RAJAH SERFOJI GOVERNMENT COLLEGE(AUTONOMOUS)

(Reaccredited with 'A'Grade by NAAC)

(Affiliated to Bharathidasan University, Tiruchirappalli)

THANJAVUR – 613 005,

TAMIL NADU.

DEPARTMENT OF PHYSICS

CURRICULUM AND SYLLABUS

Academic year 2022-2023 onwards.

RAJAH SERFOJI GOVT. COLLEGE(AUTONOMOUS)
Re accredited with 'A' Grade by NAAC
(Affiliated to Bharathidasan University, Tiruchirappalli)
Thanjavur – 613 005, Tamil Nadu, India

DEPARTMENT OF PHYSICS

BOARD OF STUDIES

IN PHYSICS

Date: 18.08.2022

BOARD OF STUDIES MEETING – 18.08.2022

The Board of Studies (BOS) meeting in Physics was held on 18.08.2022 (Thursday) at 11.00 am in the Department of Physics under the chairmanship of Dr. A. Santhanam Head, Department of Physics. The following members were present in the meeting.

INTERNAL MEMBERS		SIGNATURE
1. Dr. G. Rani	-	18/8/22.
2. Dr. S. Sakthivel	-	
3. Dr. S. Rosepriya	-	18-8-22
4. Mrs. S. Senthilkumari	-	18/08/2022
5. Dr. B. Shanmugapriya	-	18/8/22
6. Dr. S. Nilavazhagan.	-	18/8/22
7. Dr. C. Kumar	-	18/8/22
8. Dr.S. Veera Rethina Murugan	-	18/8/22
9. Dr. T. Ganesh	-	18/8/22
10. Dr. N. Chidambaram.	-	18/8/22
11. Dr. D. Anbuselvan	-	18/8/22
12. Dr. P. Jagdish	-	
13. Dr. P. Paramasivam	-	18/8/22

EXTERNAL MEMBERS: - **SIGNATURE**

1. Dr.T. Sabari Girisun
   (University Nominee) -
2. Dr. R. S. Sundararajan
   (Subject Expert) -
3. Dr. S. Valanarasu
   (Subject Expert) -
4. Mr. T. Manoharan
   (Representative from Industry/
   Corporate relating to placement) -
5. Dr. T. Arivudai Nambi
   (PG Meritorious alumni) -

The syllabus for B.Sc., physics (Major and Allied), M.Sc., physics and M.Phil., physics under CBCS system was discussed, corrections/changes were made and finalized. The finalized syllabus was approved in the meeting held on 18.08.2022. This syllabus is for the candidates admitted from the academic year 2022-2023.

Dr. A. Santhanam

(Chairman, BOS-Physics)
HEAD,
DEPARTMENT OF PHYSICS,
RAJAH SERFOJI GOVT. COLLEGE,
THANJAVUR-613 005.

PG

RAJAH SERFOJI GOVERNMENT COLLEGE (AUTONOMOUS),THANJAVUR-613005

M.Sc PHYSICS COURSE STRUCTURE

(For candidates admitted from the academic year 2022 -2023)

Sem.	Part	Course	Subject Code	Title of the Paper	Inst. Hrs.	Credit	Exam. Hrs.	Marks		Total
								Int.	Ext.	
I	III	CC1	A1PPH1	Mathematical Physics-I	6	4	3	25	75	100
	III	CC2	A1PPH2	Classical Mechanics	6	4	3	25	75	100
	III	CC3	A1PPH3	Electromagnetic Theory	6	4	3	25	75	100
	III	CC4	A1PPH4P	Practical-I	6	4	4	40	60	100
	III	DEC1	A1PPHEL1A	Communication Electronics	4	4	3	25	75	100
			A1PPHEL1B	Bio-Electronics & Bio-Sensors						
			A1PPHEL1C	Space Science						
	IV	GEC1	A1PPHGE1	First Aid and Emergency Care	2	2	3	25	75	100
				Total	**30**	**22**				**600**
II	III	CC5	A2PPH5	Mathematical Physics-II	6	4	3	25	75	100
	III	CC6	A2PPH6	Quantum Mechanics	6	4	3	25	75	100
	III	CC7	A2PPH7	Statistical Mechanics	6	4	3	25	75	100
	III	CC8	A2PPH8P	Practical-II	6	4	4	40	60	100
	III	DEC2	A2PPHEL2A	Microprocessor & Microcontroller	4	4	3	25	75	100
			A2PPHEL2B	Opto-Electronics						
			A2PPHEL2C	Analytical Instumentation						
	IV	GEC2	A2PPHGE2	Entrepreneurial Development	2	2	3	25	75	100
				Total	**30**	**22**				**600**
III	III	CC9	A3PPH9	Nuclear & Particle Physics	6	5	3	25	75	100
	III	CC10	A3PPH10	Spectroscopy	6	4	3	25	75	100
	III	CC11	A3PPH11	Condensed Matter Physics	6	4	3	25	75	100
	III	CC12	A3PPH12P	Practical-III	6	4	4	40	60	100
	III	DEC3	A3PPHEL3A	Material Science	4	4	3	25	75	100
			A3PPHEL3B	High Energy Physics						
			A3PPHEL3C	Computational Physics						
	IV	SS1	A3PPHSS1	Soft Skills-I / Skill Based-I	2	2	3	25	75	100
	IV	ECC1	A3PPHEC1	Thin Film Physics	-	2	3	-	100	100
	IV			Internship (Optional)	-	2	-	-	-	-
				Total	**30**	**23**				**600**
IV	III	CC13	A4PPH13	Theoretical Physics	6	5	3	25	75	100
	III	CC14	A4PPH14P	Practical-IV	6	4	4	40	60	100
	III	CC15	A4PPHPW	Project Work-	4	4	-	20	80	100
	III	DEC4	A4PPHEL4A	Advanced Physics	6	4	3	25	75	100
			A4PPHEL4B	Signal Processing						
			A4PPHEL4C	Robotics						
		DEC5	A4PPHEL4D	Solar Energy Utilization	6	4	3	25	75	100
			A4PPHEL4E	Nano-Physics						
			A4PPHEL4F	Geo-Physics						
		ECC2	A4PPHEC2	Nano-Technology	-	2	3	-	100	100
	IV	SS2	A4PPHSS2	Soft Skills-2 / Skill Based-2	2	2	3	25	75	100
				Total	**30**	**23**				**600**
Grand Total						**90**				**2400**

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	Number of papers x credit	Total Credit
Core Courses	12 x 4	48
	2 x 5	10
Department elective course	5 x 4	20
Generic Elective Supportive	2 x 2	4
Soft Skills / Skill Based	2 x 2	4
Project	1 x 4	4
*Internship	2	2*
*Extra Credit Courses	2	4*
Total		**90**

*Not considered for CGPA

Separate Passing Minimum is prescried for Internal and External

a) The Passing Minimum for CIA shall be 50%

b) The passing minimum for Autonomous Examinations shall be 50%

Head of the Department

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Semester: 1
Course: CC1
Code: A1PPH1

Hours: 6
Credits: 4
Medium: English

MATHEMATICAL PHYSICS – I

(For students admitted from 2022 - 2023)

OBJECTIVES

- To acquire mathematical knowledge and apply it to various physical problems.
- To develop problem solving ability related to physical problems.

Unit I: VECTOR ANALYSIS – 1

Scalar and vector fields – Gradient, Divergence and Curl – vector identities – second derivatives – Laplacian operator – line, surface and volume integral – Gauss divergence theorem – Greens theorem – Stoke's theorem.

Unit II: VECTOR ANALYSIS – 2

CURVILINEAR CO-ORDINATES

Orthogonal curvilinear co-ordinates - expansion for grad, div curl & Laplacian in cylindrical and spherical co-ordinates.

VECTOR SPACE

Linear dependence and Linear independence of vectors – Linear vector space – Axioms – Bases and Dimension – Inner product – Orthogonal – Normalization - Orthogonalities – Gram Schmidt's Orthogonalisation process – Hilbert space.

Unit III: MATRIX

Solution of linear algebraic equation – Rank of a matrix – Inverse of a matrix - characteristic equation of a matrix – Eigen values and Eigen vectors – Trace of a matrix – Cayley Hamilton Theorem – Matrix diagonalization – Types of matrices - Hermitian, Orthogonal, Symmetric, Unitary matrices

Unit IV: SPECIAL FUNCTIONS

Gamma and beta functions – series solution – Legendre, Bessel, Hermite and Laguerre's differential equations - their solutions - Recurrence relation - Rodrigue's formula –Generating functions – Orthogonality relations - Sturm Liouville theorem.

Unit V: NUMERICAL METHODS

Solving algebraic equation – Bisection, Newton Raphson and iteration methods – Numerical integration – Simpson Rule – Trapezoidal Rule – Method of least Square fit - solving differential Equation – Euler method – Runge - Kutta Method - interpolation and extrapolation.

OUTCOMES

By the end of the course, the students will be able to,

- Acquire Knowledge of vector calculus for application to problems in Electromagnetic theory, Fluid dynamics etc.
- Get the knowledge of Matrix theory.
- Understand the use of complex variables for solving definite integrals.
- Expertise of special functions and their application in Initial value problems and Boundary value problems.
-

BOOKS FOR STUDY

1. Mathematical physics – Sathyaprakash sultan chand & sons 2014.
2. Advanced engineering mathematics – E. kreyszig , John Wiley & sons 2006.
3. Matrices and tensors in physics – A.W.Joshi, New age international 1995.
4. Numerical methods in science and engineering – M.K.Venkatraman, National publishing company 1999.

BOOKS FOR REFERENCE

1. Engineering mathematics – Stroud, ELBS 1970.
2. Advance Engineering mathematics – Stroud , ELBS 1970.
3. Mathematical physics – P.K. Chattopadhyay , New age international 1990.
4. Introduction to numerical methods -S.Sastry, PHI 1998.

Question Paper Pattern

Maximum Marks -75 **Exam Duration: 3 Hours**

Part-A 10×2=20 Marks Answer ALL Questions (Two questions from each unit)
Part-B 5×5=25 Marks Answer ALL Questions (Either or Type-Two questions from each unit)
Part-C 3×10=30 Marks Answer ALL Questions (Three out of Five-One question from each unit)

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Semester: 1
Course: CC2
Code: A1PPH2

Hours/Week: 6
Medium: English
Credits: 4

CLASSICAL MECHANICS

(For students admitted from 2022- 2023)

OBJECTIVES

- To understand the fundamental principles and applications of classical mechanics.
- To learn and apply the concepts of relativistic mechanics.

Unit I: LAGRANGIAN FORMULATION

Mechanics of a particle and a system of particles – Conservation laws – Constraints – Generalized coordinates – D'Alembert's principle - Lagrange's equation — Hamiltonian function – Cyclic co-ordinates - symmetry and conservation – Applications of Lagrange's equations to linear harmonic oscillator and Atwood's machine – configuration space and phase space.

Unit II: HAMILTONIAN FORMULATION

Variational principle – Hamiltonian's principle - Hamilton equation of motion – Application of Hamiltonian equation - charged particles in an electromagnetic field.

Canonical transformation – Poisson's bracket - Hamilton – Jacobi method – action and angle variables – Kepler's motion in action and angle variable.

Unit III: CENTRAL FORCE FIELD AND COLLISION

Equivalent one body problem – motion in a central force field – Inverse square law of force – Equation of the orbit – Kepler's problem.

Scattering in a central force field – Elastic & inelastic collision – Laboratory and centre of mass system – cross section – differential cross section – Rutherford scattering

Unit IV: MOTION OF RIGID BODY AND SMALL OSCILLATION

Rotating coordinate system – coriollis force - Euler's theorem – Angular momentum and kinetic energy – inertia tensor– Euler's equations of motion – torque free motion – Euler's angle - Symmetrical top

Theory of small oscillations – Eigen value problem – frequencies of free vibration – Normal co ordinates – Linear triatomic molecule.

Unit V: RELATIVISTIC MECHANICS

Four vectors – Minkowski's space – Minkowski's space for time dilation, length contraction – Lorentz invariant – space - time diagram – time order and space separation of events – invariance of Maxwell equation under Lorentz transformation.

OUTCOMES

By the end of the course, the students will be able to,

- Acquire fundamental knowledge of classical dynamics.
- Use D'Alemberts principle to drive the Lagrange equations of motion.
- Understand theory of small oscillations in normal modes and their frequencies.
- Understand the Lagrangian and Hamiltonian methods.
- Gain the knowledge of relativity and its consequence.

BOOKS FOR STUDY

1. Classical Mechanics - H. Goldstein, C.P. Poole and J.L. Safko, Pearson Education and Dorling Kindersley, New Delhi, 2007.
2. Introduction to Classical Mechanics - R.G.Takwale and P.S. Puranik, Tata McGraw Hill, 1979.
2. Classical Mechanics - S.L. Gupta, V. Kumar and H.V. Sharma, Pragati Prakashan, Meerut, 2001.
3. Classical Mechanics - N.C. Rana and P.S. Joag, Tata McGraw-Hill, New Delhi, 1991.

BOOKS FOR REFERENCE

1. *Classical Mechanics* V.B. Bhatia, Narosa, New Delhi, 1997.
2. Classical *Mechanics* T.L. Chow, John-Wiley, New York, 1995.
3. An Introduction to mechanics- Kleppher and Kolenkow, McGraw Hill Education, 2017.

Question Paper Pattern

Maximum Marks -75 **Exam Duration: 3 Hours**

Part – A 10×2=20 Marks Answer ALL Questions (Two questions from each unit)
Part-B 5×5=25 Marks Answer ALL Questions (Either or Type-Two questions from each unit)
Part-C 3×10=30 Marks Answer ALL Questions (Three out of Five-One question from each unit)

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Semester: 1
Course: CC3
Sub code: A1PPH3

Hours/Week: 6
Credits: 4
Medium: English

ELECTROMAGNETIC THEORY

(For students admitted from 2022-2023)

OBJECTIVES

- To acquire the knowledge of electromagnetic theories
- To understand the concept of antenna

Unit I: ELECTROSTATICS

Coulomb's law – continuous charge distribution - Gauss's law and its applications – Curl of E – Electric potential - Poisson's and Laplace's equations – Energy of a point charge distribution – Energy of a continuous charge distribution - Laplace's equation in one and two dimensions - method of separation of variables using Cartesian and Spherical coordinates .

