MAHARAJA GANGA SINGH UNIVERSITY

BIKANER

SYLLABUS

SCHEME OF EXAMINATION AND

COURSES OF STUDY

FACULTY OF SCIENCE

PHYSICS

B.Sc. PART – I, II and III EXAMINATIONS 2020-2022

M.Sc. (P) 2020 and (F) 2021 EXAMINATIONS

M.Phil. EXAMINATIONS 2020

B.Sc. PART – I - 2020

PHYSICS

Scheme of examination;

Three Theory Papers		**Min. Pass Marks 48**	**Max. Marks 135**
Paper-I :	Frame of reference, Mechanics and Oscillations	3 hrs. duration	45 marks
Paper-II :	Mathematical background Properties of matter and Electromagnetic waves	3 hrs. duration	45 marks
Paper-III :	Electrostatics, Electricity and Magnetism	3 hrs duration	45 marks
Practical 5 hrs. duration		Min. Pass marks 24	Max. marks 65
		Total	200

Note : There will be two experiments of 5 hrs. duration. The distribution of marks will be as follows :

Two experiments (one from each group)		
Each of 20 marks	-	40
Viva	-	15
Record	-	10
Total	-	65

Work load : Each paper must be given 2 hrs. (or three pds) per week for theory. Practical must be given 4 hrs. (or 6 pds) per week. This gives 60 hours for each theory paper with 30 weeks of teaching every year and 120 hours for practical and laboratory tutorials work every year. For laboratory work-each batch must not be more than 20 students.

PAPER -1 FRAME OF REFERANCE, MECHANICS AND OSCILLATIONS

Duration : 3 hrs. Max Marks: 45

Note: The question paper shall contain three sections. **Section A** (**15 marks**) shall contain 10 questions two from each Unit. Each question shall be of 1.5 marks. All the questions are compulsory. The answers should not exceed 50 words. **Section B** (**15 marks**) shall contain 5 questions (two from each unit with internal choice). Each question shall be of 3 marks. The candidate is required to answer all 5 questions. The answers should not exceed 200 words. **Section C** (**15 marks**) shall contain 5

questions, one from each Unit. Each question shall be of 5 marks. The candidate is required to answer any three questions. The answers should not exceed 500 words. The question paper shall have at least 30% weightage to numerical problems. MKSA system of units is to be used.

UNIT - I

Inertial frames, Galilean Transformation, Non-inertial frames, laws of motion and motion in uniform field, fictious forces, Displacement, velocity and acceleration in rotating co-ordinate systems, centrifugal acceleration, coriolis force and its applications.

UNIT-II

Michelson-Morley experiment, search for ether, Postulates of the special theory of relativity, Lorentz transformations, length contraction, time dilation, velocity transformations, variation of mass with velocity, mass energy equivalence. Four vector formulation (qualitative only)

UNIT - III

Motion under central force, Conservation laws, Kepler's law, Gravitational law and field. Potential due to a spherical body, Gauss and Poisson equations for gravitational self energy.

System of particles, centre of mass, equation of motion of single stage and multistage rocket, concepts of elastic and inelastic collisions.

UNIT-IV

Rigid body motion, Rotational motion, Moment of inertia and their coefficients, Principle axes, Euler's equations.

Potential well and periodic oscillations, cases of harmonic oscillations, differential equations and its solution, Kinetic and potential energy.

Simple harmonic oscillations in - Spring and mass system, Simple and compound pendulum, Torsional pendulum, Bifilar oscillations, Helmholtz resonator, LC circuts, Vibration of bar magnet, Oscillation of two masses connected by a spring.

UNIT-V

Superposition of two simple harmonic motions of same frequency along the same line, Interference, Superposition of two mutually perpendicular simple harmonic vibrations of same frequency, Lissajous figures, Cases of different (multiple) frequency.

Damped harmonic oscillators, Power dissipation, Quality factor, Driven

harmonic oscillator, Transient and steady state, Power absorption, Two coupled oscillations, normal modes.

Text and Reference Books :

1. "Berkeley Physics Course Vol.-l, Mechanics" (Mc-Graw-Hill)

2. The Feynman Lectures in Physics, vol-1, R.P. Feynman, R.B. Lgnton and M. Sands.

3. P. Khandelwal — "Oscillation and Waves", (Himalaya Publishing House, Mumbai.)

4. R.S. Gambhir — Mechanics, (CBS Publishers and Distributors, New Delhi.)

5. R.K. Ghosh — The Mathematics of Waves and Vibrations, (Macmilan, 1975.)

PAPER-II MATHEMATICAL BACKGROUND, PROPERTIES OF MATTER AND ELECTROMAGNETIC WAVES

Duration : 3 hrs. Max. Marks : 45

Note: The question paper shall contain three sections. **Section A** (**15 marks**) shall contain 10 questions two from each Unit. Each question shall be of 1.5 marks. All the questions are compulsory. The answers should not exceed 50 words. **Section B** (**15 marks**) shall contain 5 questions (two from each unit with internal choice). Each question shall be of 3 marks. The candidate is required to answer all 5 questions. The answers should not exceed 200 words. **Section C** (**15 marks**) shall contain 5 questions, one from each Unit. Each question shall be of 5 marks. The candidate is required to answer any three questions. The answers should not exceed 500 words. The question paper shall have at least 30% weightage to numerical problems. MKSA system of units is to be used.

UNIT - I

Scalars and Vectors : Dot & Vector products, triple vector product, gradient of scalar field and its geometrical interpretation, divergence and curl of a vector field, line, surface and volume integral, Flux of vector field, Gauss's divergence theorem, Green's theorem and Stokes theorem.Curvilinear Coordinates.

UNIT - II

Elasticity, Small deformations, Young's modulus, Bulk modulus and Modulus of rigidity for an isotropic solid, Poisson ratio, relation between elastic constants, Theory of bending of beam, Cantilever, Torsion of a cylinder, Bending moment and

Shearing forces.

UNIT – III

Kinematics of moving fluids, Equation of continuity, Euler's equation, Bernoulli's theorem, Viscous fluids, Streamline and Turbulent flow, Reynold's number, Poiseulle's law, Capillary tube flow, Stoke's law, Surface tension and surface energy, molecular interpretation of surface tension, Pressure on a curved liquid surface, wetting.

UNIT-IV

Electromagnetic induction, Faraday's law (integral and differential form), Lenz's law, Mutual and Self inductance, Transformers, Energy in a static magnetic field, Measurement of self inductance by Rayleigh's method, Maxwell's displacement current, Maxwell's equations, Electromagnetic field and Energy density.

UNIT-V

Plane electromagnetic wave in vacuum, Wave equation for E and B of linearly, circularly and elliptically polarized electromagnetic waves, Poynting vector, Boundary condition for B, E, H & D, Frasnel's relations(E in the plane), Reflection and refraction at a plane boundary of dielectrics, Polarization by reflection and total internal reflection,

Text and Reference Books:

1. Berkeley Physics Course, Electricity and Magnetism, Ed. E.M. Procell (Mc-Graw Hill)
2. Haliday and Resnik, 'Physics'-Vol. II
3. DJ. Griffth "Introduction to Electrodynamics", (Prentice Hall of India.)
4. A.M. Partis, 'Electromagnetic field."
5. V.V. Savate, 'Electromagnetic field and Waves', (Wiley Eastern Ltd., New Delhi.)
6. S.N. Ghosh, 'Electromagnetic theory and Wave propagation', (Narosa Publishing House.)

PAPER-III ELECTROSTATICS, ELECTRICITY AND MAGNETISM

Duration: 3 hrs. Max. Marks. 45

Note: The question paper shall contain three sections. **Section A** (**15 marks**) shall contain 10 questions two from each Unit. Each question shall be of 1.5 marks. All the questions are compulsory. The answers should not exceed 50 words. **Section B** (**15**

marks) shall contain 5 questions (two from each unit with internal choice). Each question shall be of 3 marks. The candidate is required to answer all 5 questions. The answers should not exceed 200 words. **Section C** (**15 marks**) shall contain 5 questions, one from each Unit. Each question shall be of 5 marks. The candidate is required to answer any three questions. The answers should not exceed 500 words. The question paper shall have at least 30% weightage to numerical problems. MKSA system of units is to be used.

UNIT – I

Coulomb's law & its vector form, Potential and field of an arbitrary charge distribution at rest, Concept of Multipole, Potentials and field due to Dipole and Quadrupole, Work done on moving a charge in an electrostatic field, expressed as a line integral, Conservative nature of the electrostatic field, Electric potential (ϕ), $\mathbf{E} = -\nabla\phi$, Torque on a dipole in a uniform electric field and its energy, Electrostatic energy of uniformly charged sphere, Classical radius of an electron, Screening of E-field by a conductor.

UNIT – II

Dielectrics, Parallel plate capacitor with partially, or completely filled dielectrics, dielectric constant, Polarization and polarization vector Atomic and molecular polarisability, Displacement vector D, Molecular interpretation of Claussius Mosotti equation.

UNIT – III

Steady current, Current density J, Non-steady currents and continuity equation, Charging and discharging of condenser through resistance, Determination of high resistance by leakage method. Rise and decay of current in LR and CR circuits, Decay constant, transients in LCR circuits, AC circuits, Complex number and their applications in solving AC circuits, Complex impedance and reactance, Series and parallel resonance, Q-factor and sharpness of resonance, Power consumed by an AC circuit, Power factor transmission of electric power.

UNIT - IV

Force on moving charge Lorentz force equation and definition of **B**, Force on a straight conductor carrying current in a uniform magnetic field, Torque on a current loop, Magnetic dipole moment, Angular momentum and gyro magnetic ratio.

Biot and Savart's law, calculation of H in simple geometrical situations, Ampere's law, $\nabla.B = 0$, $\nabla \times B = \mu J$, Field due to a magnetic dipole, Magnetization current, Magnetization vector, **Hall effect,** Magnetic permeability (linear cases).

UNIT - V

E as an accelerating field: Electron gun, case of discharge tube, linear accelerator, **E** as deflecting field: CRO, sensitivity of CRO.

Transverse **B** field: 180° deflection, Mass spectrograph, Curvatures of tracks, energy determinations of nuclear particles, Principle of a cyclotron.

Mutually perpendicular E and B field: Velocity selector, its resolution. Parallel E and B field: Positive ray parabolas, discovery of isotopes, elements of mass spectrograph, Principle of magnetic focusing (lens).

Text and Reference Books:

1. Berkeley Physics Course, Electricity and Magnetism, Ed. E.M. Procell (Me Graw Hill)
2. Haliday and Resnik, 'Physics'-Vol. II
3. D.J. Grifth "Introduction to electrodynamics", (Prentice Hall of India.)
4. A.M. Partis, 'Electromagnetic field.[1]
5. V.V. Savate, 'Electromagnetic field and Waves', (Wiley Eastern Ltd., New Delhi.)
6. S.N. Ghosh, 'Electromagnetic theory and Wave propagation', (Narosa Publishing House.)

PHYSICS PRACTICALS

Duration: 5 hrs Min. Pass Marks 24 Max. Marks 65

Total number of experiments to be performed by the students during the session should be 16, selecting any eight from each section.

In examination two experiments are to be performed taking at least one from each section.

Section : A

1. Study of laws of parallel and perpendicular axes for moment of inertia.
2. To find M.I. of an irregular body by inertia table.
3. Study of conservation of momentum in two dimensional oscillations.
4. Study of a compound pendulum.
5. Study of damping of a bar pendulum under various conditions.

6. Study of oscillations under a bifilar suspension.
7. Potential energy curves of a 1 -dimensional system and oscillations in it for various amplitudes.
8. Study of oscillations of a mass under different combinations of springs.
9. Study of bending of a cantilever or a beam.
10. Study of torsion of a wire (static and dynamic methods)
11. Study of flow of liquids through capillaries.
12. Determination of surface tension of a liquid by different methods.
13. Study of viscosity of a fluid by different methods.
14. Determine Y by Hook's law
15. Determine Y, η, σ by Searle's apparatus
16. Determine η by Maxwell needle
17. Determine η by Statical method
18. Determine σ of Rubber tube
19. Determine surface tension of water by Jaeger's method
20. Study the air damping by compound pendulum
21. Variation of magnetic field by tangent galvanometer

Section : B

1. Characteristics of a ballistic galvanometer.
2. I-V Charateristic of a P-N junction diode.
3. I-V Charateristic of a Zener diode.
4. Setting up and using an electroscope or electrometer.
5. Use of a vibration magnetometer to study a field.
6. Study B field due to a current.
7. Measurement of low resistance by Carey-Foster bridge or otherwise.
8. Measurement of inductance using impedance at different frequencies.
9. Measurement of capacitance using impedance at different frequencies.
10. Study of decay of currents in LR and RC circuits.
11. Response curve for LCR circuit and resonance frequency and quality factor.
12. Sensitivity of a cathode-ray oscilloscope.
13. Characteristics of a choke.
14. Measurement of inductance.
15. To verify the inverse square law using photocell

16. Study of Lorentz force.
17. Convert a galvanometer to voltmeter of a given range
18. Convert a galvanometer to ammeter of a given range
19. Study the variation of RC circuit with AC source
20. To verify maximum power trasfer theorem
21. Study the charging and discharging of a capacitor (variation of RC circuit with DC)
22. Study of discrete and continuous LC transmission lines.

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तीन प्रश्न पत्र सैद्धान्तिक	न्यूनतम उतीर्णांक 48	अधिकतम अंक 135	
(i) प्रथम प्रश्न पत्र	निर्देश तंत्र, यांत्रिकी एवं दोलन	समय 3 घंटे	पूर्णांक 45
(ii) द्वितीय प्रश्न पत्र	पदार्थ के गुण तथा विद्युत चुम्बक तरंगों की गणितीय पृष्ठभूमि	समय 3 घंटे	पूर्णांक 45
(iii) तृतीय प्रश्न पत्र	स्थिर वैधुतिकी, बैधुतिकी तथा चुम्बकत्व	समय 3 घंटे	पूर्णांक 45
प्रायोगिक परीक्षा : समय 5 घंटे	न्यूनतम उतीर्णांक 24		पूर्णांक 65

नोट : 5 घंटे के लिये दो प्रयोग होंगे जिनका अंक वितरण निम्न रहेगा। दो प्रयोग (प्रत्येक खण्ड में से एक) प्रत्येक 20 अंक के 40

मौखिक प्रश्न (Viva) 15

प्रायोगिक कक्षा रिकार्ड 10

;kx ¾ 65

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प्रत्येक प्रश्न पत्र के लिये प्रति सप्ताह 2 घंटे (3 कालांश) सैद्धान्तिक शिक्षण। प्रायोगिक कार्य हेतु 4 घंटे (6 कालांश) प्रति सप्ताह होंगे। इस प्रकार 30 शिक्षण सप्ताह में प्रति प्रश्न पत्र 60 घंटों तथा 120 घंटों का प्रायोगिक का कार्यभार प्रति सत्र होगा। प्रायोगिक कार्य हेतु प्रत्येक वर्ग (बैच) में 20 छात्र/छात्रा से अधिक न हो।

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समय : 3 घंटे पूर्णांक 45

नोट : प्रश्न पत्र के कुल तीन खण्ड होंगे।)k.* +,- (15 अंक) में प्रत्येक इकाई से 2 प्रश्न,

कुल 10 प्रश्न होंगे। प्रत्येक प्रश्न ..5 अंको का होगा। सभी प्रश्नों के उत्तर देना अनिवार्य है। प्रत्येक उत्तर की अधिकतम शब्द सीमा 50 शब्दो की होगी ।)k.* +/- (15 अंक) में कुल 5 प्रश्न होंगें (प्रत्येक इकाई मे से 2 प्रश्न, आंतरिक विकल्प सहित)। प्रत्येक प्रश्न 0 अंको का होगा। परीक्षार्थी के लिए सभी 5 प्रश्नों के उत्तर देना अनिवार्य है। प्रत्येक उत्तर की अधिकतम शब्द सीमा 200 शब्दो की होगी ।)k.* +l- (15 अंक) में प्रत्येक इकाई से 1 व कुल 5 प्रश्न होंगें। प्रत्येक प्रश्न 5 अंको का होगा। परीक्षार्थी को किन्ही तीन प्रश्नों के उत्तर देने होंगे। प्रत्येक उत्तर की अधिकतम शब्द सीमा 500 शब्दो की होगी । प्रश्न पत्र में न्यूनतम 30 प्रतिशत आंकिक प्रश्नों का भार रखा गया हे। MKSA पद्धति के मात्रकों का प्रयोग करना है।

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जड़त्वीय निर्देश तंत्र, गैलेलियन रूपान्तरण, अजड़त्वीय तंत्र, गतिकीय नियम व समान क्षेत्र में गति, आभासी बल, घूर्णित निर्देश तंत्रों में विस्थापन, वेग तथा त्वरण, अपकेन्द्रीय त्वरण, कोरियोलिस बल व उसके उपयोग।

1dk1 & 2

माइकलसन–मोर्ले प्रयोग, ईथर की खोज, सापेक्षवाद की विशिष्ट सिद्धान्त के अभीग्रहीत लोरेन्ट्ज रूपान्तरण, वेग रूपान्तरण, लम्बाई संकुचन, काल विस्फारण, वेग के साथ द्रव्यमान में परिवर्तन, द्रव्यमान–ऊर्जा तुल्यता। चर्तुविम सदिश संरूपण 3d¡' (x¡.kk5ed6

1dk1 & 0

केन्द्रीय बल में गति व संरक्षी नियम, केपलर के नियम, गुरूत्वाकर्षण क्षेत्र व नियम, गोलीय वस्तु के कारण गुरूत्वीय विभव गुरुत्वीय स्व ऊर्जा में गॉस व पायजन समीकरण।

बहुकणीय तंत्र, द्रव्यमान केन्द्र तथा गति की समीकरण एकल व बहु चरणीय राकेट का संवेग व ऊर्जा संरक्षण, प्रत्यास्थ व अप्रत्यास्थ टक्कर।

1dk1 & 7

दृढ़ पिण्ड गति, घूर्णन गति, जड़त्व आघूर्ण व उनके गुणांक, मुख्य अक्ष व जड़त्व, यूलर समीकरण।

विभव कूप व आवर्ती दोलन विभिन्न प्रकार के आवर्ती दोलन व लोलक, गति की अवकलन समीकरण व उसके हल स्थितिज व गतिज ऊर्जा।

स्प्रिंग से जुड़े द्रव्यमान के निकाय की सरल आवर्त गति, सरल व दृढ़ पिण्ड लोलक, ऐठन लोलक, बाअफिलर दोलन, हेलम्होल्टज अनुनादक LC परिपथ, चुम्बक के दोलन, स्प्रिं से जुड़े दो द्रव्यमान के दोलन।

1dk1 & 5

एक सरल रेखा में गतिशील दो समान आवृति के सरल आवर्त गति का अध्यारोपण। व्यतिकरण, समान आवृति की दो लम्बवत सरल आवृति गति का अध्यारोपण, लिसाजू आकृतियॉ।

अवमंदन सरल आवृत गति, अवमंदित दोलक शक्ति का क्षय, गुणांक, चालित आवर्ती दोलक, क्षणिक व स्थाई अवस्था, ऊर्जा अवशोषण, द्वियुग्मित दोलन, सामान्य विधा ।

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1. बर्कले भौतिकी पाठ्यक्रम भाग 1 गतिकी (मैकग्राहिल)
2. भौतिकी के फाइमॅन लेक्चर भाग 1 आर पी फाइमन आर बी लेन्मरेन व एम सॅन्डस
3. तरंग व दोलन; दया प्रसाद खण्डेलवाल (हिमालय पब्लिशिंग हाऊस, मुम्बई)
4. 'गतिकी'; आर एस गम्भीर (सी बी एस पब्लिशर व वितरक, नई दिल्ली)
5. तरंग व कम्पन की गणित, आर के घोष (मैक्मिलन 1975)
6. निर्देश तंत्र, यांत्रिकी तथा दोलन – कालरा, भण्डारी, काकानी (हिमांशु पब्लिकेशन)
7. निर्देश तंत्र, यांत्रिकी तथा दोलन – सक्सेना, सिंह, रावत, (कॉलेज बुक हाऊस)

f9rh; i''u i= & i\$k#k dk x.k r#kk f':r ;k/dh; rjxk dh xf.krh; i>B Hkkfe

समय : 3 घंटे पूर्णांक 45

नोट : प्रश्न पत्र के कुल तीन खण्ड होंगे।)k.* +,- (15 अंक) में प्रत्येक इकाई से 2 प्रश्न, कुल 10 प्रश्न होंगे। प्रत्येक प्रश्न ..5 अंको का होगा। सभी प्रश्नों के उत्तर देना अनिवार्य है। प्रत्येक उत्तर की अधिकतम शब्द सीमा 50 शब्दो की होगी ।)k.* +/- (15 अंक) में कुल 5 प्रश्न होंगें (प्रत्येक इकाई मे से 2 प्रश्न, आंतरिक विकल्प सहित)। प्रत्येक प्रश्न 0 अंको का होगा। परीक्षार्थी के लिए सभी 5 प्रश्नों के उत्तर देना अनिवार्य है। प्रत्येक उत्तर की अधिकतम शब्द सीमा 200 शब्दो की होगी ।)k.* +l- (15 अंक) में प्रत्येक इकाई से 1 व कुल 5 प्रश्न होंगें। प्रत्येक प्रश्न 5 अंको का होगा। परीक्षार्थी को किन्ही तीन प्रश्नों के उत्तर देने होंगे। प्रत्येक उत्तर की अधिकतम शब्द सीमा 500 शब्दो की होगी । प्रश्न पत्र में न्यूनतम 30 प्रतिशत आंकिक प्रश्नों का भार रखा गया हे। MKSA पद्धति के मात्रकों का प्रयोग करना है।

1dk1 & .

lf\$'k ' ,f\$'k jkf'k;k % सदिश व अदिश गुणा, त्रिसदिश गुणा, अदिश क्षेत्र प्रवणता व इसका ज्यामितिय विवेचन, सदिश क्षेत्र का डायवरजेन्स व कर्ल, रेखीय क्षेत्रफल व आयतन समाकलन , सदिश क्षेत्र का फ्लक्स, माउस डायवरजेन्स प्रमेय, ग्रीन व स्टोक्स प्रमेय।वक्र रेखीय र्निदेशांक

