शासकीय कमला राजा कन्या स्नातकोत्तर स्वशासी महाविद्यालय, ग्वालियर (मध्य प्रदेश)

आनो भद्राः क्रतवो यन्तु विश्वतः

भौतिकशास्त्र विषय के अध्ययनमंडल
द्वारा अनुमोदित भौतिकशास्त्र विषय के
स्नातक (2016–2019) एवं स्नातकोत्तर (2016–2018) पाठ्यक्रम

अनुमोदन अकादमिक सत्र
2016–2017

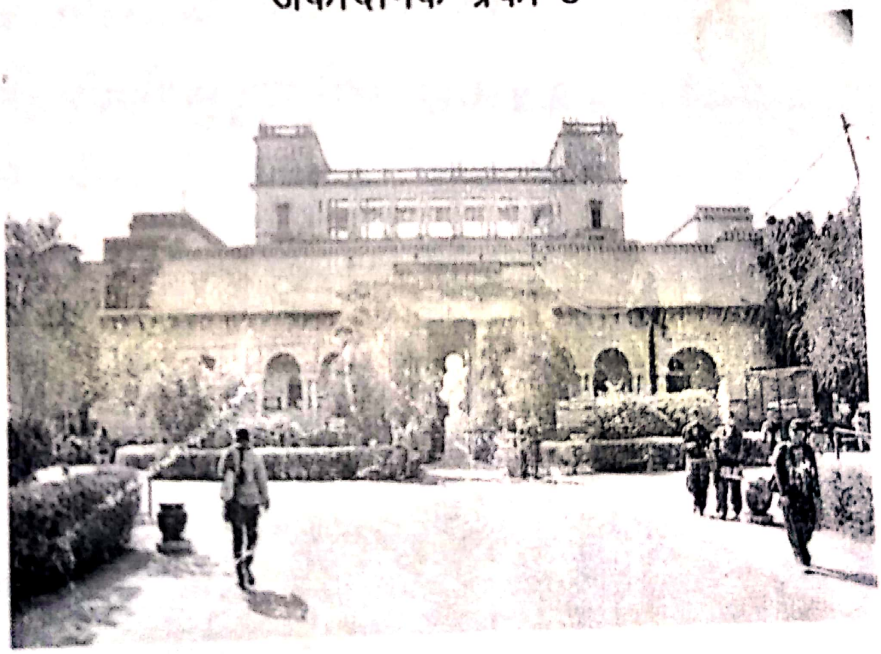
प्रस्तुतकर्ता

स्नातकोत्तर अध्ययन केन्द्र

भौतिकशास्त्र विभाग

प्राप्तकर्ता

अकादमिक प्रकोष्ठ



वेबसाइट : www.krgc.gwl.org ईमेल : krgc@rediffmail.com
दूरभाष : 0751 – 2625495, 0751 – 2438173, फैक्स : 0751 – 2625495

www.krgcgwalior.org
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कार्यालय प्राचार्य, शासकीय कमलाराजा कन्या स्नातकोत्तर स्वशासी महाविद्यालय, ग्वालियर

दिनांक 28 जून, 2016

~~गणित~~ भौतिकी विभाग

अध्ययन मंडल की बैठक का कार्यवाही विवरण

नवीन सत्र 2016–17 हेतु ~~गणित~~ भौतिकी विषय से सम्बंधित अध्ययन मण्डल की बैठक आज दिनांक 28 जून, 2016 को प्रातः 11:00 बजे ~~गणित~~ भौतिकी विभाग में आयोजित की गई, जिसमें निम्नानुसार उपस्थिति रहीं –

1. डॉ. Professor Dr. MADAN MOHAN BAJAJ, CHANCELLOR, INTERNATIONAL Kamdhenu Ahimsa University, A122, VIKASPURI, New Delhi 110018, Mobile: 09818293911
2. डॉ. P. Rajaram, School of Studies in Physics, Jiwaji University, Gwalior 9039013881
3. डॉ. Abhay Mishra Prof. & Head App. Scien; MITS, Gwalior 9425338141
4. डॉ. Subhash C. Kausik, Head Dept of Phys. & Comp Sc Govt. P.G College Datia
5. डॉ. Meenal Gokhale Govt. K.R.G. P.G. College M. Gokhale 28.6.16
6. डॉ. श्रीमती सुकृति घोष Govt. K.R.G. College. Gwalior CM.
7. डॉ. Neetu Pathak [Students M.Sc (physics)] Govt K.R.G Co Gwalior
8. डॉ. A.K. Srivastava SOS Phy. Jiwaji Univ. 9827905431 Gwalior → 9425113409
9. डॉ. V.G. Telang H.O.D Phy K.R.G – 9425336
10. डॉ.
11. डॉ.
12. डॉ.

अध्ययनमंडल की बैठक की कार्यवाही निम्नानुसार रही –

1. भौतिक शास्त्र, Ele. विषय के स्नातक स्तर के प्रथम, द्वितीय, तृतीय, चतुर्थ, पंचम एवं षष्ठ सेमेस्टर के पाठ्यक्रम अंक योजना सहित सत्र 2016–2017, 2017–2018 एवं 2018–2019 हेतु अध्ययनमंडल द्वारा मान्य किया जाता है।

2. इलेक्ट्रो, भौतिक शास्त्र विषय के स्नातकोत्तर स्तर के प्रथम, द्वितीय, तृतीय, एवं चतुर्थ, सेमेस्टर के पाठ्यक्रम अंक योजना सहित सत्र 2015–2016 एवं 2016–2017 हेतु अध्ययनमंडल द्वारा मान्य/अथवा आंशिक संशोधन के साथ मान्य किया जाता है।

3. इलेक्ट्रो, भौतिक शास्त्र विषय की सत्र 2016–2017 में होने वाली परीक्षाओं हेतु संलग्न परीक्षकों की सूची को अध्ययनमंडल द्वारा मान्य किया जाता है।

4. विभाग में सत्र 2016–2017 में यदि कोई शोध संगोष्ठी/कार्यशाला/अधिवेशन/अध्ययन भ्रमण आदि के आयोजन का प्रस्ताव है तो उसका विवरण एवं अनुशंसा———

शोध संगोष्ठी, अध्ययन भ्रमण
कार्यशाला

5. यदि विभाग में स्ववित्तीय योजना के तहत् कोई पाठ्यक्रम/अतिरिक्त विषय/डिप्लोमा कोर्स/सर्टिफिकेट कोर्स प्रारंभ करने की योजना हो तो उसका विवरण एवं अनुशंसा।

6. यदि अन्य कोई विषय हो तो उसका विवरण एवं अनुशंसा।

अतिथि विद्वानों का व्याख्यान

हस्ताक्षर अध्