Unit II: MAGNETOSTATICS

Magnetic forces - Biot-Savart law: Steady currents – Magnetic field of a steady current – Divergence and curl of B - Ampere's law - comparison of Magnetostatics and Electrostatics - magnetic vector potential – Multipole expansion of the Vector potential.

Unit III: ELECTRODYNAMICS

Equations of continuity - Faraday's law – induced electric field - Displacement current - Maxwell's equations - Poynting's theorem – Conservation of momentum - Gauge transformations - Coulomb gauge and Lorentz gauge.

Unit IV: ELECTROMAGNETIC WAVES AND WAVE PROPAGATION

Waves in one dimension: Wave Equation – Sinusoidal waves – Boundary conditions: Reflection and Transmission – Polarization – Wave Guides - TE modes in rectangular wave guides – Coaxial Transmission Line – Total internal reflection in Optical fibre cables.

Unit V: RADIATING SYSTEMS

Electric Dipole radiation – Magnetic Dipole radiation – Power radiated by a point charge – Radiation reaction - Radiation from a linear antenna, Radiation from a linear half wave antenna, antenna arrays.

OUTCOMES

By the end of the course, the students will be able to,

- Get the knowledge of electrostatics and magneto statics
- Understand how EM waves propagate in different media
- Understand how antenna works

BOOKS FOR STUDY

1. Introduction to Electrodynamics – David. J. Griffiths, Pearson Education Limited, 2013.
2. Classical Electrodynamics - J.D. Jackson, Wiley Eastern, 1988.
3. EMT and Electrodynamics - Satyaprakash Kedarnath & Ramnath & Co Meerut, 2005.

BOOKS FOR REFERENCE

1. Electromagnetic Theory – K.K.Chopra and G.C. Agarwal, K.Nath and Co Educational Publishers, Meerut, 2017.

Question Paper Pattern

Maximum Marks-75 **Exam Duration: 3 Hours**

Part – A 10×2=20 Marks Answer ALL Questions (Two questions from each unit)

Part-B 5×5=25 Marks Answer ALL Questions (Either or Type-Two questions from each unit)

Part-C 3×10=30 Marks Answer ALL Questions (Three out of Five-One question from each Unit)

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Semester: 1
Course: CC4
Code : A1PPH4P

Credits: 4
Hours/Week: 6
Medium: English

PRACTICALS – I

(GENERAL AND ELECTRONICS)

(For students admitted from 2022-2023)

OBJECTIVES

- To determine the properties of various materials
- Understand the characteristics of various semiconductor devices

(Minimum Fourteen experiments)

1. Determination of q, η, σ by elliptical fringes method.
2. Determination of Stefan's constant.
3. Planck's constant Determination.
4. Determination of λ- using LASER light
5. Four probe method – Determination of resistivities of powdered samples.
6. Determination of magnetic susceptibility of liquid by Guoy's method.
7. Determination of magnetic susceptibility of liquids by Quincke's method.
8. Charge of an electron by spectrometer.
9. Determination of wave length of monochromatic source using biprism
10. Determination of specific rotatory power of a liquid using polarimeter.
11. Forbe's method of determining thermal conductivity.
12. Determination of width of the given single slit and diameter of the given circular aperture – using LASER source
13. Series and Parallel connection of PV modules
14. Estimating the effect of sun tracking generation by solar PV modules
15. Determination of dielectric constant of a liquid by RF oscillator method.
16. Transistor power amplifier.
17. FET Amplifier.
18. Relaxation oscillator using UJT.
19. Design and study of Monostable Multivibrator

OUTCOME

By the end of the course, the students will be able to,

- Understand the properties of materials and characteristics of semiconductor materials.

Maximum Marks-60

Exam Duration: 4 Hours

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Semester : 1
Course: DEC1
Code: A1PPHEL1A

Hours/Week: 4
Credits : 4
Medium: English

COMMUNICATION ELECTRONICS

(For students admitted from 2022-2023)

OBJECTIVES

- Introducing knowledge about the generation and applications of microwaves.
- To give the knowledge about
- To introduce the basic ideas about communications through optical fiber cables.
- To study about the signal processing technique in colour television regarding light and sound.

Unit I: ANTENNAS

Antennas – Equivalent circuits – Thin linear antenna – Loop antennas – Radiation fields – Polarization – Isotropic radiator – Power gain – Effective parameters of an antenna – Dipole arrayed antennas – VHF, UHF and Microwave antennas.

Unit II: MICROWAVE GENERATION AND APPLICATION

Klystron – Magnetron – Traveling Wave Tube – Microwave Propagation through waveguides – HOI and EOI modes – Attenuators – Crystal Detection – Measurement of SWR – Radar equation – Detection and ranging – Transmitters and Receivers.

Unit III: COMMUNICATION SYSTEMS

Amplitude modulation – AM transmitters-Single side Band Principles – Balanced Modulator – SSB Generation and Reception – Frequency Modulation – FM transmitters – FM detectors – Pulse Modulation – Pulse Time Modulation –Pulse Width Modulation – Pulse Code Modulation – Delta Modulation.

Unit IV: OPTICAL FIBRE COMMUNICATION

Introduction – Electromagnetic wave Propagation in step index fibre and graded index fibres – Single mode fibre – Types of single mode fibres – Fibre parameters – Sources and detectors (semiconductor types) – Optic fibre communication system.

Unit V: MULTIPLE ACCESS METHODS AND NETWORKS

Frequency Division Multiple Accessing (FDMA) – Time Division Multiple Accessing (TDMA) – Carrier Sense Multiple Accessing (CSMA) – ALOHA – Code Division Multiple Accessing (CDMA).

Types of Networks (Circuit Switching, Message Switching, Packet - switched Networks) – Design features of Computer Communication Networks – ISDN – LAN – WAN – OSI Protocol of Network Architecture – Introduction to Mobile Telephone Communication (The Cellular concept).

OUTCOMES

By the end of the course, the students will be able to,

- Explain the operation of VHF, UHF and microwave antenna.
- Understand the principle of microwave propagation and its applications.
- Understand the role of transmitter and receiver in Communication networks.
- Acquire the knowledge on multiple access methods and networks.

BOOKS FOR STUDY

1. Electronic Communications - Dennis Ruddy and John Coolen, PHI, New Delhi, 1991.
2. Electronic Communication systems - G.Kennady, Tata McGraw Ltd. 1999.
3. Optical Communication - Gowar, Prentice Hall of India Ltd.1993.

BOOKS FOR REFERENCE

1. Principles of Communication Systems - H.Taub and D.L.Schilling, Tata McGraw Hill Edition, 1986.
2. Communication Electronics Principles and Applications - Louis E.Frenzel, Tata Mc Graw Hill Edition, 2006.

Question Paper Pattern

Maximum Marks-75 **Exam Duration: 3 Hours**

Part – A 10×2=20 Marks Answer ALL Questions (Two questions from each unit)

Part-B 5×5=25 Marks Answer ALL Questions (Either or Type-Two questions from each unit)

Part-C 3×10=30 Marks Answer ALL Questions (Three out of Five-One question from each unit)

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Semester: I
Course: DEC I
Code: A1PPHELIB

Hours/Week: 4
Credits: 4
Medium: English

BIOELECTRONICS AND BIOSENSORS

(For students admitted from 2022-2023)

OBJECTIVE

- To understand biological systems using modern devices.

Unit I: INTRODUCTION

Nature of Biomedical signals- Bio Electronic potentials- Necessity of Bio Electronics-Components-Scope and Application; Basics of cell biology- Structure of the cell. the nervous system and the neuron-function of enzymes- nucleus and role of DNA and RNA. adhesion of cell to surfaces.

Unit II:BIO ELECTRONICDEVICEPRODUCTION

Elements in contact with the surface of a biomaterial- blood composition. plasma proteins, cells, and tissues – Phenomena at the bio interfaces. Molecular and cellular processes with living environment, blood-materials interaction. short and long term reactions to the body – Testing of biomaterials- in vitro, in vivo preclinical and in vivo clinical tests.

Unit III:MATERIALS INCLINICAL DEVICES

Metals: Sulzer recall of prosthetic hip implant – Composition of stainless steel and Fe/Co/Ti alloys -Mechanical – properties – Hard Materials- Bio ceramics and Bio glasses. Carbons. Polymers as Biomaterials – Biodegradable Polymers – Composites- Biological reactions to implants – Natural Biomaterials – Collagen.

Unit IV:BIOSENSORS

Introduction to Biosensors – Types of sensors – target analytes – various recognition – signals and device types – basic design consideration – calibration – dynamic range – signal to noise – sensitivity – selectivity – interference – immobilization – adsorption – encapsulation– covalent attachment – device integration: micro scale and nano scale– Bio MEMS – nano wires –Quantum dots – magnetic beads, PEBBLE sensors.

Unit V: ELECTRICAL SIGNAL TRANSDUCTION

Seismic (mass) and thermal sensors- Electromechanical resonance – electrochemical forces – Henry's and ideal gas laws – Surface acoustic wave (SAW) devices – atomic force microscopy – manometric sensors – thermometric detection – Electrochemical sensors- Redox potentials, membrane potential, Gauss's Law, basic electrochemistry- conductimetric sensors; potentiometric sensors (ISE's and ISFETs)- amperometric sensors; Charge sensing with FET.

OUTCOMES

By the end of the course, the students will be able to,

- Get idea of biological systems
- Understand how modern sensor and devices work

BOOKS FOR STUDY

1. Fundamentals of Plasma Chemistry and Technology - H.Boenig, Technomic Publishing Co.Inc. Lancaster Basel. 1990.
2. Bioelectronics - From Theory to Applications - Itamar Willner and Eugenii Katz, John Wiley, 2005.
3. Bio electronics. S. Bone and B. Zebba, Wiley, 2012.
4. Electrodes and Membranes - J. Koryta, Ions, John Wiley, 1991.

BOOKS FOR REFERENCE

1. Chemical Sensors and Biosensors - B.R. Eggins John Wiley and Sons 2002.
2. Biosensors- E.A. Hell John Wiley and Sons, New York 1997.
3. Biomaterials: Principles and Applications - J. B. Park and J.D. Bronzion CRC Press 2003.
4. Micro Sensors. MEMS and Smart Devices -. J. W. Gardner, V.K. Varadan, and O. O. Awadelkarim Wiley 2001.

Question Paper Pattern

Maximum Marks -75 **Exam Duration: 3 Hours**

Part – A 10×2=20 Marks Answer ALL Questions (Two questions from each unit)

Part-B 5×5=25 Marks Answer ALL Questions (Either or Type-Two questions from each unit)

Part-C 3×10=30 Marks Answer ALL Questions (Three out of Five-One question from each unit)

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Semester: 1
Course: DEC1
Code: A1PPHEL1C

Hours/Week: 4
Credits: 4
Medium: English

SPACE SCIENCE

(For students admitted from 2022-2023)

OBJECTIVE

- To understand earth phenomena ,Sun activity and structure of the universe

Unit I: UNIVERSE

Large Scale Structure of the Universe- Astronomy and Cosmology- Our Galaxy- Galaxy types, Radio sources and Quasars- Structures on the largest scale- Coordinates and catalogues of astronomical objects- Expansion of the Universe.

Unit II: THE EVOLUTION OF STARS

Introduction- Classification of Stars- the Harvard classification, Hertzsprung -Russel diagram, Stellar evolution, White dwarfs and Electrons in a white dwarf star- Chandrasekhar limit-Neutron stars, Black holes, Supernova explosion and Photon diffusion time- Gravitational potential energy of a star, Internal temperature of a star, Internal pressure of a star.

Unit III: THE ACTIVE SUN

Introduction- Sunspots and Solar storms, Sunspots and Solar activity- Cosmic rays of Solar origin- The Solar wind, solar corona and the origin of the solar wind- Disturbed Solar wind.

Unit IV: THE EARTH'S ATMOSPHERE

Introduction- Nomenclature and temperature profile- Temperature distribution in the troposphere, Temperature of stratosphere - mesosphere and thermosphere - Temperature variability- The pressure profile, Scale height and Density variation- The Ionosphere- Effect on scale height, Ionospheric electric fields, Ionization profile, Layer of charge- Ionospheric hydrogen and Helium.

Unit V: MAGNETOSPHERE

Introduction- The magnetic field of Earth - Earth's variable magnetic field, Solar activity and Earth's magnetic weather, solar wind interaction- The Chapman-Ferraro closed

magnetosphere - Dungey's open magnetosphere, Structure of the magnetosphere - Magneto tail
and Plasma sheet, Plasma sphere, Earth's radiation belts.

OUTCOMES

By the end of the course, the students will be able to,

- Get the knowledge of earth atmosphere and magnetosphere
- Understand different activity of sun
- Get idea of Star formation
- Understand the structure and dynamics of universe

BOOKS FOR STUDY

1. Introduction to Space Science – Robert C Hymes John Wiley & Sons, 1971.
2. Earth's Proximal Space- Chanchal Uberoi, Universities Press India , 2000.
3. Introduction to Cosmology- J. V. Narlikar , Cambridge University Press, 1993
4. Modern Physics- R. Murugeshan, Kiruthika Sivaprasath , S.Chand & Company Ltd, 2007.

BOOKS FOR REFERENCE

1. Space Physics and Space Astronomy – Michael D Pappagiannis, Gordon and Breach Science Publishers Ltd, 1972.
2. Introductory Course on Space Science and Earth's environment Degaonkar - Gujarat University, 1978.
3. Introduction to Ionosphere and magnetosphere- Ratcliffe CUP, 1972.
4. The Physics of Atmospheres-Houghton Cambridge University Press
5. Introduction to Ionospheric Physics-Henry Rishbeth &Owen K. Garriot Academic Press, 1969.
6. Space Science –Louise K. Harra& Keith O. Mason Imperial College Press, London, 2004.

Question Paper Pattern

Maximum Marks -75 **Exam Duration: 3 Hours**

Part – A 10×2=20 Marks Answer ALL Questions (Two questions from each unit)

Part-B 5×5=25 Marks Answer ALL Questions (Either or Type-Two questions from each unit)

Part-C 3×10=30 Marks Answer ALL Questions (Three out of Five-One question from each unit)

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RAJAH SERFOJI GOVERNMENT COLLEGE (AUTONOMOUS)
THANJAVUR - 613 005.

Semester: 1
Course: GEC1
Code: A1PPHGE1

Hour: 2
Credits: 2
Medium: English

FIRST AID AND EMERGENCY CARE

(For students admitted from 2022 - 2023)

OBJECTIVES

- To understand their role as an emergency first aider.
- To understand the use of risk assessments for health and safety purposes.
- To understand how to respond to accidents and sudden illness.
- To gain the knowledge on poisoning and bites.
- To learn the first aid kids used in clinical.

