title of the paper	Hours of Teaching/ Week	No. of Credits
III	**20P3CHEDC**	**Extra Disciplinary Course - Chemistry in Every Day Life**	**4**	

OBJECTIVES

Students learn about the scientific and chemical principles underlying in everyday life.

- Students learn about the cleaning agents and water chemistry,
- Students understand about the food chemistry,
- Students shall learn about the cosmetic and their effect in health aspects
- Students shall know about the green chemistry and their significance for clean environments
- Students learn about the nano technology and their importance.

Unit-I

Cleaning agents - manufacture and uses of soaps, detergents, baking powder, shampoo, washing powder and bleaching powder **Water –** uses of water Characteristics' of water, soft water and hard water - removal of hardness – ion exchange method. Reverse osmosis method, Water pollution, causes and prevention.

Unit-II

Food – importance – spoilages – causes, preservation – additives – colouring and flavouring agents, beverages. Soft drinks aerated water – manufacturing – mineral water. Fruits, vegetables, dairy product – storage, preservation. Minerals in food and anti oxidants. Preparation of fruit Jam and pickle.

Unit-III

Cosmetics – Face powder – constituents, uses – side – effects. Nail polish, hair dye – composition and side effects. Tooth powder – lotions. Preparation of phenyl, liquid blue and incense sticks.

Unit-IV

Basic concepts of Green chemistry and its significance in day to day life. Polymers – Classification – Types of polymerization – plastics – classification – types of plastics – PVC, Teflon, PET, Bakelite – Rubber – Natural and synthetic – Bunas rubber, Butyl Rubber. Vulcanization of rubber, neoprene rubber, Plastic pollution and prevention.

Unit-V

Basic concepts of Nano Technology and its importance in day to day life.

Dyes – importance of food colours – PFA (Prevention of Food Adulteration Act) Natural dyes – Synthetic Classification importances – Uses of the following Synthetic dyes - Direct dyes, acid dye, Basic dye, mordant dye, Reactive dye, Disperse dye, Fastness – Light and Washing. Application of dyes in food, paper, plastic and lather.

COURSE OUTCOME:

- Students should able to learn about the cleaning agents and water chemistry,
- Students should able to understand about the food chemistry,
- Students should able to learn about the cosmetic
- Students shoud able to know about the green chemistry
- Students should able to learn about the nano technology

References:

1. Norrish Shreave. R. and Joseph A. Brink Jr Chemical Process Industries, McGraw Hill, Industrial Book Company London 1978.
2. Brain A.C.S. Reinhold, Production and properties of Industrial chemicals 11th Ed, John Wiley & Sons, New York.
3. Burgh, A. Fermentation Industries, Inter science, 4th Ed, 1983, A *Inter science*, New York.
4. Ramani,V. Alex, Food Chemistry(2009),MJP publishers.

Semester	Subject Code	Title of the Paper	Hours of Teaching / Week	No. of Credits
III	**20P3BOEDC**	**Extra Disciplinary Course – Medicinal Botany and Pharmacognosy**	**4**	**-**

Objectives

- To enable the students to identify local medicinal plants.
- To enable the students to prepare herbal medicines for curing human ailments.
- To impart knowledge to students on Botany and Phyto chemistry of medicinal plants.

Unit I

Medicinal Botany: Definition, Introduction, History, – Classification – Common medicinal plants cultivation, storage, collection and habitats of medicinal plants (*Catharanthus, Coleus*, *Aloe*) – Importance of medicinal plants.

Unit II

Indian systems of medicine – AYUSH - Siddha, Ayurveda, Homeopathy and Unani – Indigenous medicinal plants – Useful parts –Chemical constituents – medicinal uses – medicinal plant drugs.

Unit III

Herbal medicines for human ailments – Heart, kidney, liver, eye, skin, hair, stomach problems, diabetics, blood pressure, headache, cough, cold, fever, digestive problems, joint pains and wounds.

Unit IV

Pharmacognosy – History, Introduction, commercial drugs, crude drugs – classification of drugs – Chemistry of drug and drug evaluation of natural products.

Unit V

Drug adulteration and detection – Substitution – Detection of Adulterations - Elementary knowledge on alkaloids and flavonoids – Preparation of herbal oil, herbal tooth powder, herbal soup, herbal immune boosters.

Books for Reference

- Kumar, N.C., (1993). An introduction to Medical Botany and Pharmacognosy.
- Shah, S.C. and Quadry (1990). A text book of Pharmacognosy.
- Nadkarni, (1981). Indian MateriaMedica.
- Jain, S.K., (1980). Indian Medicinal Plants.
- Balu, S., Murugan, R. and Pandiyan, P., (2005). Herbal Technology.