1dk1 & 2

i5;kL#krk@ !;u f'Afr;k % यंग का प्रत्यास्थता गुणांक, आयतन प्रत्यास्थता गुणांक व सम रूप ठोस के लिए अपरूपण गुणांक, पायजन गुणांक, विभिन्न प्रत्यास्थता गुणांकों में

संबंध, दण्डों के बंकन का सिद्धान्त व केन्टिलीवर, बेलन में एंठन, बंकन आघुर्ण व एंठन बल।

1dk1 & 0

गतिशील, तरल गतिकी सांतव्यता की समीकरण, यूलर समीकरण बरनोली प्रमेय श्यानद्रव, रेखीय व अरेखीय प्रवाह, रेनाल्ड नम्बर, पायसुली नियम, केपिलरी नली में द्रव प्रवाह, स्टोक नियम, पृष्ठ तनाव व पृष्ठ ऊर्जा, पृष्ठ तनाव का आणविक विवेचन, गोलीय द्रव पर दाब, द्रव की चिपकन प्रक्रिया।

1dk1 & 7

f':r ;k/dh; i\j.k % फैराडे नियम (अवकलन व समाकलन रूप), लेंज का नियम, स्व व अन्योन्य प्रेरकत्व, ट्रान्सफार्मर, स्थिर चुम्बकीय क्षेत्र में ऊर्जा, रेले विधि द्वारा स्वप्रेरण का मापन, मैक्सवेल विस्थापन धारा, मैक्सवेल समीकरण, विद्युत चुम्बकीय क्षेत्र व ऊर्जाघनत्व।

1dk1 & 5

निर्वात में समतल विद्युत चुम्बकीय तरंग, रेखीय, वृतीय व दीर्घ वृतीय ध्रुवित विद्युत चुम्बकीय तरंगों के लिये E व B में तरंगीय समीकरण, पॉयन्टिंग सदिश, B, E, H व D के लिये परिसीमा प्रतिबन्ध, परावैधुति समतल सतह पर परावर्तन व अपवर्तन, Fresnal relation, पूर्ण आतंरिक परावर्तन, परावर्तन द्वारा ध्रुवण ।

ikB; ' l\$Hk iLrd

1. विद्युत व चुम्बकत्व – बर्कले भौतिक पाठ्यक्रम – सम्पादक ई एम. प्रोसेल (मेकग्राहिल)
2- भौतिकी – हेलीडे व रेसनिक भाग II
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4. विद्युत चुम्बकीय क्षेत्र – ए.एम. पार्टीश।
5. विद्युत चुम्बकीय क्षेत्र व तरंग – वी.वी. सेबेट (वाइले इस्टर्न लिमिटेड न्यू दिल्ली)
6\ Electromagnetic theory and wave propagation – एस.एन. घोष (नारोशा पब्लिशिंग हाऊस)
7. गणीतिय पृष्ठभूमि, द्रव्य के गुण धर्म तथा विद्युत चु. तरंगे – कालरा, भण्डारी, काकानी (हिमांशु पब्लिकेशन)
8. गणीतिय पृष्ठभूमि, द्रव्य के गुण धर्म तथा विद्युत चु. तरंगे – सक्सेना, सिंह, रावत (कॉलेज बुक हाऊस)

r:rh; i''u i= & fL#kj '\:rdh\ '\:rdh r#kk ;k/d5'

समय : 3 घंटे पूर्णांक 45

नोट : प्रश्न पत्र के कुल तीन खण्ड होंगे।)k.* +,- (15 अंक) में प्रत्येक इकाई से 2 प्रश्न, कुल 10 प्रश्न होंगे। प्रत्येक प्रश्न ..5 अंको का होगा। सभी प्रश्नों के उत्तर देना अनिवार्य है।

प्रत्येक उत्तर की अधिकतम शब्द सीमा 50 शब्दो की होगी ।)k.* +/- (15 अंक) में कुल 5 प्रश्न होंगें (प्रत्येक इकाई मे से 2 प्रश्न, आंतरिक विकल्प सहित)। प्रत्येक प्रश्न 0 अंको का होगा। परीक्षार्थी के लिए सभी 5 प्रश्नों के उत्तर देना अनिवार्य है। प्रत्येक उत्तर की अधिकतम शब्द सीमा 200 शब्दो की होगी ।)k.* +l- (15 अंक) में प्रत्येक इकाई से 1 व कुल 5 प्रश्न होंगें। प्रत्येक प्रश्न 5 अंको का होगा। परीक्षार्थी को किन्ही तीन प्रश्नों के उत्तर देने होंगे। प्रत्येक उत्तर की अधिकतम शब्द सीमा 500 शब्दो की होगी । प्रश्न पत्र में न्यूनतम 30 प्रतिशत आंकिक प्रश्नों का भार रखा गया हे। MKSA पद्धति के मात्रकों का प्रयोग करना है।

1dk1 & .

निर्वात में कूलाम का नियम तथा इसका सदिश रूप, किसी स्थिर स्वैच्छिक आवेश वितरण के लिये विभव एंव क्षेत्र, बहुध्रुव, द्विध्रुव एवं चतुर्ध्रव के कारण विद्युत विभव एवं क्षेत्र की अवधारणा, रेखीय समाकलन के रूप में विद्युत क्षेत्र में आवेश द्वारा किया गया कार्य, स्थिर विद्युत की संरक्षित क्षेत्र प्रकृति, विद्युत विभव ϕ, विद्युत क्षेत्र $\mathbf{E} = -\nabla\phi$, समान विद्युत क्षेत्र में द्विध्रुव पर बलाधूर्ण तथा इसकी विद्युत ऊर्जा, समरूप आवेशित गोले की विद्युत ऊर्जा, इलेक्ट्रान की चिरसम्मत त्रिज्या, चालक के द्वारा विद्युत क्षेत्र में अवरोध (Screening)

1dk1 & 2

परावैधुतता, (Dielectric) आशिंक एवं पूर्ण रूप से परावैधुत पदार्थ से भरे समानान्तर प्लेट संघारित्र, परावैधुततांक धुवगणता तथा ध्रुवणता सदिश, आणविक एवं परमाणविक ध्रुवणता, विद्युत विस्थापन सदिश D, क्लासियस – मौसोटी समीकरण का आणविक विवेचन।

1dk1 & 0

स्थिर धारा घनत्व J, अस्थिर धारा तथा संतत समीकरण, संधारित्र का प्रतिरोध में आवेशन एवं निरावेशन, रिसाव (स्मांहम) द्वारा उच्च प्रतिरोध का मापन, LR तथा RC परिपथों में धारा की वृद्धि, क्षय समय के साथ वृद्धि एवं क्षय, क्षयांक, स्ब्ब परिपथ में क्षणिक धारा (transient current)

प्रत्यावर्ती धारा परिपथ, (Complex) जटिल प्रतिबाधा तथा प्रतिघात, श्रेणी एवं समानान्तर अनुवाद, (Q) गुणता गुणांक, अनुनाद की तीक्षणता, प्रत्यावर्ती परिपथ द्वारा अवशोषित शक्ति, शक्ति गुणांक, विद्युत शक्ति का परिगमन।

1dk1 & 7

गतिशील आवेश पर बल, लॉरेन्टज बल समीकरण व B की परिभाषा, एवं किसी सम चुम्बकीय क्षेत्र में धारा वाहक सरल रेखीय चालक पर आरोपित बल, धारा लूप पर आरोपित बल–आघूर्ण, चुम्बकीय द्विध्रुव आघूर्ण, कोणीय संवेग तथा जायरोमेगनेटिक निष्पति।

बायो तथा सावार्ट का नियम, सामान्य ज्यामितीय स्थिति के लिये H की गणना।

एम्पीयर का नियम, $\nabla.B = 0, \nabla \times B = \mu J,$ चुम्बकीय द्विध्रुव के कारण क्षेत्र, चुम्बकन धारा, चुम्बकन सदिश, हॉल प्रभाव, चुम्बकीय पारगम्यता।

1dk1 & 5

विद्युतीय त्वरण हेतु क्षेत्र E इलेक्ट्रान गन, विसर्जन नलिका का उदाहरण, रेखीय त्वरक।

विद्युतीय विक्षेपण हेतु क्षेत्र E कैथोड़ किरण दोलक (CRO), CRO की सुग्राहिता।

लम्बवत क्षेत्र B; 180^0 से विक्षेपण, द्रव्यमान स्पेक्टोग्राफ, पथ की वक्रता, नाभिकीय कणों की ऊर्जा मापन, साइक्लोट्रान का सिद्धान्त।

परस्पर लम्बवत E तथा B क्षेत्र : वेग चयनक तथा इसकी विक्षेपण क्षमता (Resolving) क्षमता।

समानान्तर E तथा B क्षेत्र : धन किरण परवलय, समस्थानिकों की खोज, द्रव्यमान स्पेक्ट्रोग्राफी तथा इसके मूल तत्व, चुम्बकीय लेन्स तथा फोकस प्रक्रिया।

नोट : उपरोक्त विवरणों में यांत्रिक बिन्दुओं पर अधिक महत्व दिया जाय। उक्त उपकरणों के विवरण को निहित सिद्धान्तों को समझाने हेतु ही महत्व दिया जाय।

ikB; ' l\$Hk iLrd

1. विद्युत व चुम्बकत्व – बर्कले भौतिक पाठ्यक्रम – सम्पादक – ई एम. प्रोसेल (मेकग्राहिल)
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7. स्थिर विद्युतिकी धारा विद्युत तथा चुम्बकत्व – कालरा, भण्डारी, काकानी (हिमांशु पब्लिकेशन)
8. स्थिर विद्युतिकी धारा विद्युत तथा चुम्बकत्व – सक्सेना, सिंह, रावत (कॉलेज बुक हाऊस)

Hkkfrdh ik;kfxd ijh{kk

न्यूनतम उत्तीर्णांक 24 पूर्णांक 65 समय : 5 घंटे

नोट :

1. उक्त परीक्षा में परीक्षार्थी को प्रत्येक खण्ड में एक प्रयोग लेते हुए कुल दो प्रयोग करने होंगे।
2. कक्षा के पाठ्यक्रम हेतु पूरे सत्र में कुल 16 प्रयोग करने होंगे जिनमें प्रत्येक खण्ड के आठ प्रयोग हों।

)k.* & ,

1. जड़त्व आघूर्ण के लिये समानान्तर एवं लम्बवत अक्षीय प्रमेय का अध्ययन।
2. द्वि विमीय दोलित्र के लिये संवेग संरक्षण का अध्ययन।
3. पिण्ड लोलक (Compound pendulum) का अध्ययन।
4. छड़ लोलक द्वारा विभिन्न अवस्थाओं में अवमंदन का अध्ययन।
5. (Bifilar) बाइफिलर लटकन Suspension) के दोलन का अध्ययन।
6. एक विमीय निकाय की स्थितिज ऊर्जा वक्र तथा इसमें विभिन्न आयामों के लिये दोलनों का अध्ययन।
7. किसी द्रव्यमान की विभिन्न स्प्रिंग संयोजनों के लिये दोलनों का अध्ययन।
8. केन्टलीवर के बंकन का अध्ययन।
9. स्थितिक एवं गतिक विधि द्वारा तार के ऐंठन का अध्ययन।
10. सूक्ष्म नलिकाओं (Capillary) से द्रव के प्रवाह का अध्ययन।
11. विभिन विधियों द्वारा द्रव के पृष्ठतनाव की गणना।
12. किसी द्रव के श्यानतागुणांक का विभिन्न विधियों द्वारा अध्ययन।
13 हुक के नियम से Y की गणना।
14 र्सल विधि से Y, η, σ की गणना।
15 मैक्सवेल सुई की सहायता से η की गणना।
16 स्थेतिक विधि से η की गणना।
17 रबर की σ की गणना।
18 जेगर विधि से पानी का पृष्ठतनाव की गणना।
19 पिण्ड लोलक से हवा में अवमंदन का अध्ययन।
20 To find M.I. of an irregular body by inertia table.
21 Tangent गल्वानोमीटर से चुम्बकीय क्षेत्र के परिर्वतन का अध्ययन।

)k.* & /

1. प्रक्षेप धारामापी की विशेषताओं का अध्ययन।
2. इलेक्ट्रोस्कोप या विद्युतमापी (Electrometer) का संयोजन एवं उसका उपयोग।
3. दोलन – चुम्बकमापी का उपयोग एवं क्षेत्र का अध्ययन।
4. धारा के कारण चुम्बकीय क्षेत्र B का अध्ययन।
5. केरेफोस्टर सेतु अथवा अन्य विधि से अल्प प्रतिरोध का मापन।
6. प्रेरकत्व का विभिन्न आवृतियों पर प्रतिबाधा के द्वारा मापन।
7. धारिता का विभिन्न आवृतियों पर प्रतिबाधा के द्वारा मापन।

8. LR तथा RC परिपथों में धारा के क्षय का अध्ययन।

9. LCR परिपथ का अनुनादित आवृति तथा गुणता गुणंक के लिये दर्शित वक्र का अध्ययन।

10. कैथोड़ – किरण – ऑसीलोस्कोप (CRO) की सुग्राहिता का अध्ययन।

11. चोक कुण्डली की अभिलाक्षणिकी का अध्ययन।

12. प्रेरकत्व का मापन।

13. लॉरेन्टज बल का अध्ययन।

14. LC संचरण लाइन का सतत एवं डिस्क्रीट) विविक्त रूप में अध्ययन।

15 फोटो सेल की सहायता से व्युत्क्रम वर्ग नियम का सत्यापन

16 गल्वानोमीटर को दी गई परास के वोल्टमीटर में बदलना

17 गल्वानोमीटर को दी गई परास के अमीटर में बदलना

18 अद्यिकतम शक्ति संचरण प्रमेय का सत्यापन

19 AC स्त्रोत से RC परिपथ में परिर्वतन का अध्ययन।

20 संघारित्र के आवेशन व निरावेशन का अध्ययन (DC स्त्रोत से RC परिपथ में परिर्वतन का अध्ययन।

21 P-N संधि डायोड की I-V अभिलाक्षणिक

22 जीनर डायोड की I-V अभिलाक्षणिक

B.Sc. Part II - 2021

PHYSICS

Scheme of examination:

Three theory papers	Min. Pass Marks 48	Duration	Max Marks 135
Paper-I	Statistical Physics and Thermodynamics	3 hrs.	45
Paper-II	Waves, Acoustics and Kinetic theory of Gases	3 hrs.	45
Paper-III	Optics	3 hrs.	45
Practical		5 hrs.	65
		Total	200

Note : For practical examination, there will be two experiments of total duration 5 hrs. The distribution of marks will be as follows –

Two experiments (one from each section A & B)	40
Viva	15
Record	10
Total	65

Work Load:

Each paper must be given 2 hrs. (or three periods) per week for theory.

Practical must be given 4 hrs (or 6 periods) per week. This gives 60 hours for each theory paper with 30 weeks of teaching every year and 120 hours for practical and laboratory tutorial work every year. For laboratory work each batch must not be more than 20 students.

PHYSICS

Paper-I STATISTICAL PHYSICS AND THERMODYNAMICS

Duration: 3 hrs. Max. Marks: 45

Note: The question paper shall contain three sections. **Section A** (**15 marks**) shall contain 10 questions two from each Unit. Each question shall be of 1.5 marks. All the questions are compulsory. The answers should not exceed 50 words. **Section B** (**15 marks**) shall contain 5 questions (two from each unit with internal choice). Each question shall be of 3 marks. The candidate is required to answer all 5 questions. The answers should not exceed 200 words. **Section C** (**15 marks**) shall contain 5 questions, one from each Unit. Each question shall be of 5 marks. The candidate is required to answer any three questions. The answers should not exceed 500 words. The question paper shall

have at least 30% weightage to numerical problems. MKSA system of units is to be used.

UNIT-1

STATISTICAL PHYSICS

Phase space, micro and macro states, the statistical basis of thermodynamics:

The mu(μ) space representation, division of mu space into energy sheets and into phase cell of arbitrary size, Probability and thermodynamic probability, principle of equal a priori probabilities, probability distribution and its narrowing with increase in number of particles. The expressions for average properties. Constraints, accessible and inaccessible states, distribution of particles with a given total energy into a discrete set of energy states. The monoatomic ideal gas, the barometric relations.

UNIT-2

Some universal laws: Equilibrium before two systems in thermal contact, bridge with macroscopic physics. Probability and entropy, Boltzmann entropy relation. Statistical interpretation of second law of thermodynamics. Boltzmann canonical distribution law and its applications; rigorous form of equipartition of energy.

Transition to quantum statistics: 'h' as a natural constant and its implications, cases of particle in a one-dimensional box and one-dimensional harmonic oscillator. Indistinguishability of particles and its consequences, M.B., Bose-Einstein, and Fermi-Dirac statistics and their comparision,

UNIT-3

THERMODYNAMICS

The laws of thermodynamics: The Zeroth law, various indicator diagrams, work done by and on the system, first law of thermodynamics, internal energy as state function and other applications. Reversible and irreversible changes, Carnot cycle and its efficiency, Carnot theorem and the second law of thermodynamics Different versions of the second law, practical cycles used in internal combustion engines. Entropy,, principle of increase of entropy. The thermodynamic scale of temperature; its identity with the perfect gas scale. Third law of thermodynamics.

UNIT-4

Thermodynamic relationships: Thermodynamic variables; extensive and intensive, Maxwell's general relations, application to Joule-Thomson cooling and adiabatic cooling in a general system, Van-der Waals gas, Clausius Clapeyron heat equation.

Thermodynamic potentials and equilibrium of thermodynamic systems, relation with thermodynamical variables. Cooling due to adiabatic demagnetization, production and measurement of very low temperatures.

UNIT-5

Blackbody radiation: Pure temperature dependence. Stefan-Boltzmann law of radiation. Spectral distribution of blackbody radiation. Wien's displacement law, Rayleigh-Jean's law, the ultraviolet catastrophy, Planck's quantum postulates, Planck's law, complete fit with experiment. Interpretation of behavior of specific heats of gases and solids at different temperature.

Paper- II : WAVES, ACOUSTICS AND KINETIC THEORY OF GASES

Duration: 3 hrs. Max. Marks: 45

Note: The question paper shall contain three sections. **Section A** (**15 marks**) shall contain 10 questions two from each Unit. Each question shall be of 1.5 marks. All the questions are compulsory. The answers should not exceed 50 words. **Section B** (**15 marks**) shall contain 5 questions (two from each unit with internal choice). Each question shall be of 3 marks. The candidate is required to answer all 5 questions. The answers should not exceed 200 words. **Section C** (**15 marks**) shall contain 5 questions, one from each Unit. Each question shall be of 5 marks. The candidate is required to answer any three questions. The answers should not exceed 500 words. The question paper shall have at least 30% weightage to numerical problems. MKSA system of units is to be used.

UNIT-1

KINETIC THEORY OF MATTER

Ideal Gas: Kinetic model, deduction of Boyle's law; interpretation of temperature, estimation of rms speeds of molecules. Brownian motion, estimate of the Avogadro number. Equipartition of energy, specific heat of monatomic gas, extension to di-and triatomic gases, Behaviour at low temperatures. Adiabatic expansion of an ideal gas, application to atmospheric physics.

Transport phenomena in gases: Molecular collisions, mean free path and collision cross sections. Estimates of molecular diameter and mean free path. Transport of mass, momentum and energy and interrelationship, dependence on temperature and

pressure.

UNIT -2

Real Gas: Van der Waals gas, equation of state, nature of Van der Waals forces, comparison with experimental P-V curves. The critical constants, gas and vapour. Joule expansion of ideal gas, and of a Van der Waals gas, Joule coefficient, estimates of J-T cooling.

Liquifaction of gases: Boyle temperature and inversion temperature. Principle of regenerative cooling and of cascade cooling, liquification of hydrogen and helium. Refrigeration cycles, meaning of efficiency.

UNIT-3

Maxwellian distribution of law of velocity and speed in an ideal gas : Distribution of speeds and of velocities, experimental verification, distinction between mean, rms and most probable speed and velocity values. Doppler broadning of spectral lines.

Applied acoustics: The acousticity of a hall, reverberation period, Sabine's formula.

UNIT-4

WAVES

Waves in media: Speed of transverse waves on a uniform string, speed of longitudinal waves in a fluid, energy density and energy transmission in waves, typical measurements. Waves over liquid surface: ripples. Group velocity and phase velocity, their measurements.

Superposition of waves: Linear homogeneous equations and the superposition principle, nonlinear superposition and consequences.

Standing waves: Standing waves as normal modes of bounded systems, examples, Harmonics and the quality of sound; examples. Chladni's figures and vibrations of a drum. Production and detection of ultrasonic waves and applications.

UNIT-5

ACOUSTICS

Noise and Music: The human ear and its responses; limits of human audibility, intensity and loudness, bel and decibel the musical scale, temperament and musical instruments violin, sitar, flute, harmonium & tabla.

Reflection, refraction and diffraction of sound: Acoustic impedance of a medium, percentage reflection and refraction at a boundary, Measurements of frequency and velocity, impedance matching for transducers, diffraction of sound, principle of a sonar system, sound ranging.

Paper-III OPTICS

Duration: 3 hrs. Max. Marks: 45

Note: The question paper shall contain three sections. **Section A** (**15 marks**) shall contain 10 questions two from each Unit. Each question shall be of 1.5 marks. All the questions are compulsory. The answers should not exceed 50 words. **Section B** (**15 marks**) shall contain 5 questions (two from each unit with internal choice). Each question shall be of 3 marks. The candidate is required to answer all 5 questions. The answers should not exceed 200 words. **Section C** (**15 marks**) shall contain 5 questions, one from each Unit. Each question shall be of 5 marks. The candidate is required to answer any three questions. The answers should not exceed 500 words. The question paper shall have at least 30% weightage to numerical problems. MKSA system of units is to be used.

UNIT-1

GEOMETRICAL OPTICS

Fermat's Principle: Principle of extremum path and application to laws of reflection refraction.

General theory of image formation : Cardinal points of an optical system, general relationships, thick lens and lens combinations, Lagrange equation of magnification, telescopic combinations, telephoto lenses and eyepieces.

UNIT-2

Aberration in images: Chromatic aberrations, achromatic combination of lenses in contact and separated lenses. Monochromatic aberrations and their reductions; aplanatic points, oil immersion objectives, meniscus lens.

Optical instruments: Entrance and exit pupils, need for a multiple lens eyepiece, common types of eyepieces Ramsden & Huygen's eyepiece.