Unit I: INTRODUCTION

Rules of First Aid – Principles and objectives of first aid examination of patient – Assessment- Priorities of first aid – Patient management and care.

Unit II: FIRST AID ROOMS AND EQUIPMENTS

First aid kits, cleaning of wounds and dressing injury assessment.

Unit III: MANAGEMENT

Management of common illness and thermal illness – Risk assessment and risk reductions – Fainting, Anaphylaxis, Asthma, and Epilepsy, Diabetes, burns and Scalds.

Unit IV: INJURIES

Internal and external bleeding injuries to muscles, back, chest abdomen, joints, and bones, strokes and head injury and eye irrigation – Sudden illness – poisoning, Bites and Stings.

Unit V: ACCIDENT REPORTING

Breathing emergencies, cardiac emergencies – Oxygen therapy- resuscitation, defibrillation – Heart attack – Common gastrointestinal sickness.

OUTCOMES

On completion of the course the students will be able to

- Know what is first aid and able to examine the patient who is in need of first air
- Administer first aid to an adult casualty who is unconscious (including seizure) cardiopulmonary resuscitation to an adult, including using an AED.
- Administering first aid to who is wounded and bleeding.
- Administering first aid to an adult casualty who is suffering from heart attack and provide oxygen therapy.
- Know the first aid room and equipments.

BOOKS FOR STUDY

1. First Aid to the Injured-Authorized manual of St John's Ambulance, Red cross road John A Eastman, New Delhi . 2007
2. Manual of First Aid. Jaypee Brothers, Medical Publishers Pp-441 Abhitabh Gupta 2003.
3.

BOOK FOR REFERENCE

1. Karesh Prasad, 2012. First Aid for Nurses. Jaypee Publishers, New Delhi.

Question Paper Pattern

Maximum Marks -75 **Exam Duration: 3 Hours**

Part-A 10×2=20 Marks Answer ALL Questions (Two questions from each unit)
Part-B 5×5=25 Marks Answer ALL Questions (Either or Type-Two questions from each unit)
Part-C 3×10=30 Marks Answer ALL Questions (Three out of Five-One question from each unit)

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THANJAVUR - 613 005.

Semester : 2
Course: CC5
Code : A2PPH5

Hours/Week: 6
Credits: 4
Medium: English

MATHEMATICAL PHYSICS – II

(For students admitted from 2022-2023)

OBJECTIVES

- To acquire knowledge of mathematical physics
- To understand complex variable ,Fourier and Laplace transform, green's function, probability
- To understand tensors, Dirac delta function and group theory

Unit 1: COMPLEX VARIABLES

Functions of complex variables – Differentiability – Cauchy - Riemann conditions – Harmonic function - integrals of complex function – Cauchy's integral theorem and integral formula – Analytic function and Singularity- Types of singularity- Taylor's and Laurent's series. – Cauchy residue theorem.

Unit II: FOURIER AND LAPLACE TRANSFORM

Fourier series – Dirichlet's conditions – Sine and Cosine series – Fourier integrals – Fourier transforms – Faltung theorem – Application to heat and wave equations.

Laplace transform –theorems - Inverse Laplace transform – Solving differential equation.

Unit III: GREEN'S FUNCTION AND PROBABILITY

Green's function: Green's functions – properties – construction of Green's function by Eigen function expansion methods of solutions in one dimension – Boundary condition – Solving differential equation.

Probability: Introduction – Random variables – Binomial, Normal and Poisson distribution – Central limit theorem.

Unit IV: TENSORS AND DIRAC DELTA FUNCTION

Tensors: Transformation of co-ordinates – Summation convention – Contravariant – Covariant and mixed tensors – Rank of a tensor – Symmetric and Anti symmetric tensors – Addition, Subtraction, Outer product and Inner product of Tensors – contraction of tensors – Metric tensors - raising and lowering of indices.

Dirac Delta Function : Definition of Dirac Delta function – Properties of Dirac delta function - different representation of Dirac Delta Function – Step function, Resonance function, Gaussian distribution, Diffraction condition (Drichlet).

Unit V: GROUP THEORY

Definition of Group– Multiplication table – Sub groups and Co sets - Rearrangement theorems – Lagrange's theorem - rotation group – symmetric operation of C_{4v} and C_{3v} groups – Representation theory – Homomorphism and Isomorphism – reducible and irreducible representations – Schur's lemmas – The great Orthogonality theorem – classes – Direct product group - Character Tables.

OUTCOMES

By the end of the course, the students will be able to,

- Acquire Knowledge of complex variable.
- Understand Fourier and Laplace equations to solve Differential Equations.
- Understand the use of green function in solving Partial Differential Equations.
- Acquire knowledge of probability basics.
- Get the knowledge of group theory and its application to spectroscopy and Nuclear Physics.
- Acquire of relevant mathematical skills to predict the dynamics of physical systems.

BOOKS FOR STUDY

1. Mathematical physics – Sathyaprakash, Sultan Chand & Sons, 2014.
2. Mathematical physics – P. K. Chattopadhyay, New Age International, 1990.
3. Advanced engineering mathematics – E. Kreyszig, John Whiley & Sons, 2006.
4. Group theory for Physicist – A. W. Joshi, Wiley Eastern ltd, 1982.
5. Complex variable – Speigel, Schaam series1986.

BOOKS FOR REFERENCE

1 Engineering mathematics – Stroud. ELBS, 1970.
2 Advanced Engineering Mathematics - Stroud, ELBS, 1970.

Question Paper Pattern

Maximum Marks-75 **Exam Duration: 3 Hours**

Part – A 10×2=20 Marks Answer ALL Questions (Two questions from each unit)

Part-B 5×5=25 Marks Answer ALL Questions either or Type-Two questions from each unit

Part-C 3×10=30 Marks Answer ALL Questions (Three out of Five-One question from each unit)

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Semester: 2
Course: CC6
Code : A2PPH6

Hours/Week : 6
Credits: 4
Medium: English

QUANTUM MECHANICS

(For students admitted from 2022-2023)

OBJECTIVES

- To understand the physical laws prevailing in Quantum mechanics.
- To apply Quantum mechanics at relativistic cases.

Unit I: FORMULATION OF QUANTUM MECHANICS

Schrodinger's wave equation - Physical interpretation - continuity equation and condition on the wave function – normalization -Expectation value – Ehrenfest Theorem – Postulates in Quantum mechanics – Heisenberg's uncertainty Principle.

Unit II: OPERATOR FORMALISM

Operator formalism – Linear operators – Self adjoint operators – Commutators – Simultaneous Eigen Functions – Eigen functions and Eigen values.

Exactly solvable systems: Particle in a box – Square well Potentials – Linear harmonic oscillator – Rigid Rotator – Hydrogen atom.

Unit III: APPROXIMATION METHODS.

Time independent perturbation theory: Non - Degeneration case - First and Second order perturbation – Degenerate case – Stark effect – Variation method – Applications.

Time dependent perturbation theory: Constant perturbation – Harmonic perturbation – Transition probability.

Unit IV: ANGULAR MOMENTUM

Angular momentum operators in Spherical polar coordinates – Eigen value spectrum – commutation relations of J , Jx , Jy, Jz ,J_+ ,J-, J^2 – Matrix representation of J , Jx , Jy ,Jz - Addition of angular momentum – CG coefficient.

Matrix mechanics – Schrodinger's picture – The Heisenberg picture – the interaction picture – Dirac's Bra and Ket Vectors – Hilbert space.

Unit V: RELATIVISTIC WAVE MECHANICS

The Klein – Gordan equations – Charge and current densities – Dirac's equation – Dirac's Relativistic Hamiltonian – Dirac's Matrices – Free particle solutions – Significance of negative energy states – spin angular momentum.

OUTCOMES

By the end of the course, the students will be able to,

- Understand the fundamental concepts of quantum mechanics.
- Understand the importance Schrodinger equation and their simple applications.
- Understand the basics of relativistic quantum mechanics and its wide ramifications.

BOOKS FOR STUDY

1. Quantum Mechanics - Satya Prakash, Pragati Prakashan Meerut, 2013.
2. Quantum Mechanics by Ajoy Ghatak, S. Lokanathan, Springer Science, Kulwer Acadamy Publisher, 2004.
3. Quantum Mechanics Leonard I. Schiff, Tata McGraw Hill New Delhi, 1968.

REFERENCES

1. A Text Book of Quantum Mechanics – P. M .Mathews and Venkatesan – Tata McGraw Hill, 1976.
2. Advanced Quantum Theory and Fields - S.L. Gupta I. D. Gupta S. Chand and company New Delhi, 1982.
3. Angular momentum Techniques in Quantum Mechanics – V. Devanathan, Springer, 1999.

Question Paper Pattern

Maximum Marks -75 **Exam Duration: 3 Hours**

Part-A 10×2=20 Marks. Answer ALL Questions (Two questions from each unit)
Part-B 5×5=25 Marks .Answer ALL Questions (Either or Type-Two questions from each unit)
Part-C 3×10=30 Marks .Answer ALL Questions (Three out of Five -One question from each unit)

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Semester: 2
Course: CC7
Code: A2PPH7

Hours/Week: 6
Credits: 4
Medium : English

STATISTICAL MECHANICS

(For students admitted from 2022-2023)

OBJECTIVES

- To study the consequences of laws of thermodynamics.
- To study principles and application of clinical and quantum statistical mechanics.
- To study the basics of latest development of SM

Unit I: STATISTICAL THERMODYNAMICS

Laws of thermodynamics - Heat content and Heat Capacity-Specific heat – Entropy and second law of thermodynamics – thermodynamic potential and the reciprocity relations – Gibb's paradox -Maxwell's relations – Deductions – Properties of thermodynamic relations – Gibb's - Helmholtz relation - Nernst Heat theorem of third law – consequences of third law –Gibb's phase rule – chemical potential.

Unit II: KINETIC THEORY

Boltzmann transport equation and its validity - Boltzmann's H-theorem and its analysis – Method of most probable distribution - Transport phenomena- Mean free path - Conservation laws - Zero and first order approximations – Viscous hydrodynamics – Navier – Stoke's equation.

Unit III: CLASSICAL STATISTICAL MECHANICS

Macro and micro states – statistical equilibrium – Phase space - Ensembles –Micro canonical ensemble and Grand canonical ensembles – Liouville's theorem – Maxwell – Boltzmann distribution law - Principles of equi partition of energy – Partition function – Relation between partition function and thermodynamic quantities

Unit IV: QUANTUM STATISTICAL MECHANICS

Black body radiation -Planck's formula – Photon gas – Specific heat of solids – Einstein's Quantum theory – Dulong and Petit's law -Debye's quantum mechanical theory Bose – Einstein statistics - Bose – Einstein condensation – Liquid helium

Fermi Dirac statistics – Fermi Dirac gas –Properties – Degeneracy – Electron gas – Free electron model and thermionic emission.

UNIT V: NON EQUILIBRIUM PHENOMINA

Landau's theory of phase trasition – First and second order -Ising and Heisenberg models – Elements of non-equilibrium – phenomena – Fluctuations – Wiener–Khintchine theorem – Thermodynamics of irreversible processes – Onsager's reciprocity relations.

OUTCOMES

By the end of the course, the students will be able to,

- Understand the laws of thermodynamics and give an account of the relevant quantities used to describe the macroscopic system, thermodynamic potentials etc.
- Describe the Reciprocity theorem, Thermodynamic Equilibrium and Nernst Heat theorem.

BOOKS FOR STUDY

1. Thermodynamics and Statistical Physics – Satya Prakash and J.P.Agarwal, 2008.
2. Statistical Mechanics - Gupta and Kumar – A Pragati Edition, 1999.
3. Thermal Physics - by S Garg, R. Bansal , C. Ghosh - Tata McGraw-Hill Education, 2013.
4. Statistical Mechanics, R. Huang, Wiley Eastern Ltd., New Delhi, 1983.

BOOKS FOR REFERENCES

1, Statistical and Thermal physics, F. Reif, McGraw Hill International Edition, Singapore 1979.

2., Statistical Mechanics, Bk Agarwal, Melvin Eisner, New Age International (P) Ltd, 2016.

3., Statistical physics, F. Mandl, John Wiley, London, 1971.

4. Thermal physics, C. Kittel, 2nd Edn.(1980).Publisher Alexis Hart.

5. Thermodynamics & Statistical Physics SL Kakani Published by Sultan Chand & Sons, 1987.

6. Molecular Physics - A. N. Matveev – MIR publisher, 1985.

Question Paper Pattern

Maximum Marks -75 **Exam Duration: 3 Hours**

Part – A 10×2=20 Marks Answer ALL Questions (Two questions from each unit)
Part-B 5×5=25 Marks Answer ALL Questions (Either or Type-Two questions from each unit)
Part-C 3×10=30 Marks Answer ALL Questions (Three out of Five-One question from each unit)

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THANJAVUR - 613 005.

Semester: 2
Course: CC8
Code : A2PPH8P

Hours/Week: 6
Credits: 4
Medium: English

PRACTICAL – II

ADVANCED GENERAL EXPERIMENTS

(For students admitted from 2022-2023)

OBJECTIVES

- To study the properties of various materials
- To understand the characteristics of various semiconductor devices

(Minimum Fourteen experiments)

1. Determination of q, η, σ by hyperbolic fringes method.
2. Determination of e / m of an electron by magnetron method
3. Stefan's Law – verification
4. Optical Fibre – measurements of attenuation coefficient and Numerical aperture
5. Determination of carrier concentration and Hall coefficients in semiconductors.
6. Determination of magnetic susceptibility of powdered sample by Guoy's method.
7. Polarizabillity of liquids by finding the refractive indices at different wavelengths.
8. Determination of refractive index of liquids using biprism by scale & telescope method.
9. Determination of bulk modulus of a liquid by ultrasonic wave propagation.
10. Rydberg's constant using spectrometer.
11. Measurement of current-voltage characteristics of two solar cells connected a) in series & b) in parallel
12. Dependance of current-voltage characteristics of crystalline silicon solar cell on a) light intensity & b) temperature of solar cell.
13. Characteristics of UJT.
14. Characteristics of LDR.
15. Study of a feedback amplifier – Determination of band width, input and output impedances.
16. Characteristics of SCR.
17. Determination of dielectric constant of a liquid by RF oscillator method.