Outcome

After completion of this course, students would be able to

- Understand the various Indian system of medicine
- Learn about the vital role of herbal medicines for human ailments
- Outline and classify the crud drugs
- Trained about drugs adulteration and direction

Semester	Subject Code	Title of the Paper	Hours of Teaching / Week	No. of Credits
III	**20P3MBEDC**	**Extra Disciplinary Course – Mushroom Technology**	**4**	**-**

Objectives

- To know the various types of edible mushroom and their nutritional value.
- To understand the methods of cultivation of mushrooms.
- To know the types of food prepared from mushroom and their importance in human health.
- Marketing of mushrooms in India and abroad.
- Mushroom cultivation unit visit- mandatory –Neighbouring District –one day.

Unit I

Introduction – history – scope of edible mushroom cultivation – Types of edible mushrooms available in India – *Calocybeindica, Volvariellavolvacea, Pleurotuscitrinopileatus*, and *Agaricusbisporus.*

Unit II

Pure culture – preparation of medium (PDA and Oatmeal agar medium) sterilization – preparation of test tube slants to store mother culture – culturing of *Pleurotus*mycelium on petriplates, preparation of mother spawn in saline bottle and polypropylene bag and their multiplication.

Unit III

Cultivation Technology: Infra structure – Mushroom bed preparation – paddy straw, sugarcane thrash, maize straw, banana leaves. Factors affecting the mushroom bed preparation – Low cost technology. Composting technology in Mushroom production.

Unit IV

Storage and nutrition: Short-term storage (Refrigeration – upto 24 hours) Long term Storage (canning, pickles, papads), drying, storage in salt solutions. Nutritive value – proteins – amino acids, mineral elements – Carbohydrates, Crude fibre content – Vitamins.

Unit V

Food Preparation – Types of food prepared from mushroom; Soup, Cutlet, Omlette, Samosa, Pickles, Curry – Research Centres – National level and Regional level – Cost benefit ratio – Marketing in India and abroad, Export value.

Books for Reference:-

- Marimuthu, T., Krishnamoorthy, A.S., Sivaprakasam, K. and Jayaranjan, R., (1991). Oyster Mushrooms, Department of Plant Pathology, Tamil Nadu Agricultural University, Coimbatore.
- Swaminathan, M., (1960). Food and Nutrition. Bappco, The Bangalore Printing and Publishing Co. Ltd., No.88, Mysore Road, Bangalore 560 018.
- Tewari, Pankaj Kapoor, S.C., (1988). Mushroom Cultivation, Mittal Publications, Delhi.
- Nita Bahi (1984-1988). Handbook of Mushrooms, II Ed, Vol. I & II.
- Paul Stamets, J.S and Chilton J.s (2004). Mushroom cultivation. A practical guide to graining mushroom at home Agarikon Press.

Semester	Subject Code	Title of the Paper	Hours of Teaching / Week	No. of Credits
III	**20P3ZOEDC**	**Extra Disciplinary Course – Clinical Lab Technology**	**4**	**-**

Objectives:

1. To study the various sterilization techniques.
2. To know the disposal of waste.
3. To identify the blood group and urine sugar.
4. To identify the bacteria and fungus.
5. To know the various diagnostic equipment.

Unit I **12 Hrs**

Scope for study of Clinical Technology. Sterilization – Methods of Sterilization – Dry heat method – Wet heat method – Chemical method of sterilization – Disposal of hospital wastes and infected material - Disinfection laboratory glassware and equipments.

Unit II **12 Hrs**

Composition of blood–ABO blood typing–Rh blood typing–Blood cells counting – Total erythrocyte count, total WBC count and differential count – Sugar level in Blood – Hypoglycemia, Hyperglycemia conditions. Composition of urine – Physical characters of urine–Method of urine analysis for sugars.

Unit III **12 Hrs**

Analysis of Semen, Sputum and stool, Identification of blood parasites, Bacterial culture in NA medium, Fungal culture in PDA medium, Histological study of cells – Histological procedure for the preparation of tissue slides.

Unit IV **12 Hrs**

Diagnostic equipment and apparatus – ECG, EEG, Colorimeter, pH meter, PCR, laminar airflow inoculation chamber, Binocular microscope and Incubator.

Unit V **12 Hrs**

Immuno techniques – ELISA, HLA typing, VDRL Test.

Viral , bacterial and fungal diseases, First aid- definition and types and applications

Reference:

1. Medical Laboratory Technology (1994) (4th edition), By Ramik Sood, Jaypee Brother Medical Publishers (P) Ltd., New Delhi 110 002.
2. Medical Laboratory Technology, K.M. Samuel.
3. Clinical Pharmacology (1987), by Dr. Lawrance and P.N. Bennett (Sixth Edition), ELBS, English Language Book Society, Churchil Livingstone, England.
4. District Laboratory Practice in Tropical countries, part I, By Mouica Cheesbrough, Cambridge Las Priced Edition, Cambridge University Press, Cambridge, U.K.
5. Basic Clinical Paraitology (1993), W.Harold Brown and A.Franklin Neva (5th edition), Prntice Hall Internation Edition.
6. Biological Chemistry – Leringer.