UNIT-3

PHYSICAL OPTICS

Interference: The principle of superpositions, two-slit interference, coherence requirements for the sources, optical path retardations, lateral shift of fringes. Localised fringes Newton's ring; Interference in thin films. Michelson interferometer, its application for precision determination of wavelength, wavelength difference and

the width of spectral lines, Fabry-Perot interferometer and etalon.

UNIT-4

Fresnel diffraction : Fresnel half-period, zones plates, straight edge, rectilinear propagation of light.

Fraunhofer diffraction: Diffraction at a slit, half-period zones. Phasor diagram and integral calculus methods, the intensity' distribution, diffraction at a circular aperture and a circular disc, resolution of images, Rayleigh criterion, resolving power of telescope and microscopic systems, outline of phase contract microscopy.

Diffraction gratings: Diffraction at N parallel slits, intensity distribution, plane diffraction grating, reflection grating and blazed gratings. Concave grating and different mountings. Resolving power of a grating and comparison with resolving powers of prism and of a Fabry-Perot etalon.

UNIT-5

LASERS

Laser systems : Purity of a spectral line, coherence length and coherencen in time, spatial coherence of a source, Einstein's A and B coefficients. Spontaneous and induced emissions, conditions for laser action, population inversion, Ruby and He-Ne laser.

Holography & Nonlinear optics : Hologram, construction and reproduction mathematical analysis, principle of self focusing, principle of fiber optics and types of optical fiber.

Some Text and Reference Books for papers I, II, III

1. A.K. Ghatak, "Physical Optics"
2. D.P. Khandclwal; "Optics and Atomic Physics" (Himalaya Publisning House, Bombay, 1988).
3. F Smith and J.H. Thomson; "Manchester Physics series: Optics" (English Language Book Society and John Wiley, 1977).
4. Bom and Wolf; "Optics"
5. K.D. Moltev; "Optics" (Oxford University Press)
6. Sears; "Optics"
7. Jenkins and White; "Fundamental of Optics" (McGraw-Hill)
8. B.B. Laud; Lasers and Non-linear Optics (Wiley Eastern 1985)
9. Smith and Thomson; "Optics" (John Wiley and Sons).
10. Berkcly Physics Coursse: Vol. Ill "Waves and Oscillations"

11. I.G. Main: "Vibrations and Waves" (Cambridge University Press)
12. H.J. Pain: "The Physics of Vibrations and Waves" (MacMillian 1975)
13. B.B. Laud, "Introduction !o Statistical Mechanics" (MacMillian 1981).
14. F.Reif: "Statistical Physics" (McGraw-Hill, 1988).
15. K.Haung: "StatisticalPhysics" (Wiley Eastern, 1988)

SYLLABUS FOR PHYSICS -PRACTICALS

Duration: 5 hrs. Min. Pass Marks 24 Max. Marks 65

Note : Total number of experiment to be performed by the students during the session should be atleast 16, selecting any eight from each section.

In examination two experiments one from each section are to be performed. The laboratory tutorials are to be done in the lab classes so that these maybe applied in regular laboratory exercises.

Section 'A'

1. Study of adiabatic expansion of a gas or Determination of '$\gamma = C_p/C_v$ ' ratio of two specific heats of a gas by Clement & Desort's method.
2. Study of conversion of mechanical energy in to heat.
3. Study of temperature dependence of total radiation.
4. Application of resistance thermometry : Determine melting point of wax using platinum resistance thermometer.
5. Application of resistance thermometry : Determine temperature coefficient of resistivity using platinum resistance thermometer.
6. Application of thermo emf : Plot thermo emf versus temperature and find the neutral temperature and an unknown temperature.
7. Conduction of heat through poor conductor: Determine thermal conductivity of a poor conductor by Lee's method.
8. Experimental study of probability distribution for a two option system using a colored dice.
9. Determination of velocity of sound, using CRO microphone, speakers by standing waves.
10. Study of dependence of velocity of wave propagation on line parameters using torsional wave apparatus.
11. Study of variation of reflection coefficient with nature of termination using torsional wave apparatus.
12. Study of interference with two coherent sources of sound.
13. Determine the ballistic constant of a ballistic galvanometer/spot galvanometer.
14. Determine the charge senstivity of a ballistic galvanometer/spot galvanometer.
15. Determine the high resistance by leakage method using ballistic galvanometer
16. Determine the ratio of capacitance by using a De Sauty bridge
17. Determine the inductance of a coil by Anderson bridge

18. Determine the normal modes in coupled oscillator system
19. Study of Energy transfer in coupled oscillator system
20. Determine Planck's constant "h" by photo cell.
21. Determine the band gap of PN junction diode

Section 'B'

1. Determination of principal points of a combination of lenses.
2. Use of diffraction grating, find wavelength of main spectral lines of Hg source and its resolving power.
3. Determine resolving power limit of resolution of a telescope and study of various eye pieces, (any two).
4. Determine Angular dispersion of Prism
5. Polarization of light by reflection, verify Brewster 's law & law of Malus.
6. Study of optical rotation of plane of polarization of sugar//specific rotation of canesugar, using polarimeter.
7. Study of interference of light with Bi-prism and determine 'λ'.
8. Use of Michelson's interferometer and determine dλ, 'λ' for sodium light.
9. Use of P.P. Etalon to determine of 'λ,' for sodium light.
10. Study of laser as a monochromatic source with reference to interference.
11. Study of laser as a monochromatic source with reference to diffraction.
12. Determine the wavelength of sodium light by Newton's rings
13. Determine Peak and R.M.S value of voltage in a RC circuit with AC source
14. Characteristics of a transistor.(CB, CE)

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(1) प्रथम प्रश्न पत्र : सांख्यिकी भौतिक एवं उष्तागतिकी	3 घंटे	45
(2) द्वितीय प्रश्न पत्र : अणुगति सिद्धान्त, तरंगे एवं ध्वनिकी	3 घंटे	45
(3) तृतीय प्रश्न पत्र : प्रकाशिकी	3 घंटे	45
प्रायोगिक परीक्षा :	5 घंटे	65
	d|(	2FF

नोट :– प्रायोगिक परीक्षा में, 5 घंटे के लिए दो प्रयोग होंगे, जिनका अंक विवरण निम्न प्रकार से है:–

दो प्रयोग (खण्ड अ एंव ब में से एक–एक)	40
मौखिक	15
प्रायोगिक कक्षा रिकार्ड	10
d|(	65

f'k{k.k dk;Zdze %

प्रत्येक प्रश्न पत्र के लिए सप्ताह 2 घंटे (3 कालांश) सैद्धान्तिक शिक्षण। प्रायोगिक कार्य हेतु 4 घटे (6 कालांश प्रति सप्ताह होंगे। इस प्रकार 30 शिक्षण सप्ताह में प्रति प्रश्न पत्र 60 घंटो तथा 120 घंटो का प्रायोगिक एंव लेब ट्यूटोरियल का कार्यभार प्रति सत्र होगा। प्रयोगिक कार्य हेतु प्रत्येक वर्ग (बैच) में 20 छात्र/छात्रा से अधिक न हों ।

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i#ke i''u i= % lkf)dh Hkkfrd &'| C>rkxfrdh

समय : 3 घंटे पूर्णांक 45

नोट : प्रश्न पत्र के कुल तीन खण्ड होंगे।)k.* +,- (15 अंक) में प्रत्येक इकाई से 2 प्रश्न, कुल 10 प्रश्न होंगे। प्रत्येक प्रश्न ..5 अंको का होगा। सभी प्रश्नों के उत्तर देना अनिवार्य है। प्रत्येक उत्तर की अधिकतम शब्द सीमा 50 शब्दो की होगी ।)k.* +/- (15 अंक) में कुल 5 प्रश्न होंगें (प्रत्येक इकाई मे से 2 प्रश्न, आंतरिक विकल्प सहित)। प्रत्येक प्रश्न 0 अंको का होगा। परीक्षार्थी के लिए सभी 5 प्रश्नों के उत्तर देना अनिवार्य है। प्रत्येक उत्तर की अधिकतम शब्द सीमा 200 शब्दो की होगी ।)k.* +l- (15 अंक) में प्रत्येक इकाई से 1 व कुल 5 प्रश्न होंगें। प्रत्येक प्रश्न 5 अंको का होगा। परीक्षार्थी को किन्ही तीन प्रश्नों के उत्तर देने होंगे। प्रत्येक उत्तर की अधिकतम शब्द सीमा 500 शब्दो की होगी । प्रश्न पत्र में न्यूनतम 30 प्रतिशत आंकिक प्रश्नों का भार रखा गया हे। MKSA पद्धति के मात्रकों का प्रयोग करना है।

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lkf);dh Hkkfrdh

C>ekxfrdh dk lkf);dh ,kEkkj : म्यू आकाश निरूपन, म्यु आकाश उर्जा पट्टिकाओं एव स्वैच्छिक आकार की कला कोशिकाओं में विभाजन, कला आकाश, सुक्ष्म एंव स्थुल अवस्था, प्रायिकता एंव उष्मागतिक प्रायिकता, समान पूर्व प्रायिकता का सिद्धान्त (Principle of equal and priori probability) प्रायिकता वितरण एंव कणों की संख्या वृद्धि होने पर इसका संकीर्णन, माध्य गुणों के लिए व्यंजक, बन्धता (constrainty), बोधगम्य एंव अबोधगम्य अवस्थाएं, दी गई कुल उर्जा के कणों का एक विविक्त उर्जा अवस्थाओं के समुच्चय के लिए वितरण, एकलपरमाणविक आदर्श गैस, दाबीय सम्बन्ध, ठोस की विशिष्ट उष्मा एवं विशिष्ट क्षमता।

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lk'f=d fu;e : तापीय सम्पर्क में आने से पूर्व दो तन्त्रों की साम्यावस्था, स्थूल – भौतिकी से उसका सम्बन्ध, एन्ट्रोपी एंव बोल्ट्जमान एन्ट्रोपी सम्बन्ध उष्मागतिकी कि द्वितीय नियम का सांख्यिकी रूप, बोल्टजमान कैनानिकल वितरण का नियम एंव उसके अनुप्रयोग, उर्जा का समविभाजन का नियम व्यापक रूप।

H'k!Ie lkf);dh e lØe.k % h एक प्राकृतिक नियतांक एंव इसके प्रभाव, एक विमीय बॉक्स एंव एक विमीय आवर्ती दोलित्र, कणों की अविभेदयता प्रतिबन्ध एंव इसके परिणाम, मैक्सवैल बोल्टज मैन, बोस आइन्सटीन एंव फर्मी डिराक सिद्धान्त की शर्तें व तुलना।

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C>ekxfrdh

C>ekxfrdh dk fu;e: शुन्यांकी नियम, विभिन्न सूचक अरेख, निकाय द्वारा एवं निकाय पर किया गया कार्य, उष्मागतिकी का प्रथम नियम, आन्तरिक उर्जा एक अवस्था फलन के रूप में तथा अन्य अनुप्रयोग, उत्क्रमणीय एव अनुत्क्रमणीय परिवर्तन, कानों चक्र एंव इसकी दक्षता, कार्नो प्रमेय एंव उष्मागतिकी का द्वितीय नियम, द्वितीय नियम के विभिन्न रूप, आन्तरिक दहन इंजनों में प्रयुक्त होने वाले व्यवहारिक चक्र, एन्ट्रोपी, एन्ट्रोपी वृद्धि का सिद्धान्त ताप का उष्मागतिकी पैमाना, इसकी आदर्श गैस पैमाने से समतुल्यता, उष्मागतिकी का तृतीय नियम।

1dk1 7

C>ekxfrdh l</!Ek % उष्मागतिकीय चर वृहत एंव लधु (extensive and intensive), मैक्सवेल के सामान्य सम्बन्ध, सामान्य तन्त्र के लिए जूल थामसन शीतलन एंव रूद्वोष्म शीतलन में इनका अनुप्रयोग, वान्डर वाल्स गैस, क्लासियस क्लैपरोन उष्मीय समीकरण, उष्मा गतिकीय विभव एंव उष्मा गतिकीय तन्त्र की साम्यावस्था ऊष्मागतिक चरो से इनका सम्बन्ध, रूद्धोष्म विचुम्बकन से शीतलन तथा अतिलघु ताप का उत्पादन एंव मापन ।

1dk1 5

df>.kdk f'fdj.k % शुद्ध ताप पर विकिरण की निर्भरता, स्टीफनबोल्टजमान् नियम, विकिरण दाब, कृष्णिका विकिरण का स्पेक्ट्रमी वितरण, वीन का विस्थापन नियम, रैले–जीन नियम, पराबैंगनी अनियमितता (catastrophe) प्लांक के क्वान्टम अभिगृहीत, प्लांक नियम तथा इसकी प्रयोग से पूर्ण संगतता न्यून ताप पर गेसों व ठोसों की विशिष्ट उष्मा के व्यवहार की व्याख्या।

f9rh; i''u i= & ,.kxfr fl k!r@ rj|x| &' E'fudh

समय : 3 घंटे पूर्णांक 45

नोट : प्रश्न पत्र के कुल तीन खण्ड होंगे।)k.* +,- (15 अंक) में प्रत्येक इकाई से 2 प्रश्न, कुल 10 प्रश्न होंगे। प्रत्येक प्रश्न ..5 अंको का होगा। सभी प्रश्नों के उत्तर देना अनिवार्य है। प्रत्येक उत्तर की अधिकतम शब्द सीमा 50 शब्दो की होगी ।)k.* +/- (15 अंक) में कुल 5 प्रश्न होंगें (प्रत्येक इकाई मे से 2 प्रश्न, आंतरिक विकल्प सहित)। प्रत्येक प्रश्न 0 अंको का होगा। परीक्षार्थी के लिए सभी 5 प्रश्नों के उत्तर देना अनिवार्य है। प्रत्येक उत्तर की अधिकतम शब्द सीमा 200 शब्दो की होगी ।)k.* +l- (15 अंक) में प्रत्येक इकाई से 1 व कुल 5 प्रश्न होंगें। प्रत्येक प्रश्न 5 अंको का होगा। परीक्षार्थी को किन्ही तीन प्रश्नों के उत्तर देने होंगे। प्रत्येक उत्तर की अधिकतम शब्द सीमा 500 शब्दो की होगी । प्रश्न पत्र में न्यूनतम 30 प्रतिशत आंकिक प्रश्नों का भार रखा गया हे। MKSA पद्धति के मात्रकों का प्रयोग करना है।

1dk1 .

$J; dk ,.kxfr fl k!r

,k$'k xy: गतिक प्रारूप, बॉयल के नियम का निर्गमन, ताप की विवेचना अणुओं की वर्गमाध्य मूल चाल क आकलन, ब्राउनियन गति, आवोगेद्रो संख्या का आकलन, उर्जा का समविभाजन नियम, एक परमाणविक गैस की विशिष्ट उष्मा, द्वि एंव ब्रिपरमाणविक गैसो तक विस्तार, न्यून तापों पर व्यवहार, आदर्श गैस का रूद्धोष्म प्रसार, वायुमंडलीय भौतिकी में अनुप्रयोग।

xy|k e| ,fHkxeu ifjKkluk& %& आणविक टक्करें, माध्य मुक्त पथ एवं संघट काट क्षेत्र। माध्य मुक्त पथ एंव आणविक व्यास का आकलन । द्रव्यमान, संवेग एंव उर्जा का अभिगमन एंव दाब एवम् ताप पर निर्भरता।

1dk1 2

'kLrf'd xy % वान्डर वाल्स गैस, अवस्था समीकरण, वान्डर वाल्स बलो की प्रकृति प्रायोगिक pv वक्रो से तुलना, कांतिक नियतांक गैस एंव वाष्प, आदर्श गैस व वान्डर वाल्स गैस का जूल नियताक, जुल टॉमसन शीतलन का आकलन।

xy|k dk $'.k % बॉयल ताप एवं प्रतिलोंमन ताप, पुनर्निवेशी शीतलन एंव उत्रोतर (cascade)

शीतलन का सिद्धान्त, हाइड्रोजन एवं हीलियम का द्रवण, प्रशीतन चक्र दक्षता का अर्थ।

1dk1 0

आदर्श गैस के लिए आण्विक चाल और वेग का मैक्सवेलियन वितरण :– गति एवं वेगों का वितरण प्रायोंगिक सत्यपान, माध्य वर्ग माध्य मूल एवं अधिकतम सम्भाव्य चालों/वेगों की गणना, स्पेक्ट्रमी रेखाओं की चौड़ाई में डाप्लर विस्तार।

,uqi;qDr E'fudh % सभाकक्षों की ध्वनिकी, पुर्नभरण (Reverberation) काल, सबिने (Sabine का सूत्र)

1dk1 7

rjax

ekE;e e rjax % एक समरूप डोरी पर अनुप्रस्थ तरंगों की चाल, एक तरल में अनुदैर्ध्य तरंगों की चाल, तरंगों में उर्जा संचरण एव उर्जा धनत्व, प्रारूविक मापन (typical measurements) द्रव सतह पर तरंगे एवं उर्मिकाए, समूह एंव कला वेग, उनका मापन।

rjaxksa dk ,E;kjksi.k : रैखिक समघात समीकरण एंव अध्यारोपण का सिद्धान्त, अरेखीय अध्यारोपण एंव परिणाम ।

,i'xkeh rjax % बद्ध निकायों की प्रसामान्य विधाओ के रूव में अप्रगामी तरेंगे, उदाहरण :– संनादियों एंव ध्वनि की गुण्वत्ता, कलादनि (Chladni)के चित्र एंव ड्रम के कम्पन, पराश्रव्य तरंगों का उत्पादन एवं संसूचन तथा अनुप्रयोग।

1dk1 5

E'fudh

'kkj &' lxhr % मानव कर्ण एवं इसकी ग्राह्यता, मानवीय श्रवण की सीमाएं तीव्रता एव प्रबलता, बेल एंव डेसीबेल, संगीतीय पैमाना (Temperament) तथा वाद्य यंत्र सीतार, हारमेानियम, वायेालिन, तबला, बासुरी।

E'fu dk ijk'ruq ,i'rqu &' f''rqu : माध्यम की ध्वनिक प्रतिबाधा, परिसीमा पर प्रतिशत परावर्तन एंव अपर्वतन, आवृति व वेग का मापन, ट्रांयड्यूसर के लिए प्रतिबाधा सुमेलन ध्वनि का विवर्तन, सोनार तन्त्र का सिद्धान्त, ध्वनि का परास।

rrh; i''u i= % i'dkf'kdh

समय : 3 घंटे पूर्णांक 45

नोट : प्रश्न पत्र के कुल तीन खण्ड होंगे।)k.* +,- (15 अंक) में प्रत्येक इकाई से 2 प्रश्न, कुल 10 प्रश्न होंगे। प्रत्येक प्रश्न ..5 अंको का होगा। सभी प्रश्नों के उत्तर देना अनिवार्य है। प्रत्येक उत्तर की अधिकतम शब्द सीमा 50 शब्दो की होगी ।)k.* +/- (15 अंक) में कुल 5

प्रश्न होंगें (प्रत्येक इकाई मे से 2 प्रश्न, आंतरिक विकल्प सहित)। प्रत्येक प्रश्न 0 अंको का होगा। परीक्षार्थी के लिए सभी 5 प्रश्नों के उत्तर देना अनिवार्य है। प्रत्येक उत्तर की अधिकतम शब्द सीमा 200 शब्दो की होगी ।)k.* +l- (15 अंक) में प्रत्येक इकाई से 1 व कुल 5 प्रश्न होंगें। प्रत्येक प्रश्न 5 अंको का होगा। परीक्षार्थी को किन्ही तीन प्रश्नों के उत्तर देने होंगे। प्रत्येक उत्तर की अधिकतम शब्द सीमा 500 शब्दो की होगी । प्रश्न पत्र में न्यूनतम 30 प्रतिशत आंकिक प्रश्नों का भार रखा गया हे। MKSA पद्धति के मात्रकों का प्रयोग करना है।

1dk1 .

L;kfefr ; i'dkf'kdh

Mje.I dk fl k!r : पथ आधिक्य का सिद्धान्त, परावर्तन तथा अपवर्तन में अनुप्रयोग।

ifrf/</ fuek.k dk lkek!; fl k!r : प्रकाशीय तन्त्र के प्रधान बिन्दु सामान्य सम्बन्ध, मोटे लेन्सों का संयोजन, आवर्धन के लिए लारेंज समीकरण, दूरदर्शीय संयोजन, टेलीफोटो लैन्स।

1dk1 2

ifrf/</k e f'i#ku % वर्ण विपथन, संपर्कित एंव पृथक स्थितियों में लेसों का अवर्णक विपथन, एक वर्णीय विपथन एंव उसका निराकरण, अविपथी बिन्दु तैल निमज्जन अभिदृश्यक, नवचन्द्रक लेन्स।

i'dk'kh; ;!= % आपतन एंव निर्गम नेत्रिकाएं (Entrance and Exit Pupils) बहुगुणित नेत्रिका लेन्स की आवश्यकता साधारण प्रकार की नेत्रिकाएं रेम्सडन तथा हाइगेन (Ramsden & Huygen's) नेत्रिकाए ।

1dk1 0

Hkkfrd i'df'kdh

i'dk'k dk J;frdj.k % अध्यारोपण का सिद्धान्त, द्विस्लिट व्यतिकरण, स्त्रोतों की कना सम्बद्धता की आवश्यकता, प्रकाशीय पथ का मंदन, फ्रिन्जों का अनुप्रस्थ विस्थापन, रैलेका अपवर्तनमापी एंव अन्य अनुप्रयोग, स्थानीय फ्रिन्जें न्यूटन रिंग Newton's Ring, पतली फिल्म e J;frdj.k@ माइकलसन व्यतिकरणमापी तथा तरंग दैर्ध्य, तरंगदैध्यों में अन्तर व स्पेक्ट्रमी रेखाओं की चौडाई के परिशुद्ध मापन में इसका उपयोग। फेबी – पेरो व्यतिकरणमापी एंव ईटालोन।

1dk1 7

Nu(f''ru % फ्रेनेल के अर्द्धावर्ती कटिबन्ध, पट्टिकाएं, सीधीधार (straight edge) ऋजुरेखीय संचरण

NkuPkMj f''ru % स्लिट से विवर्तन, अर्धआवर्त कटिबन्ध, कला आरेख एंव समाकलन

विधियाँ, तीव्रता वितरण, वृताकार अवरोध एवं वृताकार चकती से विवर्तन, प्रतिबिम्बों का विभेदन, रैल की विभेदन कसौटी, दूरदर्शी एंव सुक्ष्मदर्शी की विभेदन क्षमता, कला संकुचन सुक्ष्मदर्शीता का विवरण (outline of pahse contrast microscopy)

f'f'rlu xfIx : N समान्तर स्लिट से विवर्तन, तीव्रता वितरण, समतल विवर्तन ग्रेटिग, परावर्तन ग्रेटिग तथा (Blazed) ग्रेटिग, अवतल ग्रेटिग एंव विभिन्न स्थापन व्यवस्था, ग्रेटिग की विभेदन क्षमता तथा प्रिज्म की विभेदन क्षमता तथा फैब्री – पेरो इटालॉन की विभेदन क्षमता से तुलना ।

1dk1 5

(lj

(lj fudk; : स्पेक्ट्रमी रेखा की शुद्धता, कला सम्बद्धता, दूरी एंव समय समबंधता, स्त्रोत की स्थानिक सम्बद्धता, आईन्सटाटन के ए और बी गुणांक, स्वतः एंव प्रेरित उत्सर्जन लेसर प्रक्रिया के लिए शर्ते, जनसंख्या प्रतिलोभन। रूबी व हीलियम नियोन लेंजर Ruby and He-Ne laser.