OUTCOMES

By the end of the course, the students will be able to,

- Understand the properties of materials
- Explain the various characteristics of semiconducting devices

Maximum Marks-60

Exam Duration: 4 Hours

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Semester: 2
Course: DEC2
Code: A2PPHEL2A

Hours/Week: 4
Credits: 4
Medium: English

MICROPROCESSOR AND MICROCONTROLLER

(For students admitted from 2022-2023)

OBJECTIVES

- To acquire knowledge about microprocessor and apply it to various interfacing applications.
- To introduce the basics of micro controller

Unit I: MICROPROCESSOR INTEL 8085

Introduction - Architecture – Pin configuration – Various registers – Addressing modes - Instruction set – Data transfer group – Arithmetic group – Logical group – Branch and control group – Stack I/O and Machine control group – Stack – Subroutine – Assembly language programme – addition, subtraction, multiplication and division of two 8-bit numbers – Biggest and smallest number in a data array – arranging a list of numbers in ascending or descending order-16-bit addition.

Unit II: MICROPROCESSOR INTEL 8086

Intel 8086 microprocessor – features – Architecture - pin description of 8086 – operating modes – Pin description for minimum mode - Pin description for maximum mode – functional units – registers – addressing modes – classification of instructions – data transfer , arithmetic , logical and branch instructions.

Unit III: PERIPHERAL DEVICES AND THEIR INTERFACING

Address space partitioning – memory mapped I/O scheme and I/O mapped I/O scheme – Memory and I/O interfacing – Data transfer schemes – Programmed data transfer and DMA data transfer - interfacing devices and I/O devices – generation of control signals for memory and I/O devices - I/O ports – programmable peripheral interface (PPI) – Architecture of INTEL 8255 A – operating modes of 8255 A – control groups – control word.

Unit IV: MICROCONTROLLER – 8051

Introduction - Difference between microprocessor and microcontroller - Architecture-pin configuration – Registers – key features – Assembly language programming – Addition, subtraction, multiplication and division of 8 bit numbers.

Unit V: MICROPROCESSOR AND MICROCONTROLLER APPLICATIONS

Microprocessor interfacing and applications: Interfacing 7 segment LED display - temperature measurement – Measurement of frequency, voltage and current – traffic light

control interfacing - Interfacing of ADC0800 - Interfacing of DAC0800 .

Microcontroller interfacing and applications: Interfacing of Stepper motor- keyboard Interface.

OUTCOMES

By the end of the course, the students will be able to,

- Acquire knowledge of microprocessor 8085, 8086 and microcontroller 8051.
- Gain knowledge about interfacing devices.
- Learn and write the assembly language programs.

BOOKS FOR STUDY

1. Fundamentals of Microprocessors and Microcomputers, B. Ram, 5th Edition, Dhanapat Rai Publications (P) Ltd., New Delhi , 2006.
2. The 8051 Microcontroller and Embedded systems, Muhammad Ali Mazidi, Janice Gillispie Mazidi Pearson Education, Delhi, Seventh Indian reprint 2004.
3. Microprocessor and microcontroller – Dr. J. S. Leena Jasmine, Magnus Publications, Chennai, 2016.
4. Fundamentals of microprocessor 8085 – V. Vijayendran, Divya Subramanian for Ananda Book depot, 2019.
5. Microprocessors and microcontrollers – Krishna Kant- PHI learning private limited – Delhi 2016.

BOOKS FOR REFERENCE

1. Microprocessor Architecture Programming and Applications with 8085, Ramesh S. Goankar, 5th Edition. Pergaman International Publishing India Pvt. Ltd.
2. Microprocessors and its Applications, A.P. Godse, First Edition Pune, 2006.
3. Microprocessor and Microcontrollers, A. Nagoor kani RBA Publications, Chennai-2006.

Question Paper Pattern

Maximum Marks-75 **Exam Duration: 3 Hours**

Part – A 10×2=20 Marks Answer ALL Questions (Two questions from each unit)

Part-B 5×5=25 Marks Answer ALL Questions (Either or Type-Two questions from each unit)

Part-C 3×10=30 Marks Answer ALL Questions (Three out of Five-One question from each unit)

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THANJAVUR - 613 005.

Semester: 2
Course: DEC2
Code : A2PPHEL2B

Hours/Week: 4
Credits: 4
Medium: English

OPTO ELECTRONICS

(For students admitted from 2022-2023)

OBJECTIVE

- To know different Optoelectronic devices.

.Unit I: INTRODUCTION

Propagation of electromagnetic waves in dielectric wave guides – fibers – boundary conditions – phase velocity and group velocity – Dispersion – cut off frequencies - EM field in core and cladding – single mode and multimode fibers.

Unit II:ACTIVE DEVICES

LED's lasers – Laser principles – spontaneous and stimulated emission – coherence – gain equation – three level, four level lasers- examples of lasers (He-Ne) Ruby, diode – homojunctioin and heterojunction diode lasers.

Unit III:FIBRE OPTICS COMMUNICATION

LED and lasers source – Transmitter modulator – acoustic – optic, electro optic modulator – AM, FM, DCM modulation – detection and demodulation radiation detection – PIN, APD and PM tube.

Unit IV:OPTICAL FIBRE SENSORS

General features, types of OFS, intrinsic and extrinsic sensors, intensity sensors, shuttes based multimode OFS, simple fibre based sensors for displacement, temperature and pressure measurements – reflective OFS and applications, Fibre Bragg grating based sensors.

Unit V:INTERFEROMETRIC FOS

Basic principles, interferometric configurations, Mach – Zendes, Michelson and Fabry – Perrot configurations – components and construction of interferometric FOS, applications of interferometric FOS, Sagnac interferometer, fibres gyro, OTDR and applications.

OUTCOME

By the end of the course, the students will be able to,

- Get knowledge of Opto electronic devices.

BOOKS FOR STUDY

1. Planar Optical Waveguides and Fibres - Oxford University Press, Oxford. H.G. Unger
2. Principles of Optical Electronics - John Wiley, A. Yariv New York, 1984.
3. Waves and Fields in Optoelectronics - .H.A. Haus Prentice Hall. New Jersey. 1984.
4. Optics. Second Edition - Ajoy Ghatak Tata McGraw Hill, 2013.
5. Fundamentals of Fiber Optics in Telecommunications and Sensor Systems - B.P. Pal.. New Age International. New Delhi. 1992.

BOOKS FOR REFERENCE

1, Optical Measurement Techniques and Applications - Artech House,.P. K. Rastogi .1997.

2. Optoelectronics: Infrared-Visible-Ultraviolet Devices and Applications - Dave Birtalan, William Nunley CRC Press, 2009.

3., Physics of Optoelectronics - Michael A. Parker, CRC Press. 2005.

Question Paper Pattern

Maximum Marks -75 **Exam Duration: 3 Hours**

Part – A 10×2=20 Marks Answer ALL Questions (Two questions from each unit)
Part-B 5×5=25 Marks Answer ALL Questions (Either or Type-Two questions from each unit)
Part-C 3×10=30 Marks Answer ALL Questions (Three out of Five-One question from each unit)

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THANJAVUR - 613 005.

Semester: 2
Course: DEC2
Code : A2PPHEL2C

Hours/Week: 4
Credits: 4
Medium: English

ANALYTICAL INSTRUMENTATION

(For students admitted from 2022-2023)

OBJECTIVE

- To understand the functions of various analytical instruments for research.

Unit-I: INTRODUCTION

Introduction to Chemical Instrumental Analysis - advantages over classical methods - Basic functions of instrumentation – signal to noise ratio – sensitivity and detection limit - spectrometric methods – Molecular, Electronic and vibrational energy levels – Atomic energy levels.

Unit-II: AN INTRODUCTION TO SPECTROMETRIC METHODS

Quantum mechanical properties of radiation - Atomic absorption spectroscopy - Principle - working - Instrumentation - back-ground correction - Atomic Emission Spectroscopy - Principle - Types -Flame photometer - DC arc and AC arc excitation - plasma excitation - Fluorescence and Phosphorescence spectroscopy – Instrumentation for phosphorescence measurements.

Unit-III: MOLECULAR SPECTROSCOPY

Introduction to Molecular spectroscopy – Beers law - Quantitative methodology – UV-Vis spectrometry – Instrumentation – single and double beam spectrometers – quantitative application of UV-Vis absorption spectroscopy – Theory of IR spectroscopy - Principle - sources, detectors, dispersive and Fourier Transform IR spectroscopy – application of IR spectroscopy (Near and Far IR).

Unit-IV: RAMAN SPECTROSCOPY AND X-RAY SPECTROSCOPY

Theory of Raman spectroscopy – Instrumentation – sample handling and Illumination – structural analysis – applications of Raman spectroscopy – Production of X-rays – X ray absorption and diffraction – Auger Emission spectroscopy (AES) – Electron spectroscopy for chemical analysis (ESCA).

Unit –V: MICROWAVE AND NUCLEAR MAGNETIC SPECTROSCOPY

Microwave spectroscopy – basic principle - Instrumentation – Structural analysis for organic compounds – Fundamentals of NMR - continuous and Fourier Transform NMR spectrometer – Instrumentation – spectra and molecular structure - elucidation of NMR spectra – Applications of H^1 and C^{13} NMR – quantitative analysis - NMR imaging in medicine.

OUTCOME

By the end of the course, the students will be able to,

- Understand function of various analytical instruments for material characterization.

BOOKS FOR STUDY

1 .Instrumental Methods of Analysis, Willard, Merritt, Dean, Settle, CBS Publishers & Distributors, New Delhi, 7th edition.

2. Principles of Instrumental Analysis, Skoog, Holler, Nieman, Thomson brooks-Cole publications, 6th Edition.

BOOKS FOR REFERENCE

1. Silverstein M.R., Bassler C.G. and Morrill C.T., "Spectrometric Identification Of Organic compounds", John Wiley & Sons, 1991.

2. Introduction to Instrumental Analysis, Robert D. Braun, McGraw-Hill Book Company.

Question Paper Pattern

Maximum Marks-75 **Exam Duration: 3 Hrs**

Part – A 10×2=20 Marks Answer ALL Questions (Two questions from each unit)

Part-B 5×5=25 Marks Answer ALL Questions (Either or Type-Two questions from each Unit)

Part-C 3×10=30 Marks Answer ALL Questions (Three out of Five-One question from Each unit)

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Semester: 2
Course: GEC2
Code: A2PPHGE2

Hours: 2
Credits: 2
Medium: English

ENTREPRENEURIAL DEVOLPEMENT

(For students admitted from 2022 - 2023)

OBJECTIVES

- To instruct the characteristics essential for entrepreneurial and the role of entrepreneurial in economic development
- To encourage rural entrepreneurs.
- To know the special schemes offered by the government.

Unit I: CONCEPT OF ENTREPRENEURSHIP

Meaning – Definition – characteristics – functions – role of entrepreneurs in economic development – classification of entrepreneurs – factors affecting entrepreneurial growth – entrepreneurship development programmes.

Unit II: PROJECT

Project appraisal – Project formulation – Project identification – sources of ideas – preliminary evaluation and testing of ideas.

Entrepreneurial opportunities for physical science: Microprocessor – crystal – solar panels – semiconductor devices - mobile servicing – computer servicing.

Unit III: LICENSING

Licensing procedures to start an industrial unit – procedures to start small and women entrepreneurs – import and export substitutions oriented items – new procedures.

Unit IV: GOVERNMENT SUBSIDISED LOAN SCHEMES

District industrial centre (DIC) - Definition of MSME- Classification – Types of Schemes, Objectives , Key Benefits and How to apply - Unemployed Youth Employment Generation Programme UYEGP – Prime Minister Employment Generation Programme PMEGP – New Entrepreneur Cum Enterprise Development Programme NEEDS, Ineligibility list for NEEDS.

Centre for Entrepreneurship Development and Incubation (CEDI), NIT, Triruchirapalli, Indian Institute of Food Processing Technology (IIFPT), Thanjavur.

Unit V: GOVERNMENT MSME INCENTIVE SCHEMES

Objectives and Key Benefits - Capital subsidy - Additional Capital subsidy: Thrust Sector Enterprises, List of thrust sectors, Micro Manufacturing Enterprises, select category of entrepreneurs and scaling up - Operational Improvement: Low Tension Power Tariff(LTPT) subsidy, Payroll subsidy, generator subsidy, Promotion of Energy Audit and Conservation of Energy(PEACE) – Skill training and employment scheme.

Statutory: Reimbursement of stamp duty and registration charges - Value Addition: Scheme for acquiring Quality certification (Q- Cert), Subsidy for Asset creation for intellectual property, Reimbursement of Hall Rent.

OUTCOMES

- Understand the concept of entrepreneurship.
- Get awareness about the source of project appraisal
- Understand the legal requirements for licensing procedures.
- Know the incentives and subsidies of state and central governments
- Get the idea of entrepreneurial opportunities of physical science
-

BOOKS FOR STUDY

1. Entrepreneurial development – C. Gupta, N. P. Srinivasan, Sultan Chand and sons
2. Dynamics of entrepreneurial development and Management – Vasant Desai, Himalaya Publishing House.
3. Scheme Booklet for MSMEs in Government of Tamil Nadu – with effect from 16th February 2021.

BOOKS FOR REFERENCE

1. Entrepreneurship development principles, policies and programme – P. Saravanavel.

Question Paper Pattern

Maximum Marks -75 **Exam Duration: 3 Hours**

Part-A 10×2=20 Marks Answer ALL Questions (Two questions from each unit)
Part-B 5×5=25 Marks Answer ALL Questions (Either or Type-Two questions from each unit)
Part-C 3×10=30 Marks Answer ALL Questions (Three out of Five-One question from each unit)

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RAJAH SERFOJI GOVERNMENT COLLEGE (AUTONOMOUS)
THANJAVUR - 613 005.

Semester: 3
Course: CC9
Code : A3PPH9

Hours/Week: 6
Credits : 5
Medium : English

NUCLEAR AND PARTICLE PHYSICS

(For students admitted from 2022-2023)

OBJECTIVE

- To acquire knowledge about nuclear structure, Radioactive Decays, Nuclear Fission and Fusion, Nuclear Reactions and Elementary Particles.

Unit I: NUCLEAR STRUCTURE

General properties of nucleus –Mass defect – binding energy - nuclear stability – N/P ratio - semi empirical mass formula – nuclear angular momentum – Deutron basic properties – ground state of Deutron – proton neutron scattering at low energy – scattering length – phase shift -Nuclear forces : meson theory of nuclear forces – Yukawa potential. – Properties of nuclear force – spin dependence, charge independence.