7. Human Physiology by Pearse.
8. The Biology of Animal Paraistes (1984), Cheng, T.Toppan C9 Ltd., Japan.
9. Medical Laboratory Technology: A procedure manual for routine diagnostic tests Volume – I-II By Kanai, L.Mukherjee, Tata McGraw – Hill Publishers, New Delhi.
10. Basic Clinical Paraitology 5th Edn, Harrold, W.Harold Brown and A. Franklin Neva-prentice Hall Internation Editions, U.S.A.

Web Links:

https://www.sunydutchess.edu/academics/catalog/current/courses/medical_laboratory_tech/index.pdf(Dutchess Community College, New York).
https://www.sunydutchess.edu/academics/catalog/current/programs/medicalandalliedhealth/mlt.pdf(Dutchess Community College, New York).
https://makautwb.ac.in/syllabus/BSc%20(Medical%20Lab%20Technology)28.02.2018.pdf

Course Outcome

- Pare the way for basic idea of various aseptic technique.
- Understanding the significance of waste disposal.
- Knowledge on Blood grouping and Blood sugar & urine sugar level.
- Gaining knowledge on culture of Bacteria, fungi and expertise on histological slide preparation.
- Operation technique of Diagnostic apparatus.
- Understanding for various immune techniques.

Semester	Subject Code	Title of the Paper	Hours of Teaching / Week	No. of Credits
III	**20P3BTEDC**	**Extra Disciplinary Course – Trends in Biotechnology**	**4**	**-**

Objectives:

1. To study the concept and scope of Biotechnology.
2. To Understand r-DNA Technology.
3. To aware the programmes of cell culture, preparations of hormones and vaccines, transgenic animals and human genome project.
4. To study the Bioprocess technology and their applications.
5. To study the Environment Biotechnology and aware the biodiversity and their conservation.

Unit I **Hrs12**

Biotechnology – Introduction and Scope of Biotechnology – Gene Cloning, Cell –free protein production – Production of Health care Products, Medical and Forensic application (RFLP, RAPD, DNA finger printing). Applications of PCR and LCR in disease diagnosis.

Unit II **Hrs12**

Nuclear transplantation, Transgenic Animals Development and uses – mice, goat, fish and sheep. Tendered meat production. Transgenic Plant: Insect resistance, fungus resistance, virus resistance, drought, cold resistance, saline resistance, Transgenic plant with vitamin A, Gene Production of therapeutic antibodies and edible vaccine.

Unit III **Hrs12**

Bioprocess technology – Scope – Fermentor –Bioprocess products: Organic acids – Citric acid, Lactic acid, acetic acid. Antibiotics – Wide and Narrow specxtrum antibiotics. Aminoacids – Glutamic acid, Lysine, Isoleucine, Aspartic acid and Proline. Production of SCP. Enzyme Production – Amylase, Pectinase and Cellulase. Dairy products and Biofuel production.

Unit IV **Hrs12**

Biofertilizers – N_2 fixing microbes (Azolla, Azatobacter, Azospirillum) for use in Agriculture – A. tumifasciens for crop improvement – Biopesticides. Biopolymer and its Application – Biosensor and its application – Bioleaching- Biomining – Biotechnology in oil recovery – Bioremediation of Xenobiotics – superbug – its application. Biodegradation.

Unit V **Hrs12**

Regulations of Biosafety: possible dangers of GEO, Biohazards of rDNA technology. National and International biosafety guidelines, Primary and secondary containments and implementation. Web based information of biosafety on GMO.

Reference:

1. Dubey, R.C. – A Text Book of Biotechnology, S. Chand & Co., Ltd, New Delhi, 1996.
2. Gupta, P.K. – Elements of Biotechnology, Rastogi and Co., Meerut, 1994.
3. Kumar, H.F. A text book on Biotechnology, Affiliated East & West Press Pvt., Ltd, N-Delhi.
4. D.Balasubramanian *et. al.,* - Concepts in Biotechnology.
5. Singh, R.S. – Introductory Biotechnology, Central book deport, Allahabad.
6. Primrose, R. – Molecular Biotechnolgoy, ASM Press.
7. Lick, E.R. and Pastenak – J.J. Molecular Biotechnology.
8. Ignachimuthu – Plant biotechnology, Oxford IBH Publishers, New Delhi.
9. Ranga – Fishery Biotechnology.
10. Primrose, R. – Molecular Biotechnology, ASM Press.
11. Purohit – A Text Book of Biotechnology, Agrobions, Jodhpur.