Holography & ,jf)kd i'dkf'kdh: Pk(kxke /uk'I ' iuC5ik$u xf.krh; f''lk;uk@ L'MkHlu dk fl)kr@ i'dkQkh; r!r dk fl)kr ' i'dkj Hologram, construction and reproduction mathematical analysis, principle of self focusing, principle of fiber optics and types of optical fiber.

ikB; &' l$Hk iLrd:

1. "Physical optics"
2. "Optics and Atomic Physics"
3. "Mannchestyer Physics Series, Optics" – एफ स्मिथ व जे. एच. थॉमसन (English Language Book Society and John Wiley, 1977)
4. "Optics" बोम एंव वोल्फ
5. "Optics" - के.डी. मोल्टेव (ऑक्सफोर्ड विश्वविद्यालय प्रेस)
6. "Fundamental of Optics"– जेनकिन्स एंव वाइट (मैक्ग्रा – हिल्स)
7. "Optics" - Seatrs
8. "Laser and Non-liner optics" - B.B. संदक (विले.ईसर्न 1985)
9. "Optics" स्मिथ उंव थॉमसन (जॉन विले एण्ड सन्स)
10. "Waves and Oscillations" – बर्कले भौतिक पाठ्यक्रम भाग III
11. "Vibrations and waves" – I.G. Main Cambridge University Press)
12. "The Physics of Vibrations and Waves" - H.J. Pain मैकमिलन 1975
13. "Introduction to static\stical Mechanies" - B.B. Land मैकमिलन 1981
14. "Statisitcal Physics" - F. Reif (मैक्ग्रा–हिल्स 1988)

15. "Statistical Physics" - K. Haung (Wiley-Eaxternh 1988)

ik;kfxd & Hkkfrd ikB;Øe

समयः 5 घंटे न्यूनतम उर्तीणांक : 24 पुर्णाकं : 65

नोट : कक्षा में पाठ्यक्रम हेंतू पूरे सत्र में कु 16 प्रयोग करने होंगे, जिनमें प्रत्येक खण्ड के 8 प्रयोग हों। उक्त परीक्षार्थी को प्रत्येक खण्ड से एक प्रयोग लेते हुए कुल दो प्रयोग करने होगा।

)k.* ¼ ,

1. गैस के रूद्धोष्म प्रसार का अध्ययन करना अथवा क्लेमेन्ट व डेसोरेम विधि से उष्मागमिक नियतांक $\gamma = C_p/C_v$ का मान ज्ञात करना।

2. यांत्रिक उर्जा का उष्मीय उर्जा में रूपान्तरण का अध्ययन करना

3. वस्तु के कुल उत्सर्जित विकिरण का उसके ताप के साथ अध्ययन करना ।

4. प्रतिरोध तापमापी विधि का अनुप्रयोगः प्लेटिनम प्रतिरोध तापमापी की सहायता से मोम का गलनांक ज्ञात करना।

5 प्रतिरोध तापमापी विधि का अनुप्रयोगः प्लेटिनम प्रतिरोध तापमापी की सहायता से ताप प्रतिरोध गुणांक ज्ञात करना।

6. तापीय वि.वा.ब. का अनुप्रयोग : तापयुग्म के तापीय वि.वा.ब. तथा ताप के बीच वक्र खींचना तथा उदासीन ताप एवं अज्ञात ताप ज्ञात करना।

7. न्यून चालक से उष्मा संचालन : न्यून चालक पदार्थ की उष्मा चालकता ली की विधि से ज्ञात करना।

8. रंगीन डाटस (Dice) का उपयोग करते हुए दो सम्भव निकाय के लिए प्रयिकता वितरण का प्रायोगिक अध्ययन करना।

9. C.R.O., माइक्रोफोन, स्पीकर के उपयोग से अप्रगामी तरंगो का उपयोग करते हुए ध्वनि तरंगों का वेग ज्ञात करना।

10. मरोडी तरंग उपकरण का उपयोग कर तरंग संचरण के वेग का लाइन प्राचालों पर निर्भरता का अध्ययन करना।

11. मरोडी तरंग उपकरण का उपयोग कर परार्वतन गुणांक का अन्तवस्था भार के साथ परिवर्तन का अध्ययन करना।

12. ध्वनि के दो कला सम्बद्ध स्त्रोतों से व्यतिकरण का अध्ययन करना।

13 प्रक्षेप धारामापी का प्रक्षेप नियतांक ज्ञात करना

14 प्रक्षेप धारामापी की आवेश सुग्राहिता ज्ञात करना

15 प्रक्षेप धारामापी से क्षरण विधि से उच्च प्रतिरोध ज्ञात करना

16 डीसॉटी सेतु De Sauty bridge से धारिता के अनुपात ज्ञात करना

17 एण्डरसन सेतु Anderson bridge से कुण्डली की प्रेरकत्व ज्ञात करना

18 युग्मित दोलक के सामान्य विधा का अध्ययन करना।

19 युग्मित दोलक के ऊर्जा हस्तांतरण का अध्ययन करना।

20 फोटो सेल की सहायता से प्लांक नियतांक ज्ञात करना

21 P-N संधि डायोड का बैण्ड अंतराल ज्ञात करना

)k.* ¼ /

1. लेन्सो के युग्मन के मुख्य बिन्दु ज्ञात करना।

2. विवर्तन ग्रेटिंग का उपयोग करते हुए Hg प्रकाश स्त्रोत की मुख्य वर्ण क्रम की तरंगदैर्ध्य तथा ग्रेटिंग की विभेदन क्षमता ज्ञात करना ।

3. दूरदर्शी की विभेदन क्षमता ज्ञात करना तथा विभिन्न नेत्रिकाओं का अध्ययन करना। (कोई दो)

4. प्रकाश के परावर्तन द्वारा ध्रुवण, बुस्ट्र नियम एंव मैलस के नियम को सिद्ध करना।

5. ध्रुवणमापी की सहायता से शक्कर के ध्रुवण कोण के प्रकाशिय घुर्णन का अध्ययन करना।

6 द्विप्रिज्म की सहायता से प्रकाश के व्यतिकरण का अध्ययन करना तथा प्रकाश की तरंगदैर्ध्य ज्ञात करना।

7 माइकल्सन व्यतिकरणमापी की सहायता से एक वर्णीय प्रकाश स्त्रोत की तरंगदैर्ध्य ज्ञात करना एंव सोडियम प्रकाश की D_1 व D_2 रेखाओं का तरंगदैर्ध्य में अन्तर ज्ञात करना।

8. फेब्री – पेरो इटालॉन की सहायता से साडियम प्रकाश की तरंगदैर्ध्य ज्ञात करना।

9. व्यतिकरण के संदर्भ में लेसर एक वर्णीय प्रकाश स्त्रोत का अध्ययन करना।

10. विवर्तन के संदर्भ में लेसर एकवर्णीय प्रकाश स्त्रोत का अध्ययन करना।

11 न्यूटन रिंग से साडियम प्रकाश की तरंगदैर्ध्य ज्ञात करना।

12 प्रिज्म की वर्ण विक्षेपण क्षमता ज्ञात करना।

13 ट्रांजिस्टर के अभिलाक्षणिक (CB, CE)

14 AC स्त्रोत के साथ RC परिपथ की वोल्टता के शिखर व R.M.S. मान ज्ञात करना।

B.Sc. PART – III- 2022

PHYSICS

Scheme of examination;

Three Theory Papers		**Min. Pass Marks 48**	**Max. Marks 135**
Paper-I :	Quantum Mechanics, Atomic and Molecular Physics	3 hrs. duration	45 marks
Paper-II :	Nuclear and Solid State Physics	3 hrs. duration	45 marks
Paper-III :	Electronics and Solid State Devices	3 hrs duration	45 marks
Practical 5 hrs. duration		Min. Pass marks 24	Max. marks 65
		Total	200

Note : There will be Two experiments or One experiment and a working project based on principle of physics of 5 hrs. duration. The distribution of marks will be as follows: Two experiments or One experiment and a working project based on principle of physics

Each of 20 marks	-	40
Viva	-	15
Record	-	10
Total	-	65

Work load :

Each paper must be given 2 hrs. (or three pds) per week for theory. Practical must be given 4 hrs. (or 6 pds) per week. This gives 60 hours for each theory paper with 30 weeks of teaching every year and 120 hours for practicals and laboratory tutorials work every year. For laboratory work-each batch must not be more than 20 students.

PAPER -1 Quantum Mechanics, Atomic and Molecular Physics

Duration : 3 hrs. Max Marks: 45

Note: The question paper shall contain three sections. **Section A** (**15 marks**) shall contain 10 questions two from each Unit. Each question shall be of 1.5 marks. All the questions are compulsory. The answers should not exceed 50 words. **Section B** (**15**

marks) shall contain 5 questions (two from each unit with internal choice). Each question shall be of 3 marks. The candidate is required to answer all 5 questions. The answers should not exceed 200 words. **Section C** (**15 marks**) shall contain 5 questions, one from each Unit. Each question shall be of 5 marks. The candidate is required to answer any three questions. The answers should not exceed 500 words. The question paper shall have at least 30% weightage to numerical problems. MKSA system of units is to be used.

Unit I

Origin of Quantum theory : Failure of classical Physics to explain the phenomenon such as black body spectrum. Planck's radiation law. photoelectric effect and Einstein explanation. Compton effect, "de-Broglie" hypothesis, evidence for diffraction and interference of particles. Uncertainly principle and its consequences: diffraction at a single slit, particle in a box and its applications (i) Non existence of electron in nucleus, (ii) Ground state energy of H-atom (iii) Ground slate energy of harmonic oscillator. Energy-time uncertanity.

Unit 11

Schrodinger equation- Time dependent and lime independent form. Physical significance of the wave function & its interpretation. Probability current density, Operators in quantum mechanics, linear and Hermitian operators. Expectation values of dynamical variables, the position, momentum, energy, fundamental postulates of quantum mechanics, eigen function and eigen value, degeneracy. orthogonality of eigen functions' commutation relations. Ehrenfest theorem, concept of group and phase velocities, wave packet.

Unit III

Simple Solutions of Schrodinger equation : Time independent Schrodinger equation and stationary state solution. Boundary and continuity conditions on the wave function, particle in one dimensional box. eigen function and eigen values . discrete energy levels, extension of results for three dimensional case and degeneracy of levels. Potential step and rectangular potential barriar. Calculation of reflection and transmission cofficient. Qualitative discussion of the application to alpha decay (tunnel effect), square well potential problem, calculation of transmission cofficient.

Unit IV

Bound State Problems : Particle in one dimensional infinite potential well and finite

depth potential well energy value and eigen functions, simple harmonic oscillator (one dimensional) eigen function energy eigen values zero point energy. Schrodinger equation for a spherically symmetric potential. Separation of variables. Orbital angular momentum and its quantisation spherical harmonics, energy levels of H-atom shape of n=l, n=2 wave functions, comparision with Bohr model and Correspondence principle,

Unit V

Atomic and Molecular Physics : Frank-Hertz enperiment spectra of hydrogen, spectral terms, fine structure, screening constant for alkali spectra for s, p, d, f states, selection rules.

Discrete set of electronic energies of molecules, quantisation of vibrational and rotational energies, determination of internuclear distance purerotational and rotation vibration spectra, transition rules for pure vibration and electronic vibration spectra. Raman effect.

Text and Reference Books:

1. H. S. Mani and G.K.Mehta. Introduction to modern Physics. (Affl. East West Press 1989)

2. A. Baiser. Prospective of modern Physics

3. H.E. White. Introduclion to Atomic Physics.

4. Barrow. Introduction to Molecular Physics.

5. D.P. Khandelwal. Optics and Atomic Physics (Himalaya Pub. House Mumbai 1988)

Paper-II

Nuclear and Solid State Physics

Duration: 3 hrs. Max.Marks: 45

Note: The question paper shall contain three sections. **Section A** (**15 marks**) shall contain 10 questions two from each Unit. Each question shall be of 1.5 marks. All the questions are compulsory. The answers should not exceed 50 words. **Section B** (**15 marks**) shall contain 5 questions (two from each unit with internal choice). Each question shall be of 3 marks. The candidate is required to answer all 5 questions. The answers should not exceed 200 words. **Section C** (**15 marks**) shall contain 5 questions, one from each Unit. Each question shall be of 5 marks. The candidate is required to answer any three questions. The answers should not exceed 500 words. The question paper shall have at least 30% weightage to numerical problems. MKSA

system of units is to be used.

Unit I

Rutherford theory of alpha paticle scattering, properties of nucleus quadrupole moment and nuclear ellipticity. Quadrapole moment and nuclear spin. parity and orbital angular momentum. Nuclear potential and properties of nuclear forces. Semi-emperical mass formula.

Unit II

Theory of nuclear fission and liquid drop model, Barrier penetration theory of spontaneous fission. Nuclear fission as a source of energy, chain reaction and condition of controlled chain reaction, the principle of nuclear reactor, uses of atomic energy.

Unit III

Nuclear fussion. energy production in stars by p.p and carbon cycle. Interaction of charge particles and neutron with matter and regions of multplicative operation, working of nuclear detectors G.M. counter, proportional counter, scintillation counter cloud and spark chamber, Linear accelerator. cyclotron, synchrocyclotron. Betatron. Electron synchroton.

Unit IV

Space lattice and crystal structure, Bravis lattice. Miller Indices, spacing of planes in crystal lattice. unit cell, wigner-seitzcell Atomic packing. common crystal structures. Laue's theory of X-ray diffraction. Bragg's law. laue pattern., Concept of phonon, classical view of lattice specific heat of solid, the Einstein model , Debye model, thermal conductivity.

Unit V

Band Structure : Formation of bands .periodic potential of a solid, Bloch theorem. Kroing Penny model, Drude-Lorentz theory of electrical conductivity, Boltzmann transport equation Sommerfeld theory of electrical conductivity thermal conductivity & Widemann Frenz law, Hall Effect.

Text and Reference Books:

1. H. S. Mam and G.K.Mchta. Introduction to modem Physics. (Afll East West Press 1989)

2 A. Bciscr. Prospective of modern Physics

3. C Kittel. Introduction to Solid Slate Physics.

4. J.S.Blackmore, Solid State Physics(Cambridgc Univ. Press)
5. H.A.Enge, Introduction to Nuclear Physics.

Paper-III

Electronics and Solid State Devices

Duration: 3 hrs. Max.Marks: 45

Note: The question paper shall contain three sections. **Section A** (**15 marks**) shall contain 10 questions two from each Unit. Each question shall be of 1.5 marks. All the questions are compulsory. The answers should not exceed 50 words. **Section B** (**15 marks**) shall contain 5 questions (two from each unit with internal choice). Each question shall be of 3 marks. The candidate is required to answer all 5 questions. The answers should not exceed 200 words. **Section C** (**15 marks**) shall contain 5 questions, one from each Unit. Each question shall be of 5 marks. The candidate is required to answer any three questions. The answers should not exceed 500 words. The question paper shall have at least 30% weightage to numerical problems. MKSA system of units is to be used.

Unit I

Network some definitions loop, nodel equations Driving point and transfer impedance four terminal networks parameters. Open circuit short circuit and hybrid network theorems super position, Thevenin, Norton, Reciprocity, Compensation and Maximum power transfer theorem. T and π Networks

Unit II

Instrinsic semicondutor, extrinsic semiconductor, Fermi level calculation of electron and hole concentration along with their temprature dcpendance, law of mass action . Semiconductor devices, p-n junction , majority and minority carriers , diode. zener and tunnel diodes. light emitting diode, solar cell.

Rectification : halfwave and full wave rectifiers, bridge rectifier ripple factor. different types of filters (shunt capacitor, inductor filter, L section and π filters), voltage stabilization, voltage multiplier circuits.

Unit III

Transistors :Notations and volt-ampere relation for bipolar junction transistor concept of load line and operating point, hybrid parameters. CB.CE.CC configuration. their characteristics curves and their equivalent circuits, Analysis of a transistor amplifier using h-parameter (A_i, A_v, Z_{in}, Z_o), fixed and emitter bias, bias stability in transistor circuit. FET, its characteristics and constants, biasing JFET and operation of

JFET.

Unit IV

Small signal amplifiers : General principles of operation, classification, distortion, RC coupled amplifier, gain frequency response.

Operational Amplifiers : Differential amplifier DC level shifter input & output impedance . input offset current application unity gain buffer adder, subtractor integrator differentiator. Numbers systems, Binary arithmetic, fundamental Logic gates, Boolean theorems and circuit realization of logic functions using diodes (DL).

Unit V

Amplifiers with feed hack : Concept of feed back, Effect of negative feed back on stabilization of gain, output and input impedence, reduction of nonlinear distortion, voltage & current feed back circuits.

Oscillators Feed back requirement for oscillator, basic oscillator analysis. Colpitt and Hartley Oscillators.

Text and Reference Books

1. Stanley : Electronic devices circuits and applications.
2 J D. Ryder: Electronics Fundamental and applications.(PHI 1988)
3. Millman and Gabel: Microelectronics (McGraw Hill)

PHYSICS PRACTICALS

Duration: 5 hrs Min. Pass Marks 24 Max. Marks 65

Total number of experiments to be performed by the students during the session should be 16, selecting any eight from each section.

In examination two experiments are to be performed taking atleast one from each section.

Section: A

1. Determination of Planck's constant.
2. Determination of e/m using Thomson's Tube.
3. Determination of e/m using magnetrron method.
4. Determination of e/m using helical method.
5. Absorption spectrum of Iodine vapour.
6. Study of spectra of Hydrogen and Deutron (Rydberg constant and ratio of masses of electron to proton).
7. Study of Zeeman effect for determination of Lande g-factor.

8. Study of absorption of alpha and beta rays.
9. Study of statistics in radioactive measurement.
10. Hysteresis Curve of transformer core.
11. Study of L and π filter in Half wave rectifier
12. Study the characteristic of an R-C transmission line.
13. Study the characteristic of an L-C transmission line.
14. Study the characteristic of F.E.T. and determine r_p, g_m, and μ
15. Study the frequency response of LCR series/ parallel resonance circuit with and without damping.

Section - B

1. Characteristics of a transistor.
2. Characteristics of a tunnel diode.
3. Study of voltage regulation system.
4. Study of Lissajuous figures using a CRO.
5. Study of VTVM.
6. Study of RC coupled amplifier.
7. Study of AF and RF oscillators.
8. Determination of a energy gap of a semiconductor.
9. Determination of dielectric constant.
10. Analysis of a given band spectrum.
11. Hall-probe method for measurement of magnetic field.
12. Study the application of an operational amplifier as inverting and non- inverting amplifier.
13. Determine the value of Stefan constant.
14. Study of voltage multiplier as a doublers, tripler and quadrupole.
15. Construct OR, AND,NOT, XOR gate from NAND gate and verify their truth table
16. Study the recovery time of the given diodes.

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परीक्षा योजना

तीन प्रश्नपत्र सैद्धान्तिक	न्यूनतम उर्तीणांक–48		अधिकतम अंक 135
		समय	पूर्णांक
(1) प्रथम प्रश्न पत्रः क्वांटम यांत्रिकी, परमाणवीय तथा आणविक भौतिकी		3 घंटे	45
(2) द्वितीय प्रश्न पत्रः नाभिकीय एवं ठोस अवस्था भौतिकी		3 घंटे	45
(3) तृतीय प्रश्न पत्रः इलेक्ट्रोनिकी एवं ठोस अवस्था युक्तियां		3 घंटे	45
प्रायोगिक परीक्षाः	न्यूनतम उर्तीणांक 27	5 घंटे	65
		;kx	200

uksV : प्रायोगिक परीक्षा में, 5 घंटे के लिए दो प्रयोग या एक प्रयोग व एक प्रोजेक्ट जो कि भौतिकी के सिद्धांतो पर आधारित होंगे, जिनका अंक विवरण निम्न प्रकार से हैः–

प्रत्येक 20 अंक	40
मौखिक	15
प्रायोगिक कक्षा रिकार्ड	10
d(	65

f'k{k.k dk;Zdze%

प्रत्येक प्रश्न पत्र के लिए प्रति सप्ताह 2 घंटे (3 कालांश) सैद्धान्तिक शिक्षण होगा। प्रायोगिक कार्य हेतु 4 घंटे (6 कालांश) प्रति सप्ताह होंगे। इस प्रकार 30 शिक्षण सप्ताह में प्रति प्रश्न पत्र 60 घंटो तथा 120 घंटो का प्रायोगिक एवं लेब ट्यटोरियल का कार्यभार प्रति सत्र होगा। प्रायोगिक कार्य हेतु प्रत्येक वर्ग (बैच) में 20 छात्र/छात्रा से अधिक न हो।

i''u i=&.