Unit II: RADIOACTIVE DECAY

Alpha decay - Geiger – Nuttal law – Gamow's theory of alpha decay – Beta decay - Pauli's neutrino hypothesis – Fermi's theory of beta decay – Selection rules – Gama decay – Multi pole in gamma transition – Internal conversion – Nuclear isomerism - Radioactive Growth and Decay – Ideal equilibrium – Transient equilibrium – secular equilibrium – determination of age of the earth – carbon dating.

Unit III: NUCLEAR REACTION AND MODELS

Kinds of nuclear reaction - Direct reaction – Theory of stripping and Pick up reactions – stages of reaction – compound nucleus - nuclear scattering and reaction cross section. – Level width – Resonance theory - Breit Wigner formula - Liquid drop model – magic numbers – shell model – different potential – magnetic moment – spin orbit coupling – evidences for shell model.

Unit IV: NUCLEAR FISSION AND FUSION

Types of fission – Mass and kinetic energy- distribution of fission fragments – Neutron emission in fission – types of neutrons – neutron reactions – fission cross section- Bohr wheeler theory of nuclear fission — Nuclear chain reactions – Critical size – Four factor formula – moderator - General aspects of nuclear reactor design – Classification of reactors - Breeder reactor - Fissile and fertile material - Nuclear fusion – Controlled thermo nuclear fusion reactions.

Unit V: ELEMENTARY PARTICLES

Fundamental interactions – Antiparticles - Classification of elementary particles – Strange particles - Conservation laws and Quantum numbers – Baryon number, lepton numbers, isospin, strangeness, parity, charge conjugation, time reversal – CPT theorem – Parity violation – CP violation – Quark model – SU(2) amd SU(3) symmetry. - Gellman Okuba formula

OUTCOMES

By the end of the course, the students will be able to,

- Understand the fundamentals of nuclear properties and deuterons
- .Illustrate the radioactive processes and their corresponding decay.
- Realize the importance of nuclear energy resources through various nuclear reactions.
- Understand the knowledge of elementary particles
- Acquire knowledge on fission and fusion reactions for production of energy.

BOOKS FOR STUDY

1. Elements of Nuclear Physics – M. L. Pandya & R. P. S. Yadav Kedarnath &Ramnath, 1988.
2. Nuclear physics – D. C. Tayal, Himalaya publishing House, 2014.
3. Modern Physics – R.Murugeshan, Kiruthiga Siva Prasath, S. Chand and Company, New Delhi, 2007.

REFERENCE

1. Amazingly Symmetrical World – L. Tarasov, MIR, 1973.
2. Nuclear and Particle Physics – Ashok Das & T. Ferbel, John Wiley, 1993.
3. Introduction to Elementary Particles – Longo, McGraw Hill, 1973.
4. Nuclear Physics – Y. M. Shirakov& N. P. Yudin, MIR, 1982.

Question Paper Pattern

Maximum Marks-75 **Exam Duration: 3 Hours**

Part -A 10×2=20 Marks Answer ALL Questions (Two questions from each unit)

Part-B 5×5=25 Marks Answer ALL Questions (Either or Type-Two questions from each unit)

Part-C 3×10=30 Marks Answer ALL Questions (Three out of Five -One question from each unit)

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Semester : 3
Course: CC10
Code : A3PPH10

Hours/week: 6
Credits : 4
Medium : English

SPECTROSCOPY

(For students admitted from 2022-2023)

OBJECTIVE

- To study the concepts of Infrared, Microwave, Raman, Electronic and Resonance spectroscopy and its applications.

Unit I: IR AND MICROWAVE SPECTROSCOPY

Quantization of energy – Regions of the electromagnetic spectrum – Classification of molecules — Classification of modes of vibrations – Bond stretching, Angle deformation, rocking, Wagging, Out of plane deformation, Twisting and Torsion - Vibrating diatomic molecule as a harmonic and unharmonic oscillator - Parallel and perpendicular bands of symmetric top molecules

Interaction of radiation with rotating molecule – Rigid rotator of diatomic molecule – Frequency of rotational spectral lines, selection rules of rotational spectra – Non rigid rotator – Determination of bond lengths of linear polyatomic molecules.

Unit II: RAMAN AND LASER SPECTROSCOPY

Raman Effect – Theory of Raman scattering – Quantum theory of Raman effect –Pure Rotational Raman Spectra of Linear and Symmetric Top molecules – Vibrational Rotational Raman spectra – Rule of Mutual exclusion - Difference between Raman and IR Spectra.

Raman Microscopy -Nonlinear optical effect – Hyper Raman effect – Classical treatment of Hyper Raman effect – Coherent Anti stokes Raman scattering (CARS) – Advantages and disadvantages of CARS compared to normal Raman scattering

Unit III: ELECTRONIC AND PHOTOELECTRONIC SPECTROSCOPY

Born Oppenheimer Approximation – Vibrational coarse structure – Intensity of vibrational electronic spectra - Franck- Condon principle – Dissociation energy and dissociation products – Rotational fine structure of Electronic- Vibration spectra – Fortrat parabola.

Photo Electric effect - Principle – Ultraviolet Photo Electron Spectroscopy (UPES) – Information from Photoelectron Spectra.

Unit IV: MAGNETIC RESONANCE SPECTROSCOPY

NMR: Nucleus in a magnetic field – Resonance condition – Spin-Spin and Spin-Lattice Relaxation times – Bloch equations – Chemical shift.

ESR: Principle – Position of ESR absorptions - g factor — ESR spectra of free radicals in solutions $-CH_3$ Radical and Benzene Anion - Hyperfine structure of Hydrogen, Deuterium and Tritium.

Unit V: INSTRUMENTATIONS AND APPLICATIONS OF SPECTROSCOPY

IR: Double beam IR Spectro Photometer - Identification of molecular constituents– Elucidation of molecular structure – Characterization of transition phases of ceramics - Biological applications. **Raman:** FT Raman Spectrometer - Single crystal Raman spectra – Structure determination - Molecules of types XY_2, XY_3 and XY_4 using IR and Raman. Raman spectral study of proton conduction in solids. - **Microwave:** Microwave spectrometer - General applications - Microwave Oven. **NMR:** Single and double coil NMR spectrometer - Applications in medical field - Nuclear Magnetic Resonance Imaging – Industrial applications. **ESR:** ESR Spectrometer – Biological and chemical applications.

OUTCOMES

By the end of the course, the students will be able to,

- Understand the principles and instrumentation techniques of IR and Microwave spectroscopy.
- Comprehend the basics and importance of Raman spectroscopy.
- Know the concepts of electronic and Photo electronic spectroscopy.

BOOKS FOR STUDY

1. Fundamentals of Molecular Spectroscopy, Colin. N. Banwell and Elaine M.Mccash, Tata McGraw- Hill Publishing Company Limited, 4th Edition, 1994.
2. Molecular Structure and Spectroscopy, Aruldas. G, PHI Learning Private limited, 2nd Edition, 2009.
3. Elements of Spectroscopy– Atomic, Molecular and Laser Physics, Gupta.S.L. Kumar.V. Sharma. R.C, Pragati Prakashan, 26th Edition, 2014.
4. Vibrational Spectroscopy- Theory and Applications, Sathyanarayana. D. N, New Age International Private Limited, Publishers, 2011.

BOOKS FOR REFERENCE

1. Spectroscopy - Straughan.B.P and Walker.S, Volume Two, John Wiley and Sons, Inc. 1976.
2. Molecular Spectroscopy - Suresh Chandra, Narosa Publishing House, 2009.
3. Introduction to Magnetic Resonance Spectroscopy ESR, NMR, NQR - Sathyanarayana.D.N. I.K. International Publishing House Pvt. Ltd. - 2009.

Question Paper Pattern

Maximum Marks -75 **Exam Duration: 3 Hours**

Part – A 10×2=20 Marks Answer ALL Questions (Two questions from each unit)
Part-B 5×5=25 Marks Answer ALL Questions (either or Type-Two questions from each unit)
Part-C 3×10=30 Marks Answer ALL Questions (Three out of Five -One question from each unit)

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Semester : 3
Course: CC11
Credits : 4

Medium: English
Code : A3PPHI11
Hours/Week: 6

CONDENSED MATTER PHYSICS

(For students admitted from 2022-2023)

OBJECTIVES

- To learn the basics of crystal structure
- To understand theories for the description of certain properties and phenomena of solid states.

Unit I: CRYSTAL STRUCTURE

Basics of crystal systems – Bravais Lattices - X-ray Diffraction – Bragg's Law - Reciprocal lattice of BCC, FCC Lattices- packing factors for SC,BCC,FCC and HCP structures– Bragg's condition in terms of Reciprocal Lattice – Brillouin Zones - Ewald's sphere construction – Structure factor – Experimental techniques – Laue, Powder, Rotating Crystal Method of X-Ray Diffractions.

Unit II: LATTICE VIBRATIONS AND BONDING

Vibration of monoatomic lattices – Lattices with two atoms per primitive cell – Quantization of lattice vibrations – Phonon momentum – Inelastic scattering of neutrons by phonons –dislocations – Frenkel and Schottky defects – Burger's vectors.

covalent bonding – Heitler London theory – hydrogen bonding – metallic bonding - $\prod$ -bonding and σ – bonding

Unit III: SEMICONDUCTORS AND DIELECTRICS

Carrier concentration in intrinsic and extrinsic semiconductors - electrical conductivity in intrinsic semiconductors - Hall effect in Semiconductors - Local Field at an atom - Clausius-Mossotti relation – Polarizabilities: Electronic, Ionic, Orientational and Space charge - Frequency dependence of polarizabilities – dielectric properties of materials - Piezo - Pyro and Ferro electric properties

Unit IV: CONDUCTORS AND SUPERCONDUCTORS

Heat Capacity of Electron Gas in 3 Dimension - Electrical resistivity of metals - nearly free electron model - Tight binding approximation – Experimental methods in Fermi surface studies – De Haas-van Alphen Effect – Kronig penny model.

Superconductivity- Meissner effect - BCS theory - coherence length- heat capacity - London Equation - Josephson Effect – Flux quantization - SQUID - Type I and Type II Super conductors – High Temperature Superconductors.

Unit V: MAGNETISM

Magnetic dipole moment – hysteresis BH curve - Origin of permanent magnetic

moments - Classical and Quantum theories of diamagnetism - Langevin's theory of paramagnetism – curie point - Weiss molecular field theory – Classical theory of ferromagnetism – Domain theory of ferromagnetism – Antiferromagnetism – Ferrimagnetism – Structure of Ferrites – comparison of dia , para , and ferro magnetism.

OUTCOMES

By the end of the course, the students will be able to,

- To enhance the ability of students to understand electron and band theories.
- Able to explain how the predicted electronic properties of solids differ In the classical free electron theory, quantum free electron theory and the nearly Free electron theory.
- Acquisition of knowledge concerning the electrical behavior of dielectric Materials (polar and non-polar)
- Explain the structural dependence of electrical, optical and mechanical Properties of modern engineering materials.

BOOKS FOR STUDY

1. Introduction to Solid State Physics – Kittel, 5th Edition. John Wiley and sons
2. New Delhi, 2003.
3. Solid State Physics - S.O Pillai, New Age International, 2006.
4. Solid State Physics – Kachava, New Age International, 1996.
5. Solid State Physics - S.L. Gupta and V. Kumar, K. Nath & CO., Meerut.
6. Solid State Physics - N.W Asheroft and N.D. Mermin, International Edition, Philadelphia, 1978.

BOOKS FOR REFERENCE

1. J.P.Srivastava, Elements of Solid state physics, Second edition Prenice Hall of India, New Delhi 2008.
2. Solid State Physics – Ali Omer, Pearson,1975.

Question Paper Pattern

Maximum Marks -75 **Exam Duration: 3 Hours**

Part – A 10×2=20 Marks Answer ALL Questions (Two questions from each unit)

Part-B 5×5=25 Marks Answer ALL Questions (Either or Type-Two questions from each Unit)

Part-C 3×10=30 Marks Answer ALL Questions (Three out of Five -One question From each unit)

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Semester: 3
Course: CC12
Code : A3PPH12P

Hours/Week: 6
Medium: English
Credit: 4

PRACTICAL - III

(For students admitted from 2022-2023)

OBJECTIVE

To understand and experience the characteristics and applications of operational amplifier, microprocessor and C – programming

(Minimum Fourteen experiments)

1. Construction of Dual power supply for IC experiments (9-0-9V)
2. Operational Amplifier-Parameters –Open loop gain, closed loop gain, Input impedance, Output impedance, CMRR.
3. Operational Amplifier- Sign changer, Adder, Subtractor, Differentiator and Integrator.
4. Operational Amplifier- Low pass, High pass and Band pass filters.
5. Operational Amplifier-Clipping and Clamping Circuits.
6. Half adder and Full adder using NAND gates.
7. Simplification of Boolean expression (any 4 expression) using Boolean theorems.
8. Shift Register-SISO, SIPO (Shift left and right).
9. Synchronous Counter-Up Counter and Down Counter.
10. Study of MOD counter (7490) and Seven Segment Decoder (7447).
11. BCD- Adder.
12. One- bit comparator using gates and Four- bit digital Comparator using IC (7485) .
13. D/A Conversion- R-2R Binary ladder- Weighted Resistor Network
14. Multiplexer (4 to 1, 8 to 1, 16 to 1).
15. Microprocessor 8085- 8 bit Addition, Subtraction, Multiplication and Division.
16. Microprocessor 8085- Conversion from Decimal to Hexa Decimal and Octal Number.
17. Microprocessor 8085- Traffic Control System.
18. Microcontroller 8051 – 8 bit Addition and Subtraction.
19. Microcontroller 8051– 8 bit Multiplication and Division.
20. Microcontroller 8051 – Square root of a given number.
21. C-Program- Solving equations by Newton – Raphson method.
22. C-Program- Solving equations by Successive Approximation method.
23. C-Program- Solving equations by Gauss Elimination method.
24. C-Program- Numerical Differentiation by Euler's method.

OUTCOMES

By the end of the course, the students will be able to,

- Acquire practical knowledge about electronic experiments using Operational amplifiers.
- Analyze the functioning of Digital experiments.
- Experience the use of Microprocessor and Microcontroller.
- Apply C- programming skills in solving Numerical problems.