Semester	Subject code	Title of the course	Hours of Teaching/ Week	No. of Credits
III	**20P3CSEDC/ 20P3ITEDC**	**Extra Disciplinary Course- E-Learning Technologies**	**4**	**-**

Objective

- To learn the various E-learning approaches and components.
- To understand the types of design models of E-Learning.
- To explore the models for E-learning courseware development.
- To learn about E-learning authoring tools.
- To know about evaluation and management of E-learning solutions.

UNIT I INTRODUCTION

Need for E-Learning – Approaches of E-Learning – Components of E-Learning – Synchronous and Asynchronous Modes of Learning – Quality of E-Learning – Blended Learning: Activities, Team and Technology – Work Flow to Produce and Deliver E-Learning Content – Basics of Design Thinking.

UNIT II DESIGNING E-LEARNING COURSE CONTENT

Design Models of E-Learning – Identifying and Organizing E-Learning Course Content: Needs Analysis – Analyzing the Target Audience – Identifying Course Content – Defining Learning Objectives – Defining the Course Sequence – Defining Instructional Methods – Defining Evaluation and Delivery Strategies – Case Study.

UNIT III CREATING INTERACTIVE CONTENT

Preparing Content: Tips for Content Development and Language Style – Creating Storyboards: Structure of an Interactive E-Lesson – Techniques for Presenting Content – Adding Examples – Integrating Multimedia Elements – Adding Examples – Developing Practice and Assessment Tests – Adding Additional Resources– Courseware Development Authoring Tools – Types of Authoring Tools – Selecting an Authoring Tool

UNIT IV LEARNING PLATFORMS

Types of Learning Platforms – Proprietary Vs. Open – Source LMS – LMS Vs LCMS – Internally Handled and Hosted LMS – LMS Solutions – Functional Areas of LMS.

UNIT V COURSE DELIVERY AND EVALUATION

Components of an Instructor-Led or Facilitated Course – Planning and Documenting Activities – Facilitating Learners Activities – E-Learning Methods and Delivery Formats – Using Communication Tools for E-Learning – Course Evaluation.

REFERENCES:

1. Clark, R. C. and Mayer, R. E, "eLearning and the Science of Instruction", Third Edition, John Wiley, 2016.
2. Means, B., Toyama, Y., and Murphy, R, "Evaluation of Evidence – Based Practices in Online Learning: A Meta – Analysis and Review of Online Learning Studies", Centre for Learning Technologies, 2010.
3. Crews, T. B., Sheth, S. N., and Horne, T. M, "Understanding the Learning Personalities of Successful Online Students", Educause Review, 2014.
4. Johnny Schneider, "Understanding Design Thinking, Lean and Agile", O'Riley Media, 2011.
5. Madhuri Dubey, "Effective E – learning Design, Development and Delivery", University Press, 2011.

Course Outcomes:

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

- Distinguish the phases of activities in the models of E-learning.
- Identify appropriate instructional methods and delivery strategies.
- Choose appropriate E-learning authoring tools, Create interactive E-Learning courseware, Evaluate the E-learning courseware, Manage the E-learning courseware.

Semester	Subject Code	Title of the Paper	Hours of Teaching / Week	No. of Credits
III	**20P3LSEDC**	**Extra Disciplinary course Documentation Centers in India**	**4**	**-**

Objectives:

- To promote and support adoption of standards in library operations.
- To coordinate with other regional, national & international network for exchange of information and documents

Unit I

Components of information systems-Libraries, Documentation centers, Information centers.

Unit II

Data banks, Information analysis centers, Referral centers, Clearing Houses, Reprographic and translation centers-Their function and services.

Unit III

National Information systems: DESIDOC, NASSDOC, SENDOC, NISCAIR and INFLIBNET.

Unit IV

Information Aggregators, Databases Proquest, EBscohost, J-gate, POPLINE, Shodhganga, NDL,.

Unit V

Information products and series – Newsletters, House Bulletins in – house Journals, state of art reports, digest and Technical Digest.

Outcome:

The students shall be able to:

- Know the standards in library operations.
- Understand the regional, national & international network for exchange of information and documents

Reference:

1. Date, C.J. An Introduction to Database System, ed.7, Delhi: Pearson Education (Singapore), 2002
2. Desai, Bipin C. An Introduction to Database System, New Delhi, Galgetia, 2001
3. Karts Henry F, DBS Computer, New Delhi, McGraw Hill, 2000.
4. Raghu Ramakrishnan, DBMSS, New Delhi, McGraw Hill, 2000.
5. Gangadharaiah G, Management of Information Products and Services in University Libraries, Common Wealth, New Delhi, 2012.