क्वांटम यांत्रिकी, परमाणवीय तथा आणविक भौतिकी

समय : 3 घंटे पूर्णांक 45

नोट : प्रश्न पत्र के कुल तीन खण्ड होंगे।)k.* +,- (15 अंक) में प्रत्येक इकाई से 2 प्रश्न, कुल 10 प्रश्न होंगे। प्रत्येक प्रश्न ..5 अंको का होगा। सभी प्रश्नों के उत्तर देना अनिवार्य है। प्रत्येक उत्तर की अधिकतम शब्द सीमा 50 शब्दो की होगी ।)k.* +/- (15 अंक) में कुल 5 प्रश्न होंगें (प्रत्येक इकाई मे से 2 प्रश्न, आंतरिक विकल्प सहित)। प्रत्येक प्रश्न 0 अंको का होगा। परीक्षार्थी के लिए सभी 5 प्रश्नों के उत्तर देना अनिवार्य है। प्रत्येक उत्तर की अधिकतम शब्द सीमा 200 शब्दो की होगी ।)k.* +l- (15 अंक) में प्रत्येक इकाई से 1 व कुल 5 प्रश्न होंगें। प्रत्येक प्रश्न 5 अंको का होगा। परीक्षार्थी को किन्ही तीन प्रश्नों के उत्तर देने होंगे। प्रत्येक उत्तर की अधिकतम शब्द सीमा 500 शब्दो की होगी । प्रश्न पत्र में न्यूनतम 30 प्रतिशत आंकिक प्रश्नों का भार रखा गया हे। MKSA पद्धति के मात्रकों का प्रयोग करना है।

इकाई –1

क्वांटम सिद्धांत का उद्भव : कृष्णिका विकिरण, स्पेक्ट्रमी वितरण की विवेचना करने में चिरसम्मत भौतिकी की असफलता, प्लांक की क्वांटम परिकल्पना और विकिरण नियम की गुणात्मक विवेचना, प्रकाश वैद्युत प्रभाव और आईस्टीन की व्याख्या, कोम्पटन प्रभाव, डी–ब्रोग्ली की परिकल्पना, व्यतिकरण हेतु प्रायोगिक साक्ष्य, अनिश्चितता का सिद्धांत एवं इसके परिणाम–एकलस्लिट पर विवर्तन, ऊर्जा बॉक्स में कण, व इसके अनुप्रयोग जैसे : (1) परमाण्वीय नाभिक में इलेक्ट्रोनों की अनुपस्थिति (2) हाइड्रोजन परमाणु की मूल ऊर्जा (3) आवर्ती दोलित्र की मूल अवस्था में ऊर्जा। समय–ऊर्जा अनिश्चितता।

इकाई – 2

श्रोडिंजर समीकरण : काल आश्रित और काल मुक्त स्वरूप, तरंग फलन की भौतिक सार्थकता और उसकी व्याख्या। प्रायिकता धारा घनत्व, क्वांटम यान्त्रिकी में संकारक, (रेखिक ओर हर्मिटी संकारक) गतिज चरों के प्रत्याशा मान, स्थिति, संवेग और ऊर्जा। क्वांटम यान्त्रिकी के मौलिक अभिग्रहीत, आइगेन फलन और आइगेन मान, अपभ्रष्टता, आइगेन फलनों की लांबिकता, क्रम विनिमेय सम्बन्ध, ऐरेनफेस्ट प्रमेय, कला एवं समूह वेग, तंरग संध।

इकाई – 3

श्रोडिंजर समीकारण के सरल हल : काल मुक्त श्रोडिंजर समीकरण और स्थायी अवस्था हल, तरंग फलन पर सीमान्त और सान्त्तय प्रतिबन्ध, एक विमीय बॉक्स में स्थित कण, आइगेन फलन और आइगेन मान, विविक्त ऊर्जा स्तर, त्रिविमय स्थिति के लिये सूत्रों का विस्तार और ऊर्जा स्तरों की अपभ्रष्टता, विभव सीढी, एक विमीय आयताकार विभव प्राचीर, परावर्तन और पारगमन गुणांको की गणना, α. क्षय में उपयोग के लिये गुणात्मक विवेचना (सुरंगन प्रभाव), वर्ग विभव कूप, पारागमन गुणांक की गणना।

इकाई – 4

बद्ध अवस्था की समस्याएं : एक विमीय अनन्त व परिमित गहराई के विभव कूप में स्थित कण–आइगेन ऊर्जा मान और आइगेन फलन, सरल आवर्ती दोलित्र (एक विमीय) की श्रोडिंजर समीकरण तथा इसके आइगेन फलनों की गुणात्मक विवेचना ऊर्जा आइगेन मान, शून्य बिन्दु ऊर्जा, गोलीय सममित विभव के लिए श्रोडिंजर समीकरण, चर राशियों का पृथक्करण, कक्षीय कोणीय संवेग और क्वान्टीकरण, गोलीय हार्मोनीक, हाइड्रोजन परमाणु के ऊर्जा स्तर $n=1$ ओर $n=2$ के तरंगफलनों की आकृतियां, बोहर मॉडल से तुलना और बोहर का संगति नियम।

इकाई – 5

परमाण्वीय एवं आणविक भौतिकी : फ्रेन्क–हर्टज प्रयोग, हाइड्रोजन स्पेक्ट्रम, स्पेक्ट्रमी

परिभाषायें, सूक्ष्म संरचना, क्षारीय स्पेक्ट्रम में s, p, d, o f अवस्थाओं के लिये स्क्रीनिंग नियतांक, वरण नियम।

अणुओं के लिये इलेक्ट्रोनिक ऊर्जा का विविक्त समुच्चय, कम्पन एवं घूर्णी ऊर्जाओं का क्वान्टीकरण, अन्तरनाभिकीय दूरी का निर्धाण शुद्ध घूर्णी एवं घूर्णी काम्पनिक स्पेक्ट्रम, शुद्ध काम्पनिक एवं इलेक्ट्रोनिक काम्पनिक स्पेक्ट्रम के संक्रमण नियम, रमन प्रभाव।

प्रश्न पत्र –**II**

नाभिकीय एवं ठोस अवस्था भौतिकी

समय : 3 घंटे पूर्णांक 45

नोट : प्रश्न पत्र के कुल तीन खण्ड होंगे।)k.* +,- (15 अंक) में प्रत्येक इकाई से 2 प्रश्न, कुल 10 प्रश्न होंगे। प्रत्येक प्रश्न ..5 अंको का होगा। सभी प्रश्नों के उत्तर देना अनिवार्य है। प्रत्येक उत्तर की अधिकतम शब्द सीमा 50 शब्दो की होगी ।)k.* +/- (15 अंक) में कुल 5 प्रश्न होंगें (प्रत्येक इकाई मे से 2 प्रश्न, आंतरिक विकल्प सहित)। प्रत्येक प्रश्न 0 अंको का होगा। परीक्षार्थी के लिए सभी 5 प्रश्नों के उत्तर देना अनिवार्य है। प्रत्येक उत्तर की अधिकतम शब्द सीमा 200 शब्दो की होगी ।)k.* +l- (15 अंक) में प्रत्येक इकाई से 1 व कुल 5 प्रश्न होंगें। प्रत्येक प्रश्न 5 अंको का होगा। परीक्षार्थी को किन्ही तीन प्रश्नों के उत्तर देने होंगे। प्रत्येक उत्तर की अधिकतम शब्द सीमा 500 शब्दो की होगी । प्रश्न पत्र में न्यूनतम 30 प्रतिशत आंकिक प्रश्नों का भार रखा गया हे। MKSA पद्धति के मात्रकों का प्रयोग करना है।

इकाई – 1

अल्फा कण प्रकीर्णन का रदरफोर्ड सिद्धान्त, नाभिक के गुणधर्म चर्तुधुर्व आघूर्ण एवं नाभिकीय दीर्घव तीयता, चर्तुधुर्व आघूर्ण एवं नाभिकीय चक्रण, समता तथा कक्षीय कोणीय संवेग, नाभिकीय विभव एवं नाभिकीय बलो के गुणधर्म, अर्घ–मूलानुपाति सूत्र।

इकाई – 2

नभिकीय विखण्डन का सिद्धान्त तथा द्रव बूंद मॉडल, स्वंय स्फूर्त विखण्डन का प्राचीर भेदन सिद्धान्त, नभिकीय विखण्डन एक ऊर्जा स्त्रोत के रूप में नभिकीय श्रृंखला अभिक्रिया तथा नियन्त्रित श्रृंखला अभिक्रिया के लिये प्रतिबन्ध, अभिक्रियक का सिद्धान्त परमाणु ऊर्जा के उपयोग।

इकाई – 3

नाभिकीय संलयन, तारों में ऊर्जा का स्त्रोत p-p तथा कार्बन चक्र, आवेशित कणों तथा न्यूट्रान की द्रव्य से अन्योय क्रिया, regions of multplicative operation, नाभिकीय संसूचको की

कार्य प्रणाली, गाइगर मूलर गणित्र, आनुपातिक गणित्र, प्रस्फुरण गणित्र, अभ्र तथा स्फुलिंग प्रकोष्ठ, रेखिक त्वरित्र, साइक्लोट्रान, सिन्को साइक्लोट्रान, बीटाट्रान, इलेक्ट्रान सिन्कोट्रान।

इकाई – 4

अन्तराकशी जालक तथा किस्ट्रल संरचना, ब्रेव जालक मिलर सुचकांक, किस्ट्रल जालक तलों के मध्य अन्तराल, एकांक कोष्ठिका, विगनर–स्ट्रिज कोष्ठिका, परमाणविक संकुलन, मुख्य क्रिस्टल संरचना। किरण विवर्तन, लवे नियम व ब्रेग का नियम, लवे पैटर्न, फोनान की अवधारणा, ठोस की विशिष्ठ ऊष्मा का चिरसम्मत विचार, आइन्सटीन एवं डिबाई मॉडल, ऊष्मीय चालकता।

इकाई – 5

ऊर्जा बैण्डों का निर्माण, ठोस का आवर्ति विभव, ब्लाक प्रमेय, क्रोनि पैनी प्रतिरूप, विद्युतचालकता का ड्रूड लॉरेन्ज सिद्धान्त, बोल्टजमान अभिगमन समीकरण, विद्युत चालकता का सोमर फील्ड सिद्धान्त, ऊष्मीय चालकता एवं विडेमान फ्रेन्ज नियम, हॉल प्रभाव।

प्रश्न पत्र – **III**

इलेक्ट्रानिकी एवं ठोस अवस्था युक्तियां

समय : 3 घंटे पूर्णांक 45

नोट : प्रश्न पत्र के कुल तीन खण्ड होंगे।)k.* +,- (15 अंक) में प्रत्येक इकाई से 2 प्रश्न, कुल 10 प्रश्न होंगे। प्रत्येक प्रश्न ..5 अंको का होगा। सभी प्रश्नों के उत्तर देना अनिवार्य है। प्रत्येक उत्तर की अधिकतम शब्द सीमा 50 शब्दो की होगी ।)k.* +/- (15 अंक) में कुल 5 प्रश्न होंगें (प्रत्येक इकाई मे से 2 प्रश्न, आंतरिक विकल्प सहित)। प्रत्येक प्रश्न 0 अंको का होगा। परीक्षार्थी के लिए सभी 5 प्रश्नों के उत्तर देना अनिवार्य है। प्रत्येक उत्तर की अधिकतम शब्द सीमा 200 शब्दो की होगी ।)k.* +l- (15 अंक) में प्रत्येक इकाई से 1 व कुल 5 प्रश्न होंगें। प्रत्येक प्रश्न 5 अंको का होगा। परीक्षार्थी को किन्ही तीन प्रश्नों के उत्तर देने होंगे। प्रत्येक उत्तर की अधिकतम शब्द सीमा 500 शब्दो की होगी । प्रश्न पत्र में न्यूनतम 30 प्रतिशत आंकिक प्रश्नों का भार रखा गया हे। MKSA पद्धति के मात्रकों का प्रयोग करना है।

इकाई – 1

ifji#k f''(>k.k ¼ जाल–कुछ महत्वपूर्ण परिभा गायें, पाश तथा संधि समीकरण (किरचॉफ नियम) परिचालन बिन्दु तथा आन्तरित प्रतिबाधायें, चतुटर्मिनल जाल प्राचल–खुला परिपथ, लघुपथित परिपथ तथा संकर प्राचल, जाल प्रमेय–अध्यारोपण, थेवनिन, नॉर्टन,पारस्परिकता एवं अधिकतम शक्ति हस्तान्तरण प्रमेय, T तथा Π जाल

इकाई – 2

नैज अर्धचालक, अपद्रव्यी अर्धचालक, फर्मी ऊर्जा स्तर, होल तथा इलेक्ट्रान घनत्व की

गणना तथा इनकी ताप पर निर्भरता, द्रव्य अनुपाती क्रिया का नियम।

,Ek;k(d ;fHr;k % p-n संधि, मुख्य एवं अल्पसंख्यक धारा वाहक, डायोड समीकरण, जीनर तथा टनल डायोड प्रकाश उत्सर्जक डायोड, सौर सैल।

f$>Idj.k % अर्ध तथा पूर्ण तरंग दिष्टकारी, उर्मिका गुणांक, फिल्टर (पार्श्व पथ, प्रेरण पथ संधारित्र, L section तथा Π फिल्टर), वोल्टता गुणांक परिपथ।

इकाई – 3

Ikfr LIj % प्रतीक तथा द्विध्रुवी ट्रांजिस्टर के लिये वोल्ट एम्पियर संबध, लोड लाइन की अवधारणा तथा प्राचल बिन्दु, संकर प्राचल, ट्रांजिस्टर के CB, CE व CC विन्यास तथा उनके तुल्य परिपथ के अभिलाक्षणिक वक्र, संकर प्राचल की सहायता से ट्रांजिस्टर का विष्लेषण

Analysis of a transistor amplifier using h-parameter (A_i, A_v, Z_{in}, Z_o),, नियत तथा उत्सर्जक बायसन तथा ट्रांजिस्टर परिपथों में बायस स्थायित्व, क्षेत्र प्रभाव ट्रांजिस्टर तथा इसके परिपथीय अभिलक्षण। क्षेत्र प्रभाव ट्रांजिस्टर का अभिलाक्षणिक वक्र व JFET की कार्य विधि ।

इकाई – 4

(:| Idrr i''Ekd % प्राचलन का सामान्य सिद्धान्त, वर्गीकरण, विरूपण, RC युग्मित प्रवर्धक तथा इसकी आवृति अनुक्रिया,

lfØ;k5ed i''Ekd % भेद प्रवर्धक, दिष्टधारा स्तर विस्थापक, संक्रियात्मक प्रवर्धक निवेशी तथा निर्गम प्रतिबाधायें, निवेशी ऑफसेट धारा। अनुप्रयोग : एकांक लब्धि बफर, योजक, व्यवकलित्र, समाकलक एवं अंक पद्वतियॉ, द्विआधारी गणित अभिक्रिया, मूल तार्किक द्वार ;लॉजिक गेट), बूल यन प्रमेय तथा तार्किक द्वार ;लॉजिक गेटद्ध के डायोड द्वारा वास्तविक परिपथ Numbers systems, Binary arithmetic, fundamental Logic gates, Boolean theorems and circuit realization of logic functions using diodes (DL).

इकाई – 5

पुर्ननिवेषि– प्रवर्धक % पुनर्निवेश की अवधारणा, ऋणात्मक पुनर्निवेश द्वारा लब्धि का स्थायीकरण, ऋणात्मक पुनर्निवेश का निर्गत एवं निवेशी प्रतिरोधों पर प्रभाव, ऋणात्मक पुनर्निवेश द्वारा अरेखीय विरूपण का न्यूनीकरण, वोल्टता तथा धारा पुनर्निवेश परिपथ।

दोलनों के लिये पुर्ननिवेषि प्रतिबध, आधारभूत दोलित्र, विष्लेषण, कॉल्पिट व हॉटले दोलित्र ।

संदर्भ पुस्तकें:–

1 क्वांटम यांत्रिकी, परमाणवीय तथा आणविक भौतिकी कालरा, भण्डारी, काकानी (हिमांशु पब्लिकेशन)
2 नाभिकीय एवं ठोस अवस्था भौतिकी कालरा, भण्डारी, काकानी (हिमांशु पब्लिकेशन)
3 इलेक्ट्रोनिकी एवं ठोस अवस्था युक्तियांभण्डारी, (हिमांशु पब्लिकेशन)

Hkkfrd i'k;kfxd ijh{kk

समय : 5 घण्टें न्यूनतम उत्तीर्णांक 24 पूर्णांक–65

ukl % 1. उक्त परीक्षा में परीक्षार्थी को प्रत्येक खंड में से एक प्रयोग लेते हुए कुल दो प्रयोग या एक प्रयोग व एक **प्रोजेक्ट जो कि भोतिकी के सिद्धांतो पर आधारित** करने होंगे।

2. कक्षा में पाठ्यक्रम हेतु सत्र में कुल 16 प्रयोग करने होंगे, जिनमें प्रत्येक खंड के आठ प्रयोग हो।

)k.*&A

1. प्लांक नियंताक का निर्धारण
2. थामसन ट्यूब की सहायता से e/m ज्ञात करना
3. मेगनेट्रान विधि द्वारा e/m ज्ञात करना
4. हेलिकल विधि द्वारा e/m ज्ञात करना
5. आयोडीन वाष्प का अवशोषण स्पेक्ट्रम
6. हाइड्रोजन व डयूट्रान वर्णक्रम का अध्ययन (रिडबर्ग नियतांक व इलेक्ट्रान–प्रोटोन द्रव्यमान अनुपात)
7. लैंडे g घटक को जीमन प्रभाव के अध्ययन द्वारा ज्ञात करना
8. एल्फा एवं बीटा किरणों का अवशोषण
9. रेडियों सक्रिय मापन का साख्यिकीय अध्ययन
10. ट्रांसफार्मर क्रोड का शैथिल्य वक्र
11. अर्ध तरंग दिष्टकारी में L एवं π फिल्टर का अध्ययन
12. RC संचरण लाइन के अभिलक्षणकों का अध्ययन
13- LC संचरण लाइन के अभिलक्षणकों का अध्ययन
14- FET के अभिलक्षणकों का अध्ययन एवं r_p, g_m एवं μ ज्ञात करना
15- LCR श्रेणी / सामानांतर अनुनाद परिपथ की आवृति अनुक्रिया का अध्ययन , अवमंदन रहित एवं अवमंदन सहित

)k.*&B

1. ट्रांजिस्टर अभिलक्षणकों का अध्ययन
2. टनल डायोड अभिलक्षणको का अध्ययन
3. वोल्टता नियामक तंत्र का अध्ययन
4. कैथोड किरण आस्लिोस्कोप द्वारा लिसाजू आकृतियों का अध्ययन
5. VTVM का अध्ययन
6. RC व ट्रांसफार्मर युग्मित प्रवर्धकों का अध्ययन
7. श्रव्य एवं रेडियो आवृति दोलित्रों का अध्ययन
8. परावैद्युतांक का मापन
9. बैण्ड स्पेक्ट्रम का विश्लेषण
10. हॉल प्रोब की सहायता से चुम्बकीय क्षेत्र का मापन
11. संक्रियात्मक प्रवर्धक के प्रतिलोमी एवं अप्रतिलोमी प्रवर्धक के अनुप्रयोग का अध्ययन
12. स्टीफन नियंताक का निर्धारण
13. Study of voltage multiplier as a doublers, tripler and quadrupole.
14. Construct OR, AND,NOT, XOR gate from NAND gate and verify their truth table
15. Study the recovery time of the given diodes.

M.Sc. PHYSICS

M.Sc. Previous Examination, 2020

M.Sc. Final Examination, 2021

M.Sc. (PREVIOUS) PHYSICS - 2020

Scheme of examination :

Four Theory Papers			Max. Marks 300
Practical			Max. Marks 150
Paper-I :	Mathematical Physics and Classical Mechanics	3 hrs. duration	75 marks
Paper-2 :	Statistical Mechanics and Plasma physics	3 hrs. duration	75 marks
Paper-3 :	Quantum Mechanics	3 hrs. duration	75 marks
paper-4 :	Electronic Devices, Computational Methods and Programming	3 hrs. duration	75 marks
Practical :	Two laboratory each	5 hrs. duration	150 marks (75+75)

Note: There will be one experiment of 5 hrs. duration. The distribution of marks will be as follows:

One experiment	40
Viva	20
Record	15
Total	75

A candidate for pass the M.Sc. (Previous) Physics examination shall be required to obtain at least 36% marks in aggregate both in four theory papers and practical separately. Apart from that candidate shall be required to obtain at least 25% marks in each individual theory paper.

If a candidate clears any paper (s) / practical after a continuous period of three years, than for the purpose of working out his/ her division, the minimum pass marks only viz 25% in case of theory (or 36% in case of practical) shall be taken into account in respect of such paper (s)/ practical.

Note: Non-collegiate candidates are not eligible to appear in the examination where practical is involved.

Work load: Each theory paper must be given 4 Hrs. (Or 6 periods) per week for theory and 1 pds per week for theory tutorial.

Practical must be given 30 periods per week per batch. Each laboratory batch for practical must not be of more than 10 students. This gives 120 Hrs. for each theory paper with 30 weeks of teaching every year.

PAPER-I : MATHEMATICAL PHYSICS AND CLASSICAL MECHANICS

Time : 3 hrs. Max. Marks : 75

Note: The question paper shall contain three sections. **Section A** (**20 marks**) shall contain 10 questions two from each Unit. Each question shall be of **2** marks. All the questions are compulsory. The answers should not exceed 50 words. **Section B** (**25 marks**) shall contain 5 questions (two from each unit with internal choice). Each question shall be of **5** marks. The candidate is required to answer all 5 questions. The answers should not exceed 200 words. **Section C** (**30 marks**) shall contain 5 questions, one from each Unit. Each question shall be of **10** marks. The candidate is required to answer any three questions. The answers should not exceed 500 words.

UNIT-01

Vector Spaces and Matrices : linear independence; Bases; Dimensionality; Inner product; Linear transformations; Matrices; Inverse; Orthogonal and unitary matrices; Independent elements of a matrix; Eigenvalues and eigenvectors; Diagonalization; Complete Orthonormal sets of functions.

UNIT-02

Differential Equations and Special Functions; Second order linear ODEs with variable coefficients; Solution by series expansion; Legendre, Bessel, Hermite and Lagaurre equations; Physical application; Generating functions; recursion relations.

UNIT-03

Integral Transforms : Laplace transform; First and second shifting theorems; inverse LT by partial fractions; LT; derivative and integral of a function; Fourier series; FS or arbitrary period; Half-wave expansions; Partial sums; Fourier integral and transforms; F T of delta function.

Preliminaries; Newtonian mechanics of one and many particle systems; conservation laws, work-energy theorem; open systems (with variable mass).