Maximum Marks - 60 **Exam Duration: 4 Hours**

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Semester : 3
Course: DEC3
Medium: English

Credits : 4
Hours/Week: 4
Code: A3PPHEL3A

MATERIALS SCIENCE

(For students admitted from 2022-2023)

OBJECTIVE

- To know the science of materials for specific and sophisticated applications for the modern world

Unit-I: INTRODUCTION TO MATERIALS

Perspectives of material science -properties, classification - selection of materials- Factors affecting properties - Structure property relationship - Crystal structure of metallic elements - Nacl, Diamond, Silica and Graphite - Imperfections in crystals-line, point, surface, volume- Effect of crystal imperfections.

Unit-II: ELECTRICAL MATERIALS

Different types of conducting materials- Variation of electrical property due to mechanical stress- Relaxation time, collision time, mean free path- Different types of electric polarization- Frequency and temperature effect on polarization- Dielectric loss and breakdown- Types of insulating materials- Ferroelectric materials.

Unit-III: THERMAL, OPTICAL AND MAGNETIC MATERIALS

Heat treatment- Process- Types of heat treatment- Normalizing- Annealing- Tempering- Carburizing- Surface hardening.

Optical properties of metals and nonmetals- Application of optical phenomena- Display devices and display materials- Optical fibre materials.

Magnetic materials- Types- Influence of temperature on magnetic behaviour- Hysteresis-Soft and Hard magnetic materials- High energy hard magnetic materials- Magnetic storage.

Unit-IV: MECHANICAL PROPERTIES

Types of mechanical properties -elasticity, Plasticity, Hardness, Strength, Malleability- Factors affecting mechanical properties- Nondestructive testing (NDT)-Elastic of plastic deformation- Comparison - Tensile- Stress- Strain curve-Plastic deformation by slip- edge and screw dislocations – Comparison- Burger vector- Multiplication of dislocation during deformation- Creep- Mechanism- fracture- Ductile of brittle fracture - method of production against fracture- Fatigue-Phase diagram- Gibb's phase rule- Interpretations of phase diagram- Iron- Carbon equilibrium diagram.

Unit-V: ADVANCED APPLICATIONS AND MATERIALS

Metallic glasses- Fiber Reinforced Metals (FRM) – Biomaterials for drug delivery- Historical development -Classifications -Ceramics (Applications only) – High temperature materials- Nuclear engineering materials- Nano materials (CNT only)- Advantages- SMART materials- Conducting polymer materials- Applications- Radioactive materials.

OUTCOMES

By the end of the course, the students will be able to,

- Acquire the knowledge about the properties of materials.
- Analyze the materials and their properties and applications.

BOOKS FOR STUDY

1. Materials Science and Engineering – V.Raghavan - A First Course – Fifth Edition – PHI Learning Private Limited – Eastern Economy Edition, 2011.
2. Materials Science - M. Arumugam – Anuradha Publications – ISBN -81-87721-05-7, 2014.
3. Material Science and Processes - R. S. Khurmi, R. S. Sedha – S.Chand –ISBN-10: 0906216001, 1991.
4. Material Science and Metallurgy – O.P.Khanna - Dhanpat Rai Publications -ISBN: 9789383182459 – Revised edition, 2017..
5. Material Science - S. L. Kakani, Kakani Amit - New Age International Pvt Ltd Publishers – ISBN-10: 8122430856, 2010.

BOOKS FOR REFERENCE

1. Material Science - G. K. Narula, K. S. Narula, V. K. Gupta - Tata McGraw-Hill Education , 1989.
2. Material Science and Engineering – An Introduction - William D. Callister, Jr. – John Wiley and Sons Inc., 2007.
3. Material Science and Engineering – I.P.Singh, Subash Chander, Rajesh K.Prasad, - Jain Brothers – 12th Edition, 2010.
4. The Physics and Chemistry of Materials - Joel I. Gersten, Frederick W. Smith John Wiley and Sons, Scientific Publishers- - ISBN: 978-0-471-05794-9, 2001.

Question Paper Pattern

Maximum Marks -75 **Exam Duration: 3 Hours**

Part – A 10×2=20 Marks Answer ALL Questions (Two questions from each unit)
Part-B 5×5=25 Marks Answer ALL Questions (Either or Type-Two questions from each unit)
Part-C 3×10=30 Marks Answer ALL Questions (Three out of Five -One question from each unit)

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Semester: 3
Course: DEC3
Credits: 4

Hours/Week: 4
Medium: English
Code: A3PPHEL3B

HIGH ENERGY PHYSICS

(For students admitted from 2022-2023)

OBJECTIVE

- To know the physical laws and dynamic properties of subatomic particles

Unit-I: CONSERVATION LAWS AND SYMMETRIES

Review of concepts of spin, parity, isospin in particle physics, example of pion; charge conjugation invariance, G-parity, time reversal, CP-violation and CPT theorems, introduction to symmetries: discrete and continuous symmetries, examples, Young's tables and their relation to group theory, symmetry groups O(3), SU(2), SU(3) and SU(6), applications of symmetry groups to hadron spectroscopy: meson mixing, mass formulae.

Unit-II: QUARK MODEL

Introduction to constituent quark model, quantum number of quarks & valence quark contents of hadrons, introduction to quarkonia (charm and bottom systems), simple applications to hadron phenomenology, e.g., unitary spin & spin hadron wave function of mesons and baryons, baryon masses.

Unit-III: ELECTROMAGNETIC INTERACTIONS

Low energy electron nucleon scattering and form factors, electromagnetic form factors of nucleons, deep inelastic structure functions and introduction to parton model, gauge invariance; local, global transformations and charge conservation, Noether's Theorem.

Unit-IV: WEAK AND STRONG INTERACTIONS

Weak interactions: Introduction to four fermion Fermi theory, Fermi transitions. Gamow-Telle transitions, development of V-A theory, weak neutral current and Glashow-Iliopoulos- Maiani (GIM), neutrino-nucleon scattering, electroweak unification.

Strong interactions: Introduction to gauge field theories, including non-abelian gauge field Yang-Mills theory, elements of QCD, Feynman diagrams.

Unit-V: UNIFICATION SCHEMES

Global symmetry breaking and Goldstone bosons, mass term, local symmetry breaking and the Higgs boson, introduction to Glashow-Weinberg-Salam model, introduction to the Standard Model and Lagrangian

OUTCOME

By the end of the course, the students will be able to,

- Know the fundamental laws and concepts of sub atomic particles.

BOOKS FOR STUDY

1. Introduction to Elementary Particles, D. Griffiths, 2nd Ed., Wiley VCH, 2008.
2. An Introduction to the Standard Model of Particle Physics, W.N. Cottingham, D. A. Greenwood,2nd Ed., Cambridge University Press, 2007.
3. ns, An Introduction to High Energy Physics, D.H. Perki 4th Ed., Cambridge University Press, 2000.
4. Elementary Particles, I.S. Hughes, 3rd Ed., Cambridge University Press, 1996.

BOOKS FOR REFERENCE

1. Introduction to Quarks and Partons, F.E. Close, Academic Press, London, 1981.
2. Introduction to Particle Physics, M.P. Khanna, 3rd Ed., Prentice-Hall of India, New Delhi, 2004.

Question Paper Pattern

Maximum Marks -75 **Exam Duration: 3 Hours**

Part – A 10×2=20 Marks Answer ALL Questions (Two questions from each unit)

Part-B 5×5=25 Marks Answer ALL Questions (Either or Type-Two questions from each unit)

Part-C 3×10=30 Marks Answer ALL Questions (Three out of Five -One question from each unit)

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Semester: 3
Course: DEC3
Credits: 4

Hours/Week: 4
Medium: English
Code : A3PPHEL3C

COMPUTATIONAL PHYSICS

(For students admitted from 2022- 2023)

OBJECTIVE

- To know about the various computational methods and analysis in physics

Unit 1: INTRODUCTION AND SCHRODINGER EQUATION

Computational Physics. Computational problems in Classical and Quantum Physics. Basic programming techniques
Solution of the generalized eigen value problem, perturbation theory and variational calculus.

Unit II: INTEGRAL AND DIFFERENTIAL EQUATIONS

Calculation of scattering cross section (a) quantum scattering with a spherically symmetric potential -Classical electrons in crossed electric and magnetic fields Laplace equation, wave equations , diffusion equation and Maxwell's equations.

Unit III: MOLECULAR DYNAMICS SIMULATIONS

Integration methods - molecular dynamics - simulations at different ensembles. Langevin dynamics simulations for Brownian motion. Quantum molecular dynamics for hydrogen molecule.

Unit IV: THE MONTE CARLO METHOD

Monte Carlo simulations with various ensembles. Estimation of energy and chemical potential. Ising model. Quantum Monte Carlo.

Unit V: MATRIX METHODS

System of linear equation – Gauss Jordan elimination method – matrix inverse method - Transfer matrix methods for spin chains. Finite element method for partial differential equations.

OUTCOME

By the end of the course, the students will be able to,

- Infer various analytical and computational methods to solve the physical problems.

BOOKS FOR STUDY

1. Computational Physics. J. M. Thijssen, Cambridge – 2007.

2. Understanding Molecular simulations, D. Frenkel and B. Smith, Academic press, 2002.

3. Steven E Koonin and D C Meredith, Computational Physics [FORTRAN version], Perseus Books, 1995.

BOOKS FOR STUDY

1. Numerical Recipes in C – William H. Press, William .T.Vetterling, Saul A, Teukolsky, Brain.P. Flannery, Foundation Books, 2007.

Question Paper Pattern

Maximum Marks -75 **Exam Duration: 3 Hours**

Part – A 10×2=20 Marks Answer ALL Questions (Two questions from each unit)

Part-B 5×5=25 Marks Answer ALL Questions (Either or Type-Two questions from each unit)

Part-C 3×10=30 Marks Answer ALL Questions (Three out of Five -One question from each unit)

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Semester: 3
Course: ECC1
Medium: English

Credits: 2
Code: A3PPHEC1

THIN FILM PHYSICS

(For students admitted from 2022-2023)

OBJECTIVES

- To Introduce formation of thin films
- To understand and explain various thin film preparation techniques
- To discuss about thickness measurements and vacuum
- To explain the properties and applications of thin films

Unit – I: NATURE OF THIN FILMS

Thin films an overview – Advantages of thin films over their bulk counterparts – Theories of Nucleation – The capillary model – Small cluster model – Dependence on the nature of the film and substrate – Thin film growth stages – Island stage – Coalescence stage – Channel stage – The continuous film

Unit – II: PREPARATION OF THIN FILMS

Evaporation theory – Hertz-Knudsen equation – Free evaporation and effusion – Evaporation Mechanisms – Liquid – Crystalline solids – vapour sources – wire and metal foil sources – Special evaporation techniques – reactive evaporation – two source evaporation – flash evaporation – Monitoring film properties – Optical monitors – Resistance and capacitance monitors.

Unit – III: THICKNESS MEASUREMENTS

Mass methods: Microbalance – Crystal Oscillator – Optical methods: General Interference Phenomena – Multiple beams Interferometry – FECO – FIZEAU – Michelson Interferometer – Ellipsometry – Gravimetric – High vacuum technology: Vacuum Pump – Rotary pump – Diffusion Pump – pressure gauges for high to ultra-high vacuum.

Unit – IV: PROPERTIES OF THIN FILMS

Adhesion – Mechanical and Nucleation methods – Stress – Tensile – Dielectric properties – Dielectric constant – Dielectric loss – Breakdown voltage – Polarization – piezoresistive properties of bulk, metal, semi metal and semiconductor films – Piezoelectric properties of thin films – Ferromagnetism – physics of ferromagnetism – Resonance.

Unit – V: APPLICATIONS OF THIN FILMS

Anti-reflection coatings – high Reflection coating – Interference filters – Discrete Resistive Components – Capacitors – Hall probe element – Active Devices – Thin film battery – Thin film gas sensors – Photovoltaic applications – CNT and its applications – Microelectronics, integrated circuits and other applications

OUTCOME

By the end of the course, the students will be able to,

- Know the formation, properties and applications of thin films.

BOOKS FOR STUDY

1. Hand book of thin film technology, L. T. Maissel and Glang Mc Graw hill, NY(1983)
2. Thin film fundamentals, A. Goswami, New age international, New Delhi (2003)

BOOKS FOR REFERENCE

1. Thin film phenomena, K. L. Chopra, Mc Graw hill, NY (1969)

Question Paper Pattern

Maximum Marks -100 **Exam Duration: 3 Hours**

5x20=100 (either or type two questions from each unit)

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THANJAVUR - 613 005.

Semester: 4
Course: CC13
Code: A4PPH13

Hours/Week: 6
Credits: 5
Medium: English

THEORETICAL PHYSICS

(For students admitted from 2022-2023)

OBJECTIVES

- To study theories of universe.
- To study non linear dynamics.
- To understand the applications of Quantum Mechanics to Quantum Computing.

Unit I: ASTROPHYSICS

Structure of solar system – Titius-Bode Law- Sun, Planets, Moon and Asteroids – motion of comet – Halley comet - Solar activity - Origin of Solar System – Classification of Stars – Luminosity, Brightness, Colour, spectral type and temperature of Stars – HR diagram - Stellar evolution – Sources of Stellar Energy – Proto star - final stages of Star – Red Giant, White dwarf, Neutron Star and Black Hole – Chandrasekhar limit — Types of Galaxy.

Unit II: COSMOLOGY

Origin of the Universe – Big Bang Theory –Expanding Universe – Hubbles Law – red shift -Microwave background radiation – Pulsars, Super Nova – Radio Astronomy – Aperture synthesis – Synchrotron radiation – 21 cm spectral line of hydrogen - Cosmic rays - Cosmological models – Newton, Einstein and Friedman model (only concepts)– de sitter solution - Pulsating Universe

Unit III: NON - LINEAR DYNAMICS

Nonlinear dynamical systems –Integrable systems –Solitary waves –The Scott Russell Phenomena--Soliton – Kortewig- deVries (Kdv) equation (no derivation)

Non Integrable systems –Chaos –Bifurcation theory –Period doubling cascades - Strange attractions- Controlling of Chaos- applications – Tsunamis (basic idea)

Unit IV: COMPUTATIONAL PHYSICS

Random numbers – Random walk problems – Types of RW – biased RW, unbiased RW and self avoiding RW – ising model – Cellular automata –percolation – Mante Carlo method (basic ideas) – Brownian motion.

UNIT V: QUANTUM COMPUTING

Photon Polarization (A thought experiment) - Quantum Entanglement and Quantum Teleportation – Qubit - Quantum Logic gates – Shore's Algorithm.

Computer Verses Quantum Computer.

OUTCOMES

By the end of the course, the students will be able to,

- Get the knowledge of solar systems, comet and galaxies.
- Get idea of theories of universe.
- Study non linear behaviour.
- Understand the basic concepts of Quantum Computing.

BOOKS FOR STUDY

1. Astrophysics - Stars and Galaxies – K. Abhyankar, University press, 2002.
2. Structure of the universe – J. V. Narliker, Oxford University Press, 1977.
3. Chaos and Non Linear Dynamics - Robert C. Hilbond., Oxford University press 2010.
4. An Introduction to Computer simulation methods – Harvey Gould, Jan Tobochnik & Wolfgang Christain, Addision Wesley, 1988.

BOOKS FOR REFERENCE

1. Principles of condensed matter physics – P.M. Chaikin and T.C. Lubenshy, Cambridge University Press, 2000.
2. Introduction to solid state physics – Charless Kittel, 2005.

Question Paper Pattern

Maximum Marks -75 **Exam Duration: 3 Hours**

Part – A 10×2=20 Marks Answer ALL Questions (Two questions from each unit)
Part-B 5×5=25 Marks Answer ALL Questions (Either or Type-Two questions from each unit)
Part-C 3×10=30 Marks Answer ALL Questions (Three out of Five -One question from each unit)

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RAJAH SERFOJI GOVERNMENT COLLEGE (AUTONOMOUS)
THANJAVUR - 613 005.

Semester: 4
Course : CC14
Code: A4PPH14P

Medium: English
Hours/Week: 6
Credit: 4

PRACTICAL – IV

(For students admitted from 2022-2023)

OBJECTIVE

To understand and experience the characteristics and applications of operational amplifier, microprocessor, Microcontroller and C programming

(Minimum **FOURTEEN** experiments)

1. Operational Amplifier-Sine Wave Generator- Wien's Oscillator.
2. Operational Amplifier-Square, Triangular and Ramp Wave Generator.
3. Operational Amplifier-Solving Simultaneous equations.
4. Operational Amplifier- Schmidt triggers (IC 555 Timer).
5. Half Subtractor and Full Subtractor using NAND gates.
6. Study of Flip Flops using NAND gates.
7. Simplification of Boolean expressions by Karnaugh Map method.
8. D/A Conversion- Resolution Linearity and Dual Slope.
9. Asynchronous Counter- Up Counter and Down Counter.
10. Study of 0-9 and 0-99 Counter (IC 7490 and 7447).
11. Demultiplexer-(1 to 4, 1 to 8, 1to 16).
12. Microprocessor 8085- 16 bit Addition, 1's complements Subtraction.
13. Microprocessor 8085- Conversion from Octal, Hexa decimal to Decimal number system.
14. Microprocessor 8085 – Searching a number from the given list.
15. Microprocessor 8085 - DAC interfacing (DAC 0800).
16. Microprocessor 8085- Interfacing of Stepper Motor.
17. Microcontroller 8051 – Factorial of a given number.
18. Microcontroller 8051- Smallest and Biggest number in an array of data.
19. Microcontroller 8051- Arranging an array of data in Ascending and Descending order.
20. C-Program- Numerical Integration by Simpson's method.
21. C-Program- Numerical Integration by Trapezoidal rule.
22. C-Program- Numerical Differentiation by Runge- Kutta (II Order) method

OUTCOMES

By the end of the course, the students will be able to,

- Acquire practical knowledge about electronic experiments using Operational amplifiers.
- Analyze the functioning of Digital experiments.
- Experience the use of Microprocessor and Microcontroller.
- Apply C- programming skills in solving Numerical problems.

Maximum Marks-60

Exam Duration: 4 Hours

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Semester	**: 4**	**Course: CC15**	
Code	**: A4PPHPW**	**Hours/Week: 4**	
Credits	**: 4**	**Medium**	**: English**

OBJECTIVE

- To develop the innovative thinking in project to make application oriented working models for theoretical concepts.

PROJECT WORK

OUTCOME

- This will bring out innovative ideas from the students

EVALUATION

Viva Voce Examination: 80 Marks

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Semester: 4
Course: DEC4
Code: A4PPHEL4A

Hours/Week: 6
Credits: 4
Medium: English

ADVANCED PHYSICS

(For students admitted from 2022-2023)

OBJECTIVES

- To understand harvesting of solar energy
- To understand the working of rockets and satellite
- To understand physics involved in biological systems

Unit I: RENEWABLE ENERGY

Types of renewable energy – merits and demerits - Solar power generation – Solar pond - Solar collector – Parabolic dish - Central tower – Solar Photovoltaic cell – Solar cell fundamentals – characteristics – classification – Second and third generation solar cells .

Unit II: ROCKET AND SATELLITE

Escape velocity – Principle of Rocket - (Tsiolkovsky) rocket Equation – Single stage and multi stage rocket – Rocket propellants - Orbital velocity - Geostationary Satellite - Launching of satellite into the orbit – Trajectory adjustments - Types of satellite – Space shuttle – Space station – Inter planetary space probes – Trajectory of space probes - Exploration of solar system.

Unit III: PHENOMENA OF EARTH GEOPHYSICS

Motion of object in rotating non inertial frame - Effect of Rotation of Earth on the motion of river and cyclone- Earth quake and seismic waves – Richter magnitude scale - Continental drift theory - Plate tectonics – Evidences

ATMOSPHERIC PHYSICS

Formation of cloud –Lightning and Thundering –Relative velocity between Thunder and Lightning- cyclones – Tornado.

Climate change on earth – Weather forecasting – Elnino phenomena - Upper atmosphere- structure –ionosphere – Wave propagation in ionosphere – Geoinformatics.

Unit IV: BIOPHYSICS

Blood velocity and pressure – Eye and ear physical mechanism - Molecular forces in biological structure – Mechanism of muscular contraction – Protein folding – Neuro biophysics – Information exchange through nerves.

Unit V: PLASMA PHYSICS

Introduction – Debye's shield – Plasma parameter – Application of plasma physics – Single particle motion – Motion of charged particle in magnetic field – Plasma as a fuel – Fluid equation of motion – Waves in plasma.

OUTCOMES

By the end of the course, the students will be able to,

- Get idea of different renewable energy
- Understand rocket and satellite systems
- Apply physics to biological systems

BOOKS FOR STUDY

1. Renewable energy sources & emerging technologies – D.P. Kothari, K. C. Singal & Rakesh Rajan, PHI, 2011.
2. Astronautics: The physics of space flights -Ultrich Walter, Wile, 2008.
3. Text book of physical Geology – G. P. Mahapatra, CBS, 2016.
4. Basics of atmospheric science – A. Chandrasekhar, PHI, 2016.
5. Introduction to biophysics – Pranab Kumar Banarjee, S. Chand, 2011.
6. Plasma physics by S. N. Goswami, News central, 2011.

BOOKS FOR REFERENCE

1. Essential biophysics – P. Narayanan, New age international, 2008.
2. Text book of plasma physics – Suresh Chandra, CBS, 2010.

Question Paper Pattern

Maximum Marks -75 **Exam Duration: 3 Hours**

Part – A 10×2=20 Marks Answer ALL Questions (Two questions from each unit)

Part-B 5×5=25 Marks Answer ALL Questions (Either or Type-Two questions from each unit)

Part-C 3×10=30 Marks Answer ALL Questions (Three out of Five- One question from each unit)

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Semester: 4
Course: DEC4
Code : A4PPHEL4B

Hours/Week: 6
Medium: English
Credits: 4

SIGNAL PROCESSING

(For students admitted from 2022-2023)

OBJECTIVE

- To know about various signals and processing by mathematical analysis.

Unit I: SIGNALS

Signals, noise and their classification - Continuous and discrete signals - discretization of continuous signals - sampling theorem – aliasing - Reconstruction of a signal from its samples-Gibb's phenomenon.

Unit II: FOURIER TRANSFORM APPLICATIONS

Laplace transform and inverse Laplace transform and its applications. Review of Complex exponential Fourier series - Fourier integral - .Review of Fourier transform and its properties, energy and phase spectra - Review of Fourier transforms of some commonly used functions - utility of domain transformation.

Unit III: SIGNAL ANALYSI S

Inverse Fourier transforms - use of one and two dimensional Fourier transforms in solving various problems - radial and angular spectra. - Hunkel transforms and Hilbert transforms their properties - the concept of analytic signal and its uses.

Unit IV: TRANSFORMS

Z transforms: definition and types - Z transforms of causal and non-causal sequences - properties of Z transforms and the region of convergence - application of Z transform & inverse Z transform - Concepts and application of Poles and Zeroes for Instrumentations - Introduction to wavelet transforms and its applications.

Unit V: FILTERS

Digital filters - Basic concepts of Transfer function, Impulse response- Types of filters, ideal filters - design of Martin Graham- Butterworth and Chebyshev filters - Various applications of filters - Inverse filtering - Wiener filters - deconvolution- predictive and its applications.

Homomorphic filtering - Ceptsral analysis and its applications - Processing of random signals and its applications.

OUTCOME

By the end of the course, the students will be able to,

- Know about various signals and processing by mathematical analysis.

BOOKS FOR STUDY

1. Analysis of Geophysical Potential Field: A Digital Signal Processing Approach - Naidu, P. S., and Mathur, M. P. Elsevier.
2. Signals and Systems - Rawat, T K, Oxford University Press.
3. Time Series Analysis and Inverse Theory for Geophysicists - Gubbins D, Cambridge University.
4. Signal Processing and Linear Systems - Lathi, B.P, Oxford University Press.

BOOKS FOR REFERENCE

1. Signals and Circuits - Baskakov, S. Mir Publishers, 1986,
2. Time Sequence Analysis in Geophysics - Kanasewich, E. R., the University of Alberta Press, 1975.
3. Time Series Analysis and Application: D. Reidel, Robinson, E. A., 1981,
4. Digital Signal Processing(System Analysis and Design), Dinz, P S R, da Silva, A B and Netto S L, Cambridge University Press.
5. Digital Signal Processing (Principles, Algorithms and Applications) - Proakis, J G and Manolakis D G, PHI Publication (3rd Edition)
6. Mathematical Techniques (4th Edition) Oxford University Press (An introduction for the engineering, physical and mathematical sciences) - Jordan, D.W. & Smith, P.

Question Paper Pattern

Maximum Marks -75 **Exam Duration: 3 Hours**

Part – A 10×2=20 Marks Answer ALL Questions (Two questions from each unit)
Part-B 5×5=25 Marks Answer ALL Questions (Either or Type-Two questions from each unit)
Part-C 3×10=30 Marks Answer ALL Questions (Three out of Five -One question from each unit)

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Semester: 4
Course: DEC4
Code : A4PPHEL4C

Hours/Week: 6
Medium: English
Credits: 4

ROBOTICS

(For students admitted from 2022-2023)

OBJECTIVE

- To give the basic idea about mechanization in hardcore works and in crucial situations.

Unit I: INTRODUCTION & ELEMENTS OF ROBOTS

Introduction -- brief history, types, classification and usage, Science and Technology of robots, Position and orientation of a rigid body, Homogeneous transformations, Representation of joints, link representation using D-H parameters, Examples of D-H parameters and link transforms, different kinds of actuators – stepper, DC servo and brushless motors, model of a DC servo motor, Types of transmissions, Purpose of sensors, internal and external sensors, common sensors – encoders, tachometers, strain gauge based force-torque sensors, proximity and distance measuring sensors, and vision.

Unit II: KINEMATICS OF SERIAL & PARALLEL ROBOTS

Introduction, Direct and inverse kinematics problems, Examples of kinematics of common serial manipulators, workspace of a serial robot, Inverse kinematics of constrained and redundant robots, Tractrix based approach for fixed and free robots and multi-body systems.

Degrees-of-freedom of parallel mechanisms and manipulators, Active and passive joints, Constraint and loop-closure equations, Direct kinematics problem, Mobility of parallel manipulators, Closed-from and numerical solution, Inverse kinematics of parallel manipulators and mechanisms.

Unit III: MOTION PLANNING AND CONTROL

Joint and Cartesian space trajectory planning and generation - Classical control concepts using the example of control of a single link, Independent joint PID control - Control of a multi-link manipulator - Non-linear model based control schemes - Simulation and experimental case studies on serial and parallel manipulators - Control of constrained manipulators, Cartesian control, Force control and hybrid position/force control.

Unit IV: MODELING AND CONTROL OF FLEXIBLE ROBOTS

Models of flexible links and joints - Kinematic modelling of multi-link flexible robots, Dynamics and control of flexible link manipulators - Numerical simulations results - Experiments with a planar two-link flexible manipulator.

Unit V: ADVANCED TOPICS IN ROBOTICS

Introduction to chaos - Non-linear dynamics and chaos in robot equations, - Simulations of planar 2 DOF manipulators - Analytical criterion for unforced motion - Gough-Stewart platform and its singularities - use of near singularity for fine motion for sensing, design of Gough - Stewart platform based sensors. Over - constrained mechanisms and deployable structures - Algorithm to obtain redundant links and joints, Kinematics and statics of deployable structures with pantographs or scissor-like elements (SLE's)

OUTCOME

By the end of the course, the students will be able to,

- Bring out the students about the basic ideas about mechanization.

BOOKS FOR STUDY

1. Fundamental Concepts and Analysis, Oxford University Press, Second reprint, May 2008.
2. Robotics Technology and flexible automation, S.R. Deb, Tata McGraw-Hill Education. 2009
3. Robotics Engineering an Integrated Approach - Richard D. Klafter, Thomas .A, Chri Elewski, Michael Negin, Phi Learning., 2009.
4. CAD/CAM: Principles and Applications - P.N.Rao, Tata McGraw Hill, 2010.
5. Computer Aided Manufacturing - P.N.Rao, N.K. Tewari & T.K. Kundra, Tata McGraw Hill, 2001.

BOOKS FOR REFERENCE

1. Sensors and Control Systems in Manufacturing - Sabrie Soloman, McGraw-Hill Professional Publishing, 2nd Edition, 2009.

Question Paper Pattern

Maximum Marks -75 **Exam Duration: 3 Hours**

Part – A 10×2=20 Marks Answer ALL Questions (Two questions from each unit)

Part-B 5×5=25 Marks Answer ALL Questions (Either or Type-Two questions from each unit)

Part-C 3×10=30 Marks Answer ALL Questions (Three out of Five -One question from each unit)

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THANJAVUR - 613 005.