Constraints; their classification, D'Alembert's principle, generalized coordinates. Lagrange's equations; gyroscopic forces; dissipative system; Jacobi integral; gauge invariance; generalized coordinates and momenta; integrals of motion;

UNIT-04

Principle of least action; derivation of equations of motion; Hamilton's principle and characteristic functions; Hamilton-Jacobi equation. symmetries of space and time with conservation laws; invariance under Galilean transformations.

Canonical transformation; generating functions; Properties; group property; examples; infinitesimal generators; Poisson bracket; Poisson theorms; angular momentum PBs; small oscillations; normal modes and coordinates.

UNIT-05

Rotating frames; inertial forces; terrestrial and astronomical applications of coriolis force.

Central force; definition and characteristics; Two-body problem; closure and stability of circular orbits; general analysis of orbits; Kepler's laws and equation; artificial satellites; Rutherford scattering.

Text and Reference Books:

Mathematical Methods for Physics, by G Arfken

Matrices and Tensors for Physicists, by A W Joshi

Advanced Engineering Mathematics, by E Kreyzing

Special Functions, by E D Rainville

Special Functions, by W W Bell

Mathematical Methods for Physics and Engineerings, by K F Reily . M

P Hobson and S J Bence

Mathematics for Physics, by Marry Boas

Classical Mechanics, by N.C. Rana and P.S. Joag (Tata McGraw-Hill, 1991)

Classical Mechanics, by H. Goldstein (Addison Wessley, 1980).
Mechanics, by A Sommerfeld (Academic Press, 1952).
Introduction to Dynamics, by I. Perceival and D. Richards (Cambridge University Press, 1982).

PAPER-II : STATISTICAL MECHANICS, ELECTRODYNAMICS AND PLASMA PHYSICS

Time : 3 hrs. Max. Marks : 75

Note: The question paper shall contain three sections. **Section A** (**20 marks**) shall contain 10 questions two from each Unit. Each question shall be of **2** marks. All the questions are compulsory. The answers should not exceed 50 words. **Section B** (**25 marks**) shall contain 5 questions (two from each unit with internal choice). Each question shall be of **5** marks. The candidate is required to answer all 5 questions. The answers should not exceed 200 words. **Section C** (**30 marks**) shall contain 5 questions, one from each Unit. Each question shall be of **10** marks. The candidate is required to answer any three questions. The answers should not exceed 500 words.

UNIT-01

Foundations of statistical mechanics; specification of states of a system, contact between statistics and thermodynamics, classical ideal gas, entropy of mixing and Gibb's paradox. Micro canonical ensemble, phase space, trajectories and density of states, Liouville's theorem, canonical and grand canonical ensembles; partition function, calculation of statistical quantities, Energy and density fluctuation.

UNIT-02

Density matrix, statistics of ensembles, statistics of indistinguishable particles, Maxwell-Boltzman, Fermi-Dirac and Bose-Einstein statistics, properties of ideal Bose and Fermi gases, Bose-Einstein condensation.

Correlation of space-time dependent fluctuations, fluctuations and tranport phenomena, Brownian motion, Langevin theory, Fluctuation dissipation theorem. The Fokker-Planck equation.

UNIT-03

Cluster expansion for a classical gas, Virial equation of state, Ising model, mean-field theories of the Ising model in three, two and one dimensions Exact solutions in one-dimension. Landau theory of phase transition, critical indices, scale transformation and dimensional analysis.

Review of Four-Vector and Lorentz Transformation in Four-Dimensional Space, Electromagnetic Field Tensor in Four Dimension and Maxwell's Equations, Dual Field Tensor, Wave Equation for Vector and Scalar Potential and their Solutions.

UNIT-04

Retarded Potential and Lienard-Wiechart Potential, Electric and Magnetic fields due to a Uniformly moving Charge and an accelerated Charge, Linear and Circular Acceleration and Angular Distribution of power Radiated, Bramsstrahlung, Synchrotron radiation and Cerenkoy Radiation, reaction Force of Radiation.

Motion of charged Particles in Electromagnetic Field: Uniform E and B Fields, Non-uniform Fields, Diffusion Across Magnetic Fields, Time varying E and B Fields, Adiabatic Invariants: First, Second Third Adiabatic Invariants.

UNIT-05

Elementary Concepts; Derivation of moment equations from Boltzmann equation, Plasma oscillations, Debye Shielding, Plasma Parameters, Magnetoplasma, Plasma Confinement. Hydrodynamical description of Plasma Fundamental. Hydromagnetic Waves: Magnetosonic and Alfven Waves.

Wave phenomena in Magneto plasma: Polarization, Phase velocity, Group velocity, Cut- offs, Resonance for Electromagnetic Wave propagating Parallel and Perendicular to the Magnetic Field, Propagation at Finite Angle and CMA Diagram, Appleton-Hartee Formula and Propagation through Ionosphere and Magnetosphere: Helicon, Whistler, Faraday Rotation.

Text and Reference Books

Statistical and Thermal Physics, by F Reif

Statistical Mechanics, by K Huang

Statistical Mechanics, R K Pathria

Statistical Mechanics, R Kubo

Statistical Physics, Landau and Lifshitz

Panofsky and Phillips : Classical Electricity and Magnetism.

Bittencourt : Plasma Physics.

Chen : Plasma Physics.

Jackson : Classical Electrodynamics.

PAPER-III : QUANTUM MECHANICS

Time : 3 hrs. Max. Marks : 75

Note: The question paper shall contain three sections. **Section A** (**20 marks**) shall contain 10 questions two from each Unit. Each question shall be of **2** marks. All the questions are compulsory. The answers should not exceed 50 words. **Section B** (**25 marks**) shall contain 5 questions (two from each unit with internal choice). Each question shall be of **5** marks. The candidate is required to answer all 5 questions. The answers should not exceed 200 words. **Section C** (**30 marks**) shall contain 5 questions, one from each Unit. Each question shall be of **10** marks. The candidate is required to answer any three questions. The answers should not exceed 500 words.

UNIT-01

Why Quantum Mechanics? Revision; Inadequacy of classical mechanics; Schrödinger equation; continuity equation; Ehrenfest theorem; Admissible wave function; Stationary states. One-dimensional problems, wells and barriers; Solution of Harmonic oscillator by Schrodinger equation and by operator method.

Uncertainty relation, x and p States with minimum uncertainty product, General formalism of wave mechanics, Commutation relations, Representation of states and dynamical variables.

UNIT-02

Completeness of eigenfunctions; Dirac delta function; bra and ket notation; Matrix representation of an operator; Unitary transformation.

Angular momentum in Quantum Mechanics; Addition of angular momentum, CG coefficient, Wigner-Eckart theorem, Central force problem; Solution of Schrödinger equation for spherically symmetric potentials; application in Hydrogen atom.

UNIT-03

Time-independent perturbation theory; Non-degenerate and degenerate cases; Applications Stark effect, Zeeman effect (normal and anomalous).

Time-dependent perturbation theory; Harmonic perturbation; Fermi's golden rule; Adiabatic and sudden approximations. Semi classical theory of radiation; Transition probability for absorption and induced emission; Electric dipole and forbidden transitions; Selection rules.

UNIT-04

Variational method; Helium and its excited states, WKB approximation; Alpha decay Identical particles; Symmetric and antisymmetric wave functions; collision of identical particles; Spin angular momentum; Spin functions for a many-electron.Klein-Gordan and Dirac's equation.

UNIT-05

Collision in 3-D and scattering; Laboratory and reference frames; Scattering amplitude; differential scattering cross section and total scattering cross section; Scattering by spherically symmetric potentials; Partial wave analysis and phase shifts; Scattering by a perfectly rigid sphere and by square well potential; complex potential and absorption.Born approximation

Text and Reference Books

L.I. Schiff, Quantum Mechanics (McGraw-Hill)

S. Gasiorowicz, Quantum Physics (Wiley)

B Craseman and J.D. Powell, Quantum Mechanics (Addison Wesley)

A.P. Messiah, Quantum Mechanics

J.J. Sakurai, Modem Quantum Mechanics

Mathews and Venkatesan Quantum Mechanics

PAPER-IV : ELECTRONIC DEVICES, COMPUTATIONAL METHODS AND PROGRAMMING

Time : 3 hrs. Max. Marks : 75

Note: The question paper shall contain three sections. **Section A** (**20 marks**) shall contain 10 questions two from each Unit. Each question shall be of **2** marks. All the questions are compulsory. The answers should not exceed 50

words. **Section B** (**25 marks**) shall contain 5 questions (two from each unit with internal choice). Each question shall be of **5** marks. The candidate is required to answer all 5 questions. The answers should not exceed 200 words. **Section C** (**30 marks**) shall contain 5 questions, one from each Unit. Each question shall be of **10** marks. The candidate is required to answer any three questions. The answers should not exceed 500 words.

UNIT-01

Transistors : JEET, BIT, MOSFET, and MESFET : Structure, Working, Derivations of the equations for I-V characteristics under different conditions. High frequency limits.

Photonic Devices ; Radiative and non-radiative transitions. Optical Absorption, Bulk and Thin film Photoconductive devices (LDR), diode photodetectors, solar cell (open circuit voltage and short circuit current, fill factor). LED (high frequency limit, effect of surface and indirect recombination current, operation of LED),

UNIT-02

Memory Devices : Static and dynamic random access memories, SRAM and DRAM, CMOS and NMOS, non-volatile—NMOS, magnetic, optical and ferroeletric memories, charge coupled devices (CCD).

Other Electronic Devices: Electro-Optic, Magneto-Optic and Acousto-Optic Effects. Material Properties related to get these effects. Important Ferro electric, Liquid Crystal and Polymeric materials for these devices. Piezoelectric,

UNIT-03

Electrostrictive and magneto strictive effects, Important materials exhibiting these properties, and their applications in sensors and actuator devices. Acoustic Delay lines, Piezoelectries resonators and filters. High frequency piezoeelectric devices-Surface Acoustic Wave Devices.

Sources of errors, Round off errors, Computer arithmetic error analysis, condition and stability, Appoximations.

Solution of linear and nonlinear equations: Direct, iterative, Bisection method, Newton's method, modified Newton's method.

UNIT-04

Interpolation: The method of undetermined coefficients, Finite differences,

Newton's, Gauss's Central difference and Stirling's Formulae, Lagrange's Interpolation Formulae, Double interpolation.

Methods of integration: Method of integration for a system of equation and functions, error estimates, Newton's method for complex roots, Trapezoidal and Simpson's rules, Newton-Cotes formulae, Gauss method, Quadrature formula, Singular Integrals, Double Integration.

UNIT-05

Numerical differentiation by Newton's Forward, backward formula; By Stirling Formula, Numerical solution of ordinary differential equations, Euler and Runge-Kutta methods.

Elementary information about Digital computer Principles, Compilers, Interpreters and Operating systems, Fortran77/C programming, Flow Charts Integer and Floating Point Arithmitic, Expressions, built in functions, executable and non-executable statements assignment, control and input- output elements Subroutines and functions, Operation with files. Introduction to MATLAB.

Text and Reference Books

Semiconductor Devices-Physics Technology, by SM Sze (Wiley 1985)

Introduction to semiconductor devices, by M.S. Tyagi, John Wiley & Sons

Measurement, Instrumentation and Experimental Design in Physics and Engineering by M. Saver and A. Mansingh. Prentice Hall, India (2000)

Optical electronics by Ajoy Ghatak and K. Thyaearajan. (Cambridge Univ. Press)

Shastry : Introductory Methods of Numerical Analysis

Rajaraman : Numerical Analysis, Rajaraman : Fortran Programming

Vetterming, Teukolsky, Press and Flannery : Numerical Recipes

PRACTICALS

LIST OF EXPERIMENTS :

Number of experiments to be performed by the students during the academic session should be atleast eight from each Laboratory.

Laboratory A General

1. To determine e/m by Thomson Method.
2. To determine e/m by Helical Method.
3. To analyze Elliptically Polarized light by Babinet's Compensator.

4. To verify Fresnel's Relations using prism and spectrometer.
5. To determine the Young's Modulus of rod using Cornu's Optical Method.
6. To determine e/m by Millikan's oil Drop method.
7. To determine Resolving Power of a Telescope.
8. To plot B-H Hysteresis curve using a solenoid on CRO and study it.
9. To determine velocity of Sound in Air by Standing Wave Method.
10. To determine the Magnetic Susceptibility of a Paramagnetic salt using Quinke's method .
11. To study Energy Transfer between Coupled Oscillators.
12. To use a Michelson Interferometer to determine :
    a. λ,-the wave length of Sodium yellow light
    b. (λ_1- λ_2), the difference between the wave length of the two sodium D-lines. (iii) the thickness of a mica sheet.
13. To test the validity of the Hartmann's prism dispersion formula using the visible region of mercury spectrum.
14. To find the refractive index of air by means of a Fabry-Perot Etalon, the thickness between the plates being given.
15. Determination of wave length of Neon light taking Hg source as a standard source Appling Hartmann formula.
16. Determine Stefan's constant.
17. X-ray diffraction by Telexometer.
18. Determination of ionization potential of Lithium.
19. Determination of e/m of electron by Normal Zeeman Effect.
20. Determinations of dissociation energy of Iodine (I) molecules by photography, the absorptions band of I in the visible region.
21. Using He-Ne laser light :
    a. Measure of wavelength with the help of ruler. (b) Measure of thickness of the wire.
22. Testing goodness of fit of Poisson distribution to cosmic ray busts by Chi-square test.
23. To study Faraday effect using He-Ne laser.

Laboratory B - Electronic

1. To Study Mathematical Operations using OPAMP.

2. To study OPAMP as Comparator using Inverting and Non-inverting configuration
3. To study Clipping and Clamping circuits.
4. To study Differentiating and Integrating circuits using diode.
5. To study Miller Sweep Generator.
6. To study Bootstrap Sweep Generator.
7. To study the Recovery Time of Diode.
8. To study Free-running Multivibrator.
9. To study Mono- and Bi-stable Multivibrator circuits.
10. To study RC coupled Two-Stage Amplifier.
11. Design of a Regulated Power supply.
12. Design of a Common Emitter Transistor Amplifier.
13. Experiment on Bias Stability
14. Characteristics and applications of Silicon Controlled Rectifier.
15. Experiment on FET and MOSFET characterization and application as an amplifier.
16. Experiment on Uni-junction Transistor and its application,
17. Digital I : Basic Logic Gates, TTL, NAND and NOR.
18. Digital II: Combinational logic.
19. Flip-Flops.
20. Operational Amplifier (741)
21. Differential Amplifier.

M.Sc. (FINAL) PHYSICS, 2021

Scheme of examination :

Four Theory Papers		Max. Marks 300
Practical		Max. Marks 150
Paper-V : Condensed Matter Physics	3 hrs. duration	75 marks
Paper-VI : Nuclear And Particle Physics	3 hrs. duration	75 marks
Paper-VII A : Electronics, Digital Electronics & Communication Electronics	3 hrs. duration	75 marks
OR		
Paper-VII B : Analog, Digital Systems & Communication	3 hrs. duration	75 marks
OR		
Paper-VII C : Medical Physics - I	3 hrs. duration	75 marks
Paper -VIII A : Physics of Lasers and Science & Technology of Solar Hydrogen	3 hrs. duration	75 marks
OR		
Paper-VIII B : Physics of Nanomaterials & Environmental Physics	3 hrs. duration	75 marks
OR		
Paper-VIII C : Medical Physics - II	3 hrs. duration	75 marks

Practical : Three laboratory each 5 hrs. duration, 150 marks (50+50+50)

General Lab	:	50 marks (30+10+10)
Electronic Lab	:	50 marks (30+10+10)
Project and Seminar	:	50 marks (40+10)

Note: There will be one experiment of 5 hrs. duration for each lab on separate day for project and seminar. Supervisor for each student will be appointed in the beginning of the session and the viva-voice examination will be conducted by the Board consisting of two teacher one from the same college and other from the different university.

A candidate for pass the M.Sc. (Final) Physics examination shall be required to obtain at least 36% marks in aggregate both in four theory papers and practical separately.

Apart from that candidate shall be required to obtain at least 25% marks in each individual theory paper.

If a candidate clears any paper (s) / practical after a continuous period of three years, than for the purpose of working out his/ her division, the minimum pass marks only viz 25% in case of theory (or 36% in case of practical) shall be taken into account in respect of such paper (s)/ practical.

Note: Non-collegiate candidates are not eligible to appear in the examination where practical is involved.

Work load: Each theory paper must be given 4 Hrs. (Or 6 periods) per week for theory and 1 pds per week for theory tutorial.

Practical must be given 30 periods per week per batch. Each laboratory batch for practical must not be of more than 10 students. This gives 120 Hrs. for each theory paper with 30 weeks of teaching every year.

M.Sc. PHYSICS (Paper V) : CONDENSED MATTER PHYSICS

Time : 3 hrs. Max. Marks : 75

Note: The question paper shall contain three sections. **Section A** (**20 marks**) shall contain 10 questions two from each Unit. Each question shall be of **2** marks. All the questions are compulsory. The answers should not exceed 50 words. **Section B** (**25 marks**) shall contain 5 questions (two from each unit with internal choice). Each question shall be of **5** marks. The candidate is required to answer all 5 questions. The answers should not exceed 200 words. **Section C** (**30 marks**) shall contain 5 questions, one from each Unit. Each question shall be of **10** marks. The candidate is required to answer any three questions. The answers should not exceed 500 words.

UNIT-01

Crystalline solids, unit cells and direct lattice, two and three dimensional Bravais lattices, closed packed structures.

Interaction of X-rays with matter, absorption of X-rays. Elastic scattering from a perfect lattice. The reciprocal lattice and its applications to diffraction techniques. The Laue, powder and rotating crystal methods, crystal structure factor and intensity of diffraction maxima.

Unit-02

Point defects, line defects and planer (stacking) faults. The role of dislocations

in plastic deformation and crystal growth. The observation of imperfections in crystals, X-ray and electron microscopic techniques.

Electrons in a periodic lattice: Bloch theorem, band theory, classification of solids, effective mass. Tight-binding, pseudo potential methods.

Unit-03

Fermi surface, de Hass von Alfen effect, cyclotron resonance, magneto resistance, quantum Hall effect.

Paramagnetism- Langavin theory, Weiss theory of ferromagnetism, Heisenberg model and molecular field theory. Spin waves and magnons. Curie-Weiss law for susceptibility, Ferri- and antiferro-magnetic order . Domains and Bloch-wall energy.

Unit-04

I Superconductivity : critical temperature, persistent current, Meissner effect, superconducting phase transitions, manifestations of energy gap. London theory, Cooper pairing due to phonons.

Unit-05

BCS theory of superconductivity, Ginzsburg-Landau theory and application to Josephson effect : d-c Josephson effect, a-c Josephson effect, macroscopic quantum interference. Vortices and type II superconductors, high temperature superconductivity (elementary).

Text and Reference Books

Verma and Srivastava: Crystallography for Solid State Physics

Azaroff: Introduction to Solids

Omar: Elementary Solid State Physics

Aschroft & Mermin: Solid State Physics

Kittel: Solid State Physics

Chaikin and Lubensky: Principles of Condensed Matter Physics

Madelung: Introduction to Solid State Theory

Callaway: Quantum Theory of Solid State

Huang: Theoretical Solid State Physics

Kittet: Quantum Theory of Solids

M.SC. PHYSICS (Paper VI) : NUCLEAR AND PARTICLE PHYSICS

Time : 3 hrs. Max. Marks : 75

Note: The question paper shall contain three sections. **Section A** (**20 marks**) shall contain 10 questions two from each Unit. Each question shall be of **2** marks. All the questions are compulsory. The answers should not exceed 50 words. **Section B** (**25 marks**) shall contain 5 questions (two from each unit with internal choice). Each question shall be of **5** marks. The candidate is required to answer all 5 questions. The answers should not exceed 200 words. **Section C** (**30 marks**) shall contain 5 questions, one from each Unit. Each question shall be of **10** marks. The candidate is required to answer any three questions. The answers should not exceed 500 words.

UNIT-01

Nucleon - nucleon interaction - Exchange forces and tensor forces - Meson theory of nuclear forces - Nucleon - nucleon scattering - Effective range theory - Spin dependence of nuclear forces - Charge independence and charge symmetry of nuclear forces - Isospin formalism -Yukawa interaction.

Direct and compound nuclear reaction mechanisms - Cross sections in terms of partial wave amplitudes - Compound nucleus - Scattering matrix - Reciprocity theorem - Breit - Wigner one -level formula - Resonance scattering.

UNIT-02

Liquid drop model - Bohr - Wheeler theory of fission - Experimental evidence for shell effects -Shell model - Spin - Orbit coupling - Magic numbers - Angular momenta and parities of nuclear ground states - Qualitative discussion and estimates of transition rates - Magnetic moments and Schmidt lines - Collective model of Bohr and Mottelson.

UNIT-03

Beta decay - Fermi theory of beta decay - Shape of the beta spectrum - Total decay rate-Angular momentum and parity selection rules - Comparative half - lives - Allowed and forbidden transitions - Selection rules - Parity violation - Two-component theory of neutrino decay -Detection and properties of neutrino - Gamma decay - Multipole transitions in nuclei - Angular momentum and parity selection rules - Internal conversion - Nuclear isomerism.

Unit-04

Ionizing radiations : Ionization and transport phenomena in gases, Avalanche multiplication.

Detector Properties : Detection, Energy measurement, Position measurement, Time measurement.

Gas Counters : Ionization chambers, - Proportional counters – Multiwire proportional counters -Geiger - Muller counters - Neutron detectors.

Solid State Detectors: Semiconductor detectors - Surface barrier detectors.

Scintillation counters: Organic and inorganic scintillators, Theory, characteristics and detection efficiency.

Unit-05

High Energy Particle Detectors: General principles, Nuclear emulsions, Cloud chambers, Bubble chambers, Cerenkov counter.

Types of interaction between elementary particles - Hadrons and leptons - Symmetry and conservation laws - Elementary ideas of CP and CPT invariance - Classification of hadrons -Lie algebra, SU(2) - SU(3) multiplets - Quark model - Gell - Mann - Okubo mass formula for octet and decuplet hadrons - Charm, bottom and top quarks.

Text and Reference Books

A. Bohr and B.R. Mottelson, Nuclear Structure, Vol. 1 (1969) and Vol.2, Benjamin, Reading, A, 1975.

Kenneth S.Kiane, Introductory Nuclear Physics.Wiley, New York,1988.

Ghoshal, Atomic and Nuclear Physics Vol. 2,

P. H. Perkins, Introduction to High Energy Physics, Addison-Wesley, London, 1982.

G. E. Brown and A. D. Jackson, Nucleon - Nucleon Interaction, North - Holland, Amsterdam, 1976.

S. de Benedetti, Nuclear Interaction, John Wiley and Sons, New York, 1964.

P. Marmier and E.Sheldon, Physics of Nuclei and Particles, Vol. I & II, Academic Press, New York, 1970.

H. A. Enge, Introduction to Nuclear Physics, Addison - Wesley, 1975.

S. S. Kapoor and V. S. Ramamurthy, Nuclear Radiation Detectors, Wiley - Eastern, New Delhi, 1986.

W. H. Tail, Radiation Detection. Butterworths, London, 1980.

W. J. Price, Nuclear Radiation Detection, Me Graw Hill, New York, 1964. R.M. Singru

M.SC. PHYSICS (Paper VII A) : Electronics, Digital Electronics & Communication Electronics

Time : 3 hrs. Max. Marks : 75

Note: The question paper shall contain three sections. **Section A** (**20 marks**) shall

contain 10 questions two from each Unit. Each question shall be of **2** marks. All the questions are compulsory. The answers should not exceed 50 words. **Section B** (**25 marks**) shall contain 5 questions (two from each unit with internal choice). Each question shall be of **5** marks. The candidate is required to answer all 5 questions. The answers should not exceed 200 words. **Section C** (**30 marks**) shall contain 5 questions, one from each Unit. Each question shall be of **10** marks. The candidate is required to answer any three questions. The answers should not exceed 500 words.

UNIT-01

Differential amplifier - circuit configurations, dual input, balanced output differential amplifier, DC analysis , AC analysis, inverting and non inverting inputs CMRR , constant current bias level translator.

Block diagram of a typical Op-Amp-analysis. Open loop configuration inverting and non-inverting amplifiers. Op-amp with negative feedback, voltage series feed back, effect of feed back on closed loop gain input resistence output resistance bandwidth and output offset voltage, voltage follower.

Unit-02

Practical op-amp input offset voltage - input bias current - input offset current, total output offset voltage, CMRR frequency response.

DC and AC amplifier summing scaling and averaging amplifiers instrumentation amplifier, integrator and differentiator, Voltage regulators - fixed regulators - adjustable voltage regulators switching regulators

Unit-03

Oscillators principles, oscillator types, frequency stability, response, The phase shift oscillator. Wein bridge oscillator, LC tunable oscillators, Multivibrators - Monostable and Astable, comparators, square wave and Triangle wave generators.

Klystrons, Magnetrons and Traveling Wave Tubes, Velocity modulation, Basic principles of two cavity Klystrons and Reflex Klystrons, principles of operation of magnetrons.

Unit-04

Helix Traveling Wave Tubes, Wave Modes. Transferred electron devices, Gunn Effect, Principles of operation. Modes of operation, Read diode, IMPATT diode, TRAPATT Diode.

Advantages and disadvantages of microwave transmission, loss in free space,

propagation of microwaves, atmospheric effects on propagation, Fresnel zone problem, ground reflection, fading sources, detectors, components, antennas used in MW communication systems.

Unit-05

Radar block diagram an operation, radar frequencies, pulse considerations. Radar range equation, derivation of radar range equation, minimum detectable signal, receiver noise, signal to noise ratio, Integration of radar pulses. Radar cross section. Pulse repetition frequency. Antenna parameters, system Losses and Propagation losses. Radar transmitters, receivers. Antennas, Displays.

Orbital satellites, geostationary satellites, orbital patterns, look angles, orbital spacing, satellite systems. Link modules.

Text and Reference Books

"Microelectronics" by Jacob Millman, Megraw-hill International Book Co., New Delhi, 1990

"Optoelectronics: Theory and Practice", Edited by Alien chappa). Me GrawHill Book Co., New York.

"Microwaves" by K.L. Gupta, Wiley Eastern Ltd., New Delhi, 1983

"Advanced Electronics Communications Systems" by Wayne Tomasi., Phi.Edn.

"Electronic Devices and circuit theory" by Robert Boylested and Louis Nashdsky PHI, New Delhi - 110001,1991

"OP-Amps & Linear integrated circuits," by Ramakanth A. Gayakwad PHI, Second Edition, 1991

"Digital principles and Applications" by A.P. Malvino and Donald P. Laach, Tata Megraw - Hill company. New Delhi,

1993. "Microprocessor Architecture, programming and Applications with 8085/8086 by Ramesh S. Gaonkar, Wiley - Eastern

Ltd., 1987 (for unit v)

M.SC. PHYSICS (Paper VII B) : Analog, Digital Systems & Communication

Time : 3 hrs. Max. Marks : 75

Note: The question paper shall contain three sections. **Section A** (**20 marks**) shall contain 10 questions two from each Unit. Each question shall be of **2** marks. All the questions are compulsory. The answers should not exceed 50 words. **Section B** (**25 marks**) shall contain 5 questions (two from each unit with internal choice). Each question shall be of **5** marks. The candidate is required to answer all 5 questions. The answers should not exceed 200 words. **Section C** (**30 marks**) shall contain 5 questions, one from each Unit. Each question shall be of **10** marks. The candidate is required to answer any three questions. The answers should not exceed 500 words.

UNIT-01

Analog computation, active filters, comparators, logarithmic and anti-logarithmic amplifiers, sample and hold amplifiers, waveform generators. Square and triangular wave generators, pulse generator.

Read-only Memory (ROM) and applications. Random Access Memory (RAM) and applications.

Digital to-analog converters, ladder and weighted resistor types Analog to digital converters -counter type, successive approximation and dual slope converters, Applications of DACs and ADCs.

UNIT-02

Photo detectors : Photo detectors with external photo effect, photo detectors with internal photo effect, photo conductors and photo resistors, junction photo detectors.

Circuits with Light Emitting Diodes, Diode tester. Polarity and voltage tester, measuring instruments with LED indication, LED, Numeric and alphanumeric display units.

UNIT- 03

Semiconductor switches and potential isolation, The phototransistor as a switch in the optocouplers, steady state performance, dynamic performance, use of optocouplers.

Amplitude modulation - Generation of AM waves - Demodulation of AM waves - DSBSC modulation. Generation of DSBSC waves, Coherent detection of DSBSC waves, SSB modulation, Generation and detection of SSB waves. Vestigial sideband modulation. Frequency Division multiplexing (FDM).

Unit-04

The transistor as a switch, OR, AND and NOT gates, NOR and NAND gates, Boolean algebra, Demorgan's theorems, Exclusive OR gate, Decoder/Demultiplexer, Data selector/multiplexer, Encoder.

Flip - Flops : A I - bit memory, The RS Flip - Flop, JK Flip – Flop, JK master slave Flip – Flops, T Flip – Flop, D Flip – Flop, Shift registers, synchronous and asynchronous counters, cascade counters.

Unit-05

Introduction to microcomputers, memory, input/output, Interfacing devices 8085 CPU, Architecture, BUS timings, Demultiplexing the address bus generating

control signals, Instruction set, addressing modes, Illustrative programmes, writing assembly language programmes looping, counting and indexing, counters and timing delays, stack and subroutine,

Text and Reference Books

"Electronic Devices and circuit theory" by Robert Boylested and Louis Nashdsky PHI, New Delhi - 110001,1991

"OP-Amps & Linear integrated circuits," by Ramakanth A. Gayakwad PHI, Second Edition, 1991

"Digital principles and Applications" by A.P. Malvino and Donald P. Laach, Tata Megraw - Hill company. New Delhi,

1993. "Microprocessor Architecture, programming and Applications with 8085/8086 by Ramesh S. Gaonkar, Wiley – Eastern Ltd., 1987

"Microelectronics" by Jacob Millman, Megraw-hill International Book Co., New Delhi, 1990

"Optoelectronics: Theory and Practice", Edited by Alien chappa). Me GrawHill Book Co., New York.

"Advanced Electronics Communications Systems" by Wayne Tomasi., Phi.Edn.

M.SC. PHYSICS (Paper VII C) : MEDICAL PHYSICS - I

Time : 3 hrs. Max. Marks : 75

Note: The question paper shall contain three sections. **Section A** (**20 marks**) shall contain 10 questions two from each Unit. Each question shall be of **2** marks. All the questions are compulsory. The answers should not exceed 50 words. **Section B** (**25 marks**) shall contain 5 questions (two from each unit with internal choice). Each question shall be of **5** marks. The candidate is required to answer all 5 questions. The answers should not exceed 200 words. **Section C** (**30 marks**) shall contain 5 questions, one from each Unit. Each question shall be of **10** marks. The candidate is required to answer any three questions. The answers should not exceed 500 words.

UNIT 1

Radiation Detection and Measurement

Principles of measurements of radiation and radioactivity. Gas filled Ionization chamber, proportional counters, GM counters, Scintillation detectors, semiconductor detectors, BF_3 counters for neutron detection.

TLD dosimetry: process and properties, glow curves and dose response, photon energy dependence, fading, physical form of TLD materials, residual TL and annealing for reuse, repeated read out of TLD's. TL instrumentation, ultrathin TLD's, graphite /boron carbide mixed TLD'S glow curve analysis.

UNIT 2

Ionization Dosimetry

Theoritical aspects of ionization dosimetry-Bragg-Gray theory-Models and equations-practical aspects of ionization dosimetry-characteristics of ionization chambers-polarity effect-stability and collection efficiency-principles of low current measurements.

Measurement of absorbed dose: calculation of absorbed dose from exposure-Bragg-gray cavity theory-.Other methods of measuring absorbed dose: calorimetry-Chemical dosimetry-solid state methods; -Silicon diodes-Radiographic film-Radiocromic film.

UNIT 3

Low and medium energy dosimetry and high energy Dosimetry

In phantom measurements–reference conditions-comparison with ICRU equations-in air measurements-comparison of two methods-Exposure and kerma calibrations(in air)-K-curves-D-curves-concept of CPE and TE-Determination of in water absorbed dose-Graphite dosimetric calibration.

Historical developments-High energy photon dosimetry-CSDM,SAM models-cfactors-development of electron beam dosimetry-concept of cavity gas calibration factor for high energy dosimetry-development of new high energy dosimetry formalism-reference depth-Gradient correction-saturation correction-average stopping power ratio-comparison of electron and photon dosimetry-electron beam dose transfer formalism.

UNIT 4

Dosimeters and survey meters

Dosimeters: Primary standard dosimeters, secondary standard dosimeters, Victoreen R meter, dosimeter based on current measurements, radio isotope calibrator, multi purpose dosimeters -water phantom dosimetry systems, Brach therapy dosimeters. Calibration and maintenance of dosimeters.

Instruments for personal monitoring, digital pocket dosimeters using solid state devices, and GM counters, teledetectors, portable survey meters, gamma area (zone) alaram monitors, contamination monitors for alpha, beta and gamma radiations, scintillation monitors for X ray and gamma radiation –neutron monitors-tissue equivalent survey meter-flux meters, dose equivalent monitors.

UNIT 5

Standardization of electrons,x-ray and gamma rays beams

Determination of exposure and air kerma, conditions for the realization of exposure, ionization chamber for low, medium and high energy x-rays and gamma rays, determination of absorbed dose, Bragg Gray theory and its validity, Burlin's theory for measurement for radiation quantities,

Standardization of x-ray and high energy beams, design of free air chambers, characteristics of free air chambers and graphite chambers, intercomparision of standard chambers for ensuring traceability, standardization of electron beams used in radiotherapy – calibration of secondary standards.Details of IAEA and other protocols for dosimetry of photon beams.

Standardization of Brachy therapy sources and sealed source in terms their radiation output, calibration of protection level dosimeters in terms of dose equivalent units.

BOOKS FOR STUDY AND REFERENCE

H.E. Jones and J.R. Cunnigham, The Physics of Radiology, Charles C.Thomas. New York (1980).

B.H. Brown, R.H. Smallwood, D.C. Barber, P.V. Lawford and D.R. Hose, Medical Physics and Biomedical Engineering, Overseas Press India Private Limited, New Delhi (2005).

The Physics of Radiation Therapy Faiz .M. Khan, Williams & Willkinds (2003).

IAEA Technical Reports Series Number 398, Vienna 2000.

Advanced Medical Radiation Doseimetry, Govindharajan; Prentice Hall of India(Pvt) Ltd 1992.

Physics of electron beam therapy: SC Klevenhagen, Medical physics handbooks 13; Adem Hilger Ltd,Bristol and Boston (1985) M.

M.SC. PHYSICS (Paper VIII A) : PHYSICS OF LASERS AND SCIENCE & TECHNOLOGY OF SOLAR HYDROGEN

Time : 3 hrs. Max. Marks : 75

Note: The question paper shall contain three sections. **Section A** (**20 marks**) shall contain 10 questions two from each Unit. Each question shall be of **2** marks. All the questions are compulsory. The answers should not exceed 50 words. **Section B** (**25 marks**) shall contain 5 questions (two from each unit with internal choice). Each question shall be of **5** marks. The candidate is required to answer all 5 questions. The answers should not exceed 200 words. **Section C** (**30 marks**) shall contain 5 questions, one from each Unit. Each question shall be of **10** marks. The candidate is required to answer any three questions. The answers should not exceed 500 words.

UNIT-01

Laser Characteristics

Gaussian beam and its properties. Stable Two-Minor Optical Resonators, Longitudinal and Transverse Modes of Laser Cavity. Mode Selection, Gain in a Regenerative Laser Cavity. Threshold for 3 and 4 level Laser Systems. Mode Locking Pulse Shortening - Picosecond & femtosecond operation, Spectral Narrowing and Stabilization.

UNIT-02

Laser Fluorescence and Raman Scattering and their use in pollution studies, Non-Linear interaction of Light with matter, Laser induced multiphoton processes and their applications, Ultrahigh resolution Spectroscopy with lasers and its applications, Propagation of light in a medium with variable refractive index. Optical Fibers. Light wave communication. Qualitative treatment of Medical and Engineering applications of Lasers.

UNIT-03

Ruby Laser, Nd-YAG Laser, Semi Conductor Lasers, Diode-Pumped Solid State Lasers, Nitrogen Laser, Carbon-dioxide Laser, Excimer Laser, Dye Laser, High Power Laser Systems.

Fundamentals of photovoltaic Energy Conversion Physics and Material Properties Basic to Photovoltaic Energy Conversion: Optical properties of Solids. Direct and indirect transition semiconductors, interrelationship between absorption coefficients and band gap recombination of carriers.

UNIT-04

Types of Solar Celts, p n junction solar cell, Transport Equation, Current Density, Open circuit voltage and short circuit current, Brief descriptions of single crystal silicon and amorphous silicon solar cells, elementary ideas of advanced solar cells e.g. Tandem Solar Cells. Solid Liquid Junction Solar Cell.

Elements of Solar Thermal Energy, Wind Energy and Ocean Thermal Energy Conversion.

UNIT-05

Principles of Photoelectrochemical solar cells, Relevance in relation to depletion of fossil fuels and environmental considerations.Solar Hydrogen through Photoelectrolysis and Photocatalytic process. Physics of material characteristics for

production of Solar Hydrogen.

Brief discussion of various storage processes, special features of solid state hydrogen storage materials, structural and electronic characteristics of storage materials. New Storage Modes.

Various factors relevant to safety, use of Hydrogen as Fuel, Use in Vehicular transport, Hydrogen for Electricity Generation, Fuel Cells, Elementary concepts of other Hydrogen Based devices such as Air Conditioners and Hydride Batteries.

Text and Reference Book

Svelto: Lasers

Yariv: Optical Electronics

Demtroder: Laser Spectroscopy

Letekhov: Non-Linear Laser Spectroscopy

Fonash : Solar Cell Devices – Physics

Fahrenbruch & Bube : Fundamentals of Solar Cells Photovoltaic Solar Energy

Chandra : Photoelectrochemical Solar Gells

Winter & Nitch (Eds.) : Hydrogen as an Energy Carrier Technologies Systems Economy

M.SC. PHYSICS (Paper VIII B) : PHYSICS OF NANOMATERIALS & ENVIRONMENTAL PHYSICS

Time : 3 hrs. Max. Marks : 75

Note: The question paper shall contain three sections. **Section A** (**20 marks**) shall contain 10 questions two from each Unit. Each question shall be of **2** marks. All the questions are compulsory. The answers should not exceed 50 words. **Section B** (**25 marks**) shall contain 5 questions (two from each unit with internal choice). Each question shall be of **5** marks. The candidate is required to answer all 5 questions. The answers should not exceed 200 words. **Section C** (**30 marks**) shall contain 5 questions, one from each Unit. Each question shall be of **10** marks. The candidate is required to answer any three questions. The answers should not exceed 500 words.

UNIT-01

Free electron theory [qualitative idea] and its features, Idea of band structure, Metals, insulators and semiconductors, Density of state in bands, Variation of density of states with energy, Variation of density of state and band gap with size of crystal.

UNIT-02

Electron confinement in infinitely deep square well, confinement in two and

one dimensional well, Idea of quantum well structure, Quantum dots, Quantum wires.

Determination of particle size, Increase in width of XRD peaks of nanoparticles, Shift in photoluminescence peaks, Variations in Raman spectra of nanomaterials

UNIT-03

Different methods of preparation of nanomaterials, Bottom up: Cluster beam evaporation, Ion beam deposition, Chemical bath deposition with capping techniques and Top down : Ball Milling.

Nanotechnology's Application to Environment: Nanotechnology for waste reduction and improved energy efficiency, nanotechnology based water treatment strategies. Nanoporous polymers and their applications in water purification, Nanotoxicolog

Structure and thermodynamics of the atmosphere. Composition of air. Greenhouse effect. Transport of matter, energy and momentum in nature. Stratification and stability of atmosphere. Laws of motion, hydrostatic equilibrium. General circulation of the tropics. Elements of weather and climate of India.

UNIT-04

Physics of radiation. Interaction of light with matter. Rayleigh and Mie scattering. Laws of radiation (Kirchoffs law, Planck's law, Beer's law, Wien's displacement law, etc.). Solar and terrestrial spectra. UV radiation. Ozone depletion problem. IR absorption energy balance of the earth atmosphere system.

Elementary fluid dynamics. Diffusion. Turbulence and turbulent diffusion. Factors governing air, water and noise pollution. Air and water quality standards. Waste disposal. Heat island effect. Land and see breeze. Puffs and plumes. Gaseous and paniculate matters. Wet and dry deposition

UNIT-05

Energy sources and combustion processes. Renewable sources of energy. Solar energy, wind energy, bio-energy, hydropower, fuel cells, nuclear energy. Forestry and bioenergy.

Elements of weather and climate. Stability and vertical motion of air. Horizontal motion of air and water. Pressure gradient forces. Viscous forces. Inertia forces. Reynolds number. Enhanced Greenhouse Effect. Energy balance- a zero-dimensional Greenhouse model. Global climate models.

Text and Reference Books

Nanotechnology Molecularly designed materials by Gan-Moog Chow, Kenneth E. Gonsalves, American Chemical Society

Quantum dot heterostructures by D. Bimerg, M. Grundmann and N.N. Ledentsov, John Wiley & Sons, 1998.

Nano technology : Molecular speculations on global abundance by B.C. Crandall, MIT Press 1996.

Physics of low dimensional semiconductors by John H. Davies, Cambridge Univ. Press 1997. Physics of semiconductor nano structures by K.P. Jain, Narosa 1997.

Nano fabrication and bio system : Integrating materials science engineering science and biology by Harvey C. Hoch, Harold G. Craighead and Lynn Jelinski, Cambridge Univ. Press 1996.

Nano particles and nano structured films; Preparation characterization and applications Ed. J.H Fendler, John Wiley &Sons 1998.

Egbert Boeker & Rienk Van Groundelle : Environmental Physics (Joha Wiley).

J.T. Hougtion : The Physics of Atmosphere (Cambridge University Press, 1977).

J.Twidell and J. Weir : Renewable Energy Resources (Elbs, 1988).

Sol Wieder : An Introduction to Solar Energy for Scientists and Engineers (John Wiley, 1982).

R.N. Keshavamurthy and M. Shanker Rao : The Phisics of Monsoons (Allied Publishers, 1992).

G.J. Haltiner and R.T. Williams : Numerical Weather Prediction (John Wiley, 1980).

M.SC. PHYSICS (Paper VIII C) : MEDICAL PHYSICS -II

Time : 3 hrs. Max. Marks : 75

Note: The question paper shall contain three sections. **Section A** (**20 marks**) shall contain 10 questions two from each Unit. Each question shall be of **2** marks. All the questions are compulsory. The answers should not exceed 50 words. **Section B** (**25 marks**) shall contain 5 questions (two from each unit with internal choice). Each question shall be of **5** marks. The candidate is required to answer all 5 questions. The answers should not exceed 200 words. **Section C** (**30 marks**) shall contain 5 questions, one from each Unit. Each question shall be of **10** marks. The candidate is required to answer any three questions. The answers should not exceed 500 words.

UNIT 1

Biosignal acquisition, Bioelectric signal recording and Physiological assist devices

Physiological signal amplifiers-isolation amplifiers-differential amplifiers-bridge amplifiers-chopper amplifiers-noises and CMRR –medical preamplifier design, Bioelectric potentials-resting and action potentials-half cell potential-surface,needle and micro electrodes,electrical equivalent circuits-ECG,EMG,EEG recording circuits.

Cardiac pace makers-natural and artificial pace makers-pace maker batteries - defibrillator- AC/DC. Synchronised defibrillator-stimulators-bladder stimulators - heart lung machine.

UNIT 2

Clinical equipments, Operation theatre equipments, Biotelemetry and safety instrumentation

Various types of oxygenators - kidney machine-hemodialying units-peritonial dialysis. Flame photometer- spectro-flurophotometer - pH meters. Audiometers-endoscopes-electromagnetic and laser blood flow meters-ventilators –diathermy units-ultrasonic,micro wave diathermy techniques.

Design of a biotelemetry system, radiotelemetry with subcarrier-multiple channel telemetry systems-problems in implant telemetry-uses of biotelemetry-physiological effects of 50 HZ current –microshock and macro shock-electrical accidents in hospitals-devices to protect against electrical hazards.

UNIT 3

Radiation Protection Standards and Regulations

Need for protection, philosophy of radiation protection, basic radiation protection criteria, External and internal exposure, additive risk model and multiplicative risk model. Risk coefficients. Dose to the foetus. Dose limits for occupational exposure, for public and special exposure situations. ICRP and AERB recommendations. Basic safety standards. Source, practices, types of exposures, interventions. Atomic energy act, Radiation protection Rules, Notifications, Transport regulations, Waste disposal rules, Food irradiation rules, licensing, approval of devices, installations, sites and packages containing radioactive material. Source of radioactive waste and classification of waste, treatment techniques for solid, liquid and gaseous effluents, permissible limits for disposal of waste, sampling techniques for air,water and solids, ecological consideration, general methods of disposal, management of radioactive waste in medical and research institutions.

UNIT 4

Radiation Shielding

Shielding calculation for gamma radiation, choice of material, Primary and secondary radiation, source geometry, discrete sources, point, kemel method, introduction to Monte Carlo method, Beta shielding, Bremsstrahlung. Neutron shielding, scattering and absorption, activation of the shielding material, heat effects.

Optimization of shielding, gamma, electron, neutron irradiation facilities. Transport and storage of containers for high activity sources. Shielding requirements for medical and research facilities including accelerator installations.

UNIT 5

Diffusion: (a) Ficks first law(b)diffusion related to viscosity (c) Ficks second law and applications Transport through semipermeable membranes; (a)Osmotic pressure (b)plasma exchange in capillaries (c) Edema: osmotic diureses:Osmotic fragibility of red blood cells(d) Volume transport ;solute transport:the artificial kindney (e) external factors on solute molecules;ionic solute and equilibrium electric fields in membranes(f) Ion movement in solution involving diffusion,solvent drag and electrical fields (g) Nernst-Plank equation and the Goldman equation

Books for Study and Reference

Jacobson and Webster; Medicine and clinical engineering,Prentice Hall of India,New Delhi,1979

R.S.Khandpur,Hand book of biomedical instrumentation,Tata McGraw Hill,New Delhi,1990

M.Arumugam, Biomedical instrumendation, Anuradha publishing Co, Kumbakonam, Tamilnadu 1992.

Richad Aston,Principles of biomedical instrumendation and measurements,Merrill publishing Co,London,1990.

R.F.Mould, Radiation Protection in Hospital, Adam Hilger Ltd., Bristol, 1985.

The essential Physics of Medical Imaging; Jerrold. T. Bushberg et.al, Lipcontt Williams & Wilkins 2002.

Faiz. M. Khan, The Physics of Radiationtherapy, Lippincott Williams & Wilkins, Philadelphia, 3rd edtion 2003.

A.Martin and S.A.Harbison, An introduction to Radiation Protection, John Wiley &'Sons Inc., New York, 1981.

ICRP Publications (ALL)

AERB Safety codes(ALL)

NCRP Publications(ALL)

Hobbie,Russell 1988, Intermediate physics for medicine and biology(Wiley, NY)

Guyton A.C.1976 Text book of medical physiology 5 th ed (W.B.Saunders co. Philadelphia)

Ganong W F 1975 Review of medical physiology 7 th ed (Lange Los Altos CA)

PRACTICALS

LIST OF EXPERIMENTS :

Number of experiments to be performed by the students during the academic session should be atleast eight from each Laboratory.

A. General Laboratory Course

1. To Study frequency versus energy curve using magnet-magnet interaction using air track.
2. To study potential energy curve of magnet-magnet interaction using air track.
3. To study parametric amplifier for different initial length and variation of damping with mass of bob.
4. To draw the characteristic curve of GM counter.
5. To determine the end point energy of a beta ray source.
6. To write and run program using microprocessor 8085A.
7. To determine Resolving Power of a Telescope.
8. To write numerical analysis program and solving them using BASIC.
9. To determine velocity of Sound in Air by Standing Wave Method.
10. To study modulus of rigidity with temperature using tortional pendulum.
11. To determine Dielectric constant of liquid using Lechar wire method.
12. To determine wavelength of laser beam and study beam divergence.
13. Determine fine structure constant using sodium doublet.
14. Verify Cauchy's relation & determination of constants.
15. To determine e/m for an electron by Zeeman effect.
16. Determine the dissociation energy of Iodine molecute.
17. Determine of energy of a given ray from Re-De source.
18. Find out the percentage resolution of given scintillation spectrometer using Cs_{137}
19. Find out the energy of a given X-ray source with the help of scintillation spectrometer.
20. Plot the Gaussian distribution for a radioactive source.
21. Determine the dielectric constant of turpentine oil with the Leacher wire system.
22. To determine velocity of waves in water using ultrasonic interferometer.
23. To determine the magnetic susceptibility of two given samples by Gouy's method.
24. Determine of Lande's 'g' factor for IRRH crystal using electron spin resonance spectrometer.

    Any other experiments of the equivalent standard can be set

B. Electronic Devices Laboratory Course

1. To Study LC Transmission Line

2. To Study Wide Band Amplifier.
3. To study RF oscillator using Hartley and Colpitts Method.
4. To study Wein bridge Oscillator.
5. To study Phase Shift Oscillator.
6. To study RS & JK Flip Flop Circuits and to verify the Truth Tables.
7. To study the SCR circuit.
8. To study Absorption Coefficient of a Liquid using Photovoltaic cell.
9. To study Fourier Analysis.
10. To study Decade and Binary Counters.
11. To study Two-input Multiplexer and to verify its Truth Table.
12. Create a Pspice model of square wave generator/ Wein bridge oscillator using 741 Op-amp.
13. To determine e/m of an electron by magnetron valve method.
14. To determine e/k using transistor characteristics.
15. To study dark and illumination characteristic of p-n junction solar cell and to determine (i) Its internal series resistance (ii) Diode ideality factor
16. To study the characteristics of following semiconductor devices (i) VDR (ii) photo transistor (iii) Thermistor (iv) IED
17. To study the characteristics of MOSTET and MSSFET amplifier.
18. To study dark and illumination characteristics of p-n junction solar cell and to determent its (i) Maximum power available (ii) Fill factor.
19. To study the frequency and phase Characteristic of band pass filter.
20. Study the wave from characteristic of transistorized astable symmetrical multivibrator.
21. CRO & determine its frequency by various C& R.
22. Artificial transmission line.

Any other Experiments of the equivalent standard can be set.

C. <u>Special Lab/Project and Seminar :</u>

1. To study the characteristic curve of Klystron.
2. To study the mode characteristics of reflex Klystron and hence to determine mode number, Transmit time, electronics, tunning range, electronic tunning sensitivity.
3. To study the E-Plane radiation pattern of pyramidal horn antenna and compute

the beam width of Antenna.

4. To study the H-plane radiation pattern of pyramidal horn antenna and compute the Directional gain of the Antenna.
5. To determine the dielectric constant of a given sample at Microwave frequency.
6. To determine the dielectric constant of a Benzene using plunger technique at room temperature.
7. To determine the unknown impedance using slotted line section Smith chart in the K-band.
8. To study the microwave absorption in dielectric sheets.

Any other experiments of the equivalent standard can be set.

M.Phil. PHYSICS EXAMINATION - 2020

M. Phil. PHYSICS

Scheme of examination :

Three Theory Papers		Max. Marks 300	
Practical / Dissertation		Max. Marks 100	
Paper	Nomenclature	Duration	MM
I	Quantum Solid State Physics	3 hrs.	100
II	Nonlinear Dynamics and Electrodynamics	3 hrs.	100
Elective Papers			
III(a)	Physics of Amorphous Solids	3 hrs.	100
	OR		
III(b)	Physics of Nanomaterials & Liquid crystals	3 hrs.	100
	OR		
III(c)	Applied Electronics	3 hrs.	100
IV	Practical / Dissertation	6 hrs	100

Note : Minimum pass marks in each paper has to be 40% while in aggregate it has to be 50% for a pass. 20 marks in each paper and Practical/Dissertation will be awarded through internal assessment and 80 marks through external assessment. Four periods of one hour each per week shall be provided for each theory paper and two periods for dissertation. The lab. work per batch will be 18 hours per week. In each laboratory, each batch for practical must not be of more than 08 students.

PAPER-I

QUANTUM SOLID STATE PHYSICS

Time : 3 hrs. Max. Marks : 100

Note : Ten questions will be set in the question paper. Candidates are required to attempt five questions in all. Each question will carry equal marks.

1. **Mathematical introduction:** Basic Hamiltonian and Hartree-Fock approximation.
2. **Acoustic Phonons:** Discrete elastic line quantum theory of the continuous line. Long wavelength acoustic mode phonons in isotropic crystals. Superfluidity, second sound in crystals. Frequency distribution for phonons.
3. **Plasmons :** Optical phonons and polarization waves, Plasmos. Long wavelength optical phonons in isotropic crystals, interaction of optical phonons with photons.
4. **Magnons :** Ferromagnetic Magnons. Helstein - Primakeff transformation Hamiltonian in spin-wave-variables. Magnon heat capacity. Magnons interaction magnetization reversal. Anti ferromagnetic magnon, zero point energy, zero point sublattice magnetization. Temperature dependence of sublattice magnetization. Microscopic magnon theory.
5. **Fermion Fields and the Hartree-Fock Approximation :** Particle field equation of motion method for the Hartree Fock equation. Koopman's theorem. Fermion Quasi particles. Electron gas in the Hartree and Hartree-Fock Approximations. Modified Hartree model. Two electron correlation functions. Coulomb's interactions and the formation.
6. **Polarons :** Current carrier spectrum, renormalization and effective mass of polarons, Strong coupling polarons. Londan and Pekar theory. Theory of small radium polarons.
7. **Superconductivity :** Indirect electrons. Electron interaction via phonons. Bound electron pairs in a fermi gas. Superconductivity ground state. Solution of the CS equation spin-analog method. Solution of the CS equation. Equation of the motion method. Ground state wave function. Electrodynamics of superconductors. Coherence length. Matrix elements coherence effects. High temperature superconductivity (basic

ideas). Fullerence superconductors (basic ideas) organic superconductors (basic ideas).

8. **Superfluidity :** Basic properties of superfluid 4 He. Elementary excitation in He-II and their interaction. Elementary excitation spectrum of superfluid-3 He. Helium-II. The two fluid model. The fountain effect and heat transport in Helium-II. The propagation of sound in Helium-II. Superconductivity in Liquid 3 He.

References :

1. Quantum Solid State Physics : Vensovsky and Kalsnelson (Springer Verlag).
2. High-Tc superconductivity : R.P. Sinha & S.L. Kakani - Nova. Sc. Publisher.
3. Superconductivity Current Problems : S.L. Kakani Arihant Jaipur.
4. Condensed Matter Physics : Stephen W. Levessy Benjamin : Dynamic Correlations II ed.
5. Superfluidity and Superconductivity : D.R. Tilley and J. Cilley : Adam Highler-1986, II ed.
6. Quantum theory of solids : Kittel

PAPER - II

NONLINEAR DYNAMICS AND ELECTRODYNAMICS

Time : 3 hrs. Max. Marks : 100

Note : Ten questions will be set in the question paper. Candidates are required to attempt five question in all. Each question carry equal marks.

1. **Introduction to Dynamical Systems :** Physics of nonlinear systems, dynamical equations and constants of motion, phase space, fixed points, stability analysis, bifurcations and their classifications, Poincare section and iterative maps.
2. **Dissipative Systems :** One-dimensional noninvertible maps, simple and strange attractors, iterative maps, period doubling and universality, intermittency, invariant measure, Lyapunov exponents, higher dimensional system, Henon map, Lorenz equation. Fractal geometry,

generalized dimensions, examples of fractals.

3. **Hamiltonian Systems :** Integratibility, Liouville's theorem, action-angle variables, introduction to perturbation techniques, KAM theorem, area preserving maps, concepts of chaos and stochasticity.
4. **Coherence :** Superposition of waves, coherence-spatial and temporal, couple signal representation of quasiomonochromatic light, theory of partial coherence, power spectrum and intensity distribution, Laser-principle and working elements of holography.
5. **Radiation by moving charges :** Power radiated by an accelerated charge. Larmor's formula and its relativistic generalization, frequency and angular distribution emitted by an accelerated charge, extreme relativistic case, Thomson scattering, scattering of radiation by quasi-free charges, coherent and incoherent scattering, transition radiation.
6. **Radiation by Collision :** Bremsstrahlung radiation in coulomb collision, non relativistic and relativistic case, screening effects, method of virtual quanta, radiation emitted during data decay and orbital electron capture disappearance of charge and magnetic moment.

Reference Books :

Section-(1) is based on A.P. - French (I) Vibrations (Arnold-Meinemann India, 1973) Ch., Section 2 on L.A. Pipes. L.R. Harvell, Applied Mathematics for Engineers and Physicist (McGraw Hill Book Co., 1970), Chapter-5 for section 3, this is defined by G.R.Fowels. An Introduction to Modern Optics (Mait, Rinchart and Winston INC., 1968) Chapter-2, Section 4 and 5 are in accordance with J.D. Jackson, classical electrodynamics. (Wiley-Eastern Limited, 1975) Chapter 14, 15.

Other References :

The Physics of Vibrations : H.J.Pain John Wiley and Sons, 1968.

Waves Physics Course : F.S. Grawford, Jr. McGraw Hill, Vol. 3, 1968

Optical Physics : S.C.Lipson, Cambridge Univ. Press, H. Lipson

Physics of Vibration : Vierk

Electricity and Magnetism : Panofsky and Philips Addision Wesley

Introduction to Dynamics : Percival and D. Richards

Nonlinear Dynamics I & II : E.A. Jackson

Introduction to Dynamical Systems : R.L. Devaney

Regular and Stochastic Motion : A.J. Lichtenberg and M.A. Lieberman Chaos in Classical and Quantum Mechanics:M.C.Gulzwiller,E.Ott M. Tabor

ELECTIVE (ANY ONE OUT OF III(A) OR III(B) OR III(C))

PAPER III(A) PHYSICS OF AMORPHOUS SOLIDS

Time : 3 hrs Max Marks : 100

Note : Ten questions will be set in the question paper. Candidates are required to attempt five question in all. Each question carry equal marks.

1. **Preparation :** Basic Definitions, preparation of amorphous materials : Thermal evaporation, sputtering, Glow discharge decomposition, Chemical vapour deposition, Melt quenching, Gel desiccation, Electrolytic deposition, Reaction amorphization, irradiation pressure induced amorphization, solid state diffusional amorphization.
2. **Glasses :** The glass transition - theories for the glass transition - Thermodynamic phase transition, Entropy, Relaxation processes. Dynamical theories, Free volume factor determining the glass - transition temperature - Glass forming systems and ease of glass formation, structure and topology, Eutectic compositions, crystalline polymorphs, constraint theory, Electronic structure.
3. **Structure (over view of following) :** Microscopic structure - Experimental techniques like diffraction, x-ray absorption spectroscopy, magnetic resonance, Mossbauer spectroscopy, vibrational spectroscopy - short range order, medium range order experimental probes of medium range order structural modeling - continuous random networks. Macroscopic structure - Microscopy, small angle scattering.
4. **Electronic transport in Amorphous Semiconductors :** Chemical bond description of covalent non crystalline semiconductors dang ling bonds. Overview of band-model - CFO Model, Davis-Mott Model, Small Polaron model Electrical Properties - DC electrical conductivity Thermo

power, Hall effect, ac conduction, Transit time, photoconductivity and small poloran motion.

5. **Amorphous silicon solar cells :** Amorphous Semiconductors cells,: Deposition of hydrogenated amorphous Si:, Properties- Role of H, optical properties, Resistivity, photoconductivity, carrier mobility and lifetime, DOS; Solar cell structures, photovoltaic charecteristics- I V behaviour, effect of impurities, effect of substrate temperature, analysis of a- Si:H solar cell

Text and Reference Books :

Mott and Davis : Electronic Processes in Non-Crystalline materials

Elliot : Physics of Amorphous materials.III ed. Cambridge press UK

Brodsky: amorphous semiconductors Springer , Berlin.

J Tauc : amorphous and liquid semiconductors Plenum press NY

PAPER III(B)

PHYSICS OF NANOMATERIALS

Time : 3 hrs. Max.Marks 100

Note : Ten questions will be set in the question paper. Candidates are required to attempt five question in all. Each question carry equal marks.

1. **Free electron theory :** Free electron theory (qualitative idea) and its features, Idea of band structures, Metals, insulators and semiconductors, Density of state in bands, variation of density of states with energy, Variation of density of state and band gap with size of crystal.
2. **Quantum size effect :** Electron confinement in infinitely deep square well, confinement in two and one dimensional well, Idea of quantum well structure, quantum dots, quantum wires.
3. Determination of Particle size, Increase in width of XRD peaks of nanoparticles, shift in photoluminescence peaks, variations in Raman spectra of nanomaterials.
4. Different methods of preparation of nanomaterials, Bottom up : Cluster beam evaporation, Ion beam deposition, Chemical bath deposition with capping techniques and top down : Ball Milling.

5. **Classification and Liquid Crystals :** Symmetry, structure and classification of liquid crystals, Polymorphism in thermotropics, Reentrant phenomena in liquid crystals. Blue phases, Polymer liquid crystals, Distribution functions and order parameters, macroscopic and microscopic order parameters. Measurement of order parameters magnetic resonance electron spin resonance. Raman Scattering and X-Ray diffraction.

6. **Theories of Liquid Crystalline Phase Transitions :** Nature of phase transitions and critical phenomena in liquid crystals, hard particle, Maier-Saupe and Van der Waals theories for nematic - isotropic and nematic-smectic A transitions : Landau theory : Essential ingredients, application to nematic-isotropic, nematic-smectic Atransitions and transitions involving smectic phases.

7. **Dynamical Properties of Nematics and Optical Properties of Cholesterics :** The equations of nematodynamics, Laminar flow, molecular motions. Optical properties of an ideal helix, agents influencing the pitch, liquid crystal displays.

8. **Ferroelectric Liquid Crystals :** The properties of smectic C, continuum description, smectic C smectic A transition, applications.

9. **Discotic Liquid Crystals :** Symmetry and structure, mean-field description of discotic liquid crystals, continuum description Lyotropic liquid crystals and biological membrane. Application of liquid crystals.

Text and Reference Books :

Nanotechnology Molecularly designed materials by Gan-Moog Chow, Kenneth E. Gonsalves, American chemical society.

Quantum dot heterostructures by D. Bimerg M. Grundmann and N.N. Ledenntsov, John Wiley & Sons, 1998.

Nano Technology : Molecular Speculations on global abundance by B.C. Crandall, MIT Press, 1996.

Physics of low dimensional semiconductors by John H. Davies, Cambridge Univ. Press, 1997.

Physics of semiconductor nano structures by K.P. Jain, Narosa, 1997.

Nano fabrication and bio system : Integrating materials science engineering science and biology by Harvey C. Hoch, Harold G. Craighead and Lynn Jelinski, Cambridge Univ. Press, 1996.

Nano particles and nano structured films : Preparation characterization and application, Ed. J.H. Fendler, John Wiley & Sons, 1998.

Liquid Crystals : Chandrasekhar

Thermotropic Liquid Crystals : Fundamentals Vertpgem & de Jei,

The Physics of Liquid Crystals : de Gennes & Prost

Introduction to Liquid Crystals : Physics and Chemistry (1997, Taylor and Francis)

Elston & Sambles : The Optics of Thermotropic Liquid Crystal

Collyer : Liquid Crystal Polymers : From Structures to Applications

Goodby et al. : Ferroelectric Liquid Crystal : Principles, Properties and Application

PAPER III(C)

APPLIED ELECTRONICS

Microprocessors and Micro computers

Microprocessors and Architecture : Internal Microprocessor Architecture, Real Mode and Protected modes of memory addressing, memory paging.

Addressing Modes : Data addressing modes, Program memory addressing modes, stack-memory addressing modes.

Instruction Set : Data movement instructions, Arithmetic and Logic Instructions, Program control instructions, Assembler details.

Programming the Microprocessor : Modular programming, using the keyboard and video display, data conversions, Disk files, Example programs.

Hardware specifications : Pin-outs and the pin functions, clock-generator (8284A), Bus buffering and latching, Bus timing, ready and wait state, Minimum mode versus maximum mode.

Memory Interface : Memory devices, address decoding, 8088 and 80188 (8 bit) memory interface, 8086, 80186, 80286 and 80386 (16 bit) memory

interface, 80386DX and 80486 (32-bit) memory interface, dynamic RAM.

Basic I/O interface : Introduction to I/O interface, I/O port address decoding, 8255, 8279, 8254, 16550, ADC and DAC (excluding multiplexed display and keyboard display using 8255).

Interrupts : Basic interrupt processing, Hardware interrupts, Expanding the interrupt structure, 8259A PIC.

Direct Memory Access : Basic DMA Operation, 8237 DMA controller, shared bus operation, Disk memory systems, Video displays.

Text and Reference Books :

Barry, B. Brey, "The Intel Microprocessors 8086/8088, 80186/80188, 80286, 80386, 80486, Pentium and Pentium pro processor architecture, programming and interfacing", IV Edition, PHI, 1999.

Douglas V. Hall, "Microprocessors and interfacing, programming and Hardware", II Edition, McGraw Hill International Edition, 1992.

Muhammad Ali Maxidi and Janice Gillispie Mazidi, "The 80x86 IBM PC and Compatible Computers (Volumes I & II), II Edition, Prentice Hall International, 1998.

M.Phil.: Laboratory/Practical

Note : Students are required to perform at least eight experiments from the list given below. Few other experiments may be set at the college/university level, at par with the standard of M.Phil. class. In each laboratory, each batch for practical must not be of more than 08 students.

List of experiments :

1. Study of various exercises of Microprocessor 8085
2. Study of analog to digital convertor
3. Design and study a 4 line to 16 line decoder
4. Study the β-spectrum with the help of β-ray spectrometer.
5. Study the Compton profile and calculation of change in wave length of γ-rays of various sources.
6. Study the dielectric permittivity of given solid sample at various microwave frequencies.

7. Study the piezo electric effect and design a crystal oscillator
8. Study the crystal delector
9. Study the electron spin resonance spectrometer and its application
10. Study the nuclear magnetic resonance spectrometer
11. Study of variation of modulus of rigidity with temperature for a given sample.
12. Study of Compton scattering using different targets.
13. Study of linear air track.
14. Determination of thermal parameters using DSC & TPS.
15. Determination of mechanical parameters using DMA.