Semester: 4
Course: DEC5
Code : A4PPHEL4D

Hours/Week: 6
Credits: 4
Medium: English

SOLAR ENERGY UTILIZATION

(For student admitted from 2022-2023)

OBJECTIVE

- To know about harvesting of solar energy as alternative to fuels.

Unit I: SOLAR CELL FUNDAMENTALS

Need for sustainable energy sources – Place of photovoltaics in energy supply – Semiconductors as solar cell materials – Formation of energy band gaps – Charge carriers in semiconductors – Generation and recombination of carriers – p – n junction under illumination for solar cell – I – V equation of solar cells – Solar cell characteristics

Unit II: DESIGN FOR SOLAR CELLS

Short circuit current – open circuit voltage – Fill factor – Efficiency – Losses in solar cell – Design for high I_{SC} – Design for high V_{OC} – Design for high FF – Analytical techniques – Solar simulator – Quantum efficiency measurement – Minority carrier life time and diffusion length measurement.

Unit III: SILICON AND THIN FILM SOLAR CELLS

Silicon solar cells – Production of Silicon wafers – Si usage in solar PV – Process flow of commercial Si cell technology – Thin film solar cells – materials and substrate configuration
– Amorphous Si solar cell – Cadmium telluride solar cell – CIGS solar cell – Monocrystalline and polycrystalline silicon solar cells.

Unit IV: SOLAR PHOTOVOLTAIC APPLICATIONS

Solar cookers – Solar flat plate collectors – Solar water heaters – Solar PV modules – Series and parallel connections – Design and Structure of PV modules – Introduction to batteries – Classification - Batteries for PV – Lead acid batteries – Ni-Cd batteries – Hybrid PV systems.

Unit V: EMERGING SOLAR CELL TECHNOLOGIES

GaAs solar cell – Dye sensitized solar cells – Operation – Materials and properties - Perovskite solar cell – Device structure – working - Quantum dot solar cells - Fabrication of QD solar cells - Hybrid solar cells – Types of hybrid solar cells – Interface and structures - Kesterite material – structure – Kesterite SC - construction and working.

OUTCOME

By the end of the course, the students will be able to

- Know the alternative to fuels.

BOOKS FOR STUDY

1. SOLAR PHOTOVOLTAICS, Fundamentals, technology and applications, Second edition, Chetan Singh Solanki, 2011.

BOOKS FOR REFERENCE

1. Solar cells from basics to advanced, Cheming Hu & Richard M. White, University of California, Berkeley.

Question Paper Pattern

Maximum Marks -75 **Exam Duration: 3 Hours**

Part – A 10×2=20 Marks Answer ALL Questions (Two questions from each unit)

Part-B 5×5=25 Marks Answer ALL Questions (Either or Type-Two questions from each unit)

Part-C 3×10=30 Marks Answer ALL Questions (Three out of Five -One question from each unit)

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Semester: 4
Course: DEC5
Code:A4PPHEL4E

Hours / Week:6
Credits: 4
Medium: English

NANO PHYSICS

(For students admitted from 2022-2023)

OBJECTIVES

- To understand the nano optics nano computing and nano electronics
- To study the application of nano materials.

Unit I: IMPERFECTION IN ATOMIC PACKING

Atomic structures-Molecular and atomic size-Bohr radius -Nucleation-Influence of nucleation rate on the size of the crystals- macroscopic to microscopic crystals and nano crystals
- large surface to volume ratio, top-down and bottom-up approaches-self assembly process-grain
boundary volume in nano crystals-defects in nano crystals-surface effects on the properties.
Nano SEM – SEM, HRTEM, AFM – STM – TEM.

Unit II: NANOMATERIALS AND SYNTHESIS ROUTES

Carbon Nano Tubes (CNT) - Metals (Au, Ag) - Metal oxides (TiO2, CeO2, ZnO) - Semiconductors (Si, Ge, CdS, ZnSe) - Ceramics and Composites - Dilute magnetic Semiconductor -Metallic glasses- Shape Memory Alloys (SMA) - Bio Materials - Biological system - DNA and RNA - Lipids - Size dependent properties -Mechanical, Physical and Chemical properties. New forms of Carbon- Types of nano tubes- formation of nano tubes-methods and reactants- arcing in the presence of Cobalt- LASER methods- Ball Milling-Chemical Vapour Deposition Methods- Catalytic route- Properties of Nano tubes- Plasma arcing electro deposition-Pyrolytic Synthesis.

Unit III: NANO OPTICS AND NANO COMPUTING

Optics- Photonics of Nanotechnology– Properties of light and nanotechnology – interaction of light with nano systems-Absorbance- Surface Plasma excitation. Nano computers -Types- Quantum computers- DNA computers- construction-working - molecular computing - optical computing.

Unit IV: NANO ELECTRONICS

Nano electronics – Nano fabrication- molecular electronics- Nano electronic devices-Nano circuitry- Nano electronics with tunneling devices and superconducting devices – Applications of superconducting devices – plastic electronics.

Unit V: SENSORS AND ENERGY APPLICATIONS

Chemical and Molecular Sensors- Bio-sensor- DNA Sensors-optical bio-sensors Displacement and motion sensors- Force nano sensors- pressure sensors- Thermal Sensors Neural micro sensing. Nano tubes based sensors, Fluid flow, gas temperature, Gas sensing (SnO_2) - LPG (sensor SnO_2-Powder.) - Fuel cells - Solar cells.

OUTCOME

By the end of the course, the students will be able to,

- infer about nano particles and their sophisticated applications in miniaturized and micro miniaturized devices and systems.

BOOKS FOR STUDY

1. Understanding nanotech, Scientific American, editors at Scientific Wmer books , 2002.
2. Nano electronics and nano system: From transistors to molecular devices K.Goser, P.Glosekottert, J.Dienstuhl sringer 2004.

BOOKS FOR REFERENCE

1. Magnetic Materials: Fundamentals and device applications Nicola Am Spalding, Cambridge University Press, 2003, ISBN 0521016584.
2. Nano composite Science and Technology, Pulicket.M.Ajayan, Linda.S.Schadler Paul V.Braum, Willey-VCH Verlag, Weiheim, 2003,

Question Paper Pattern

Maximum Marks -75 **Exam Duration: 3 Hours**

Part – A 10×2=20 Marks Answer ALL Questions (Two questions from each unit)
Part-B 5×5=25 Marks Answer ALL Questions (Either or Type-Two questions from each unit)
Part-C 3×10=30 Marks Answer ALL Questions (Three out of Five- One question from each unit)

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Semester: 4
Credits: 4
Code: A4PPHEL4F

Course: DEC5
Hours / Week: 6
Medium: English

GEO PHYSICS

(For students admitted from2022-2023)

OBJECTIVE

- To know the earth's structures and its behaviours.

Unit I: PHYSICAL GEOLOGY

Introduction: Definition of Geology -Basic principles of Geology – its relationship with other sciences Different branches of Geology – Aim and applications of Geology. Origin of the earth -Brief review of different theories, weathering of rocks: Agents and Types of weathering, Rivers: Source and surface flow of water-erosion, transportation and development of landforms by deposition – V-shaped valleys, river capture phenomena. Rapid, water fall, alluvial fan, meander, Ox Bow Lake, flood plain, Mountain: Types, causes of mountain building, horst, and graben, Volcanoes: Parts of typical volcano, products of volcano and types of volcanic eruptions.

Unit II: CRYSTALLOGRAPHY

Crystallography: Definition of a crystal – Amorphous and crystalline states. Morphology of crystals: Face, edge, solid angle, interfacial angle. Form: Simple, combination, closed, open pinacoid, prism – pyramid and dome. Symmetry Elements: Plane of symmetry, axis of symmetry, center of symmetry, Crystallographic axes, parameters, indices, crystallographic notation, parameter systems of Miller, law of rational indices, classifications of crystals into 7
Systems.

Unit III: MINERALOGY

Definition of mineral – Classification of mineral into rock forming and ore forming minerals. Physical Properties of Minerals: Colour, streak, transparency, luster, luminescence, Fluorescence, Form, hardness, cleavage, fracture, specific gravity, magnetic properties, Mode of mineral formation: Occurrence and association of minerals, chemical properties of minerals – isomorphism – solid solution – polymorphism, mineral formation and silicate structure, Descriptive Mineralogy: Study of physical, chemical and optical properties and mode of Occurrence of following minerals: Olivine, Augite, Hypersthene,

Unit IV: IGENEOUS PETROLOGY

Introduction: Definition of rock, chemical composition of the curst, classification of Rocks-igneous sedimentary and metamorphic rocks, IGNEOUS PETROLOGY: Classification into plutonic, hypabyssal and volcanic rocks. Forms of igneous rocks. Lava

flows, sill, lacolith, lopolith, dyke, cone, sheet ring dyke, Volcanic neck, Phacolith, Botholith, structures: vesicular, amygdaloidal, block and ropy lava, pillow: Textures: Definition of texture, microstructure, allotromorphic, hypidiomorphic, Panidiomorphic, ophitic, intergranular, porphyritic, poikilitic, intersectral and intergranular.

Unit V: SEDIMENTARY AND METAMORPHIC PETROLOGY

Sedimentary Petrology: Introduction, mode of formation source, Transportation and deposition, classification of Sedimentary rocks, Structures and textures of sedimentary rocks, Brief description of the following sedimentary rocks: Conglomerate, breccia, sandstone, greywacke, shale, limestone, dolomite, Shelly and limestone. Metamorphic Petrology: Introduction: Definition, Types and agents of metamorphism; structure and textures of metamorphic rocks .

OUTCOME

By the end of the course, the students will be able to,

- Know the earth's structures and its behaviors.

BOOKS FOR STUDY

1. Principles of physical Geology - Arthur Holmes, 1978.
2. Elementary of Mineralogy – Rutleys, 1991, Revised by Gribble, C.D. CBS, Publishers and Distributors.
3. The Principles of Petrology - Tyrrell, G.W, B.I. Publications, 1975.
4. Petrology - Hueng, W.T., McGraw Hill Co., 1962.

BOOKS FOR REFERENCE

1. The Evolving Continent New York - Wingley, B.F. 1995, John Wiley and Pars.
2. Plate tectonics and Crustal evolution – Canilic, K.C., Butterworth Heinemann, 1977.

Question Paper Pattern

Maximum Marks -75 **Exam Duration: 3 Hours**

Part – A 10×2=20 Marks Answer ALL Questions (Two questions from each unit)

Part-B 5×5=25 Marks Answer ALL Questions (Either or Type-Two questions from each unit)

Part-C 3×10=30 Marks Answer ALL Questions (Three out of Five- One question from each unit)

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THANJAVUR - 613 005.

Semester: 4
Course: ECC2
Medium: English

Credits: 2
Code: A4PPHEC2

NANO TECHNOLOGY

(For students admitted from 2022-2023)

OBJECTIVES

- To know the salient features of nano structures and nano materials.

Unit I: CRYSTAL STRUCTURE, SEMICONDUCTORS & THEIR PROPERTIES

Atomic structure – Atomic bonding in solids- Crystalline state of solids – Unit cells and Space lattices – Crystal structures – Crystal planes and directions- Miller Indices – Diffraction of X-rays by crystal - Bragg's equation – Correction to Bragg's equation – Reciprocal lattice – Crystal Defects – point, line and surface defects - Band model of semiconductors – carrier concentrations in intrinsic and extrinsic semiconductors – Fermi level – variation of conductivity and mobility with temperature – law of mass action. Hall Effect – Hall coefficients for intrinsic and extrinsic semiconductors – determination of Hall constant – Hall Effect devices.

Unit II: QUANTUM THEORY OF NANOMATERIALS

Development of Quantum theory of Nano materials: Application of Block functions in Nano materials. Quantum Dots: (a) Semiconductor Quantum Dots, (b) Introduction to lasers (c) Quantum Dot lasers (d) Quantum Cascade lasers and € Quantum Dot optical memory.

Unit III: PHYSICALPROPERTIES AND FERROELECTRIC & PIEZOELECTRIC MATERIAL

Static dielectric constant, electronic, ionic and orientation polarizations – Internal or local fields in solid and liquids - Lorentz field in cubic materials – Clausius-Mossotti equation – complex dielectric constant – determination of dipole moment for polar substances – dielectric losses – frequency dependence of electronic, ionic, orientation polarizabilities – optical absorption, luminescence – Thallium activated alkali halides – electro luminescence.

Unit IV: SIZE DEPENDENT PROPERTIES OF NANOMATERIALS

Elucidation of the structure: chemistry and properties of Nano-structured materials - Variation in properties of micro and Nano materials - Length scale involved and effect on properties: mechanical, electronic, optical, magnetic and thermal properties.

Unit V: TYPES OF NANOSTRUCTURES AND NANOMATERIALS AND PROPERTIES

Definition of a Nano system – Types of Nano crystals-One Dimensional (1D)-Two Dimensional (2D) -Three Dimensional (3D) nano structured materials – Quantum dots – Quantum wire Core/Shell structures - Carbon Nano tubes (CNT) – Metals (Au, Ag) – Metal oxides (TiO2, CeO2, ZnO) – Semiconductors (Si, Ge, CdS, ZnSe) – Ceramics and Composites – Dilute magnetic semiconductor- Biological system – DNA and RNA – Lipids – Size dependent properties – Mechanical, Physical and Chemical properties.

OUTCOME

By the end of the course, the students will be able to,

- Know the salient features of nano structures and nano materials.

BOOKS FOR STUDY

1. Nano: The Essentials, T. Pradeep, Tata Mc Graw Hill education Pvt. Ltd, 2013
2. Nanotechnology Fundamentals and Applications, Manasi Karkare, I.K. International, 2011.
3. Introduction to Nanotechnology, K. Ravi chandran, K. Swaminathan, P.K. Preetha, P. Kavitha, JAZYM Publications, 2019.
4. Nanotechnology: Technology revolution of 21st century, S. Chand and Publications, 2009

BOOKS FOR REFERENCE

1. Nanophysics and Nanotechnology: An Introduction to Modern Concepts in Nano science, - Edward L. Wolf - Wiley-VCH, 2006.
2. Nano systems - K.E.Drexler, Wiley, 1992.
3. Nano structures and Nano materials: Synthesis, properties and applications - G.Cao - Imperial College Press, 2004.
4. Nanotechnology: An Introduction, Jeremey Ramsden, Elsevier, 2011
5. Nanotechnology, Richard Booker and Earl Boysen, Wiley India Pvt. Ltd. 2011

Question Paper Pattern

Maximum Marks: 100 Marks **Exam Duration: 3 Hrs**

5x20=100 (either or type two questions from each unit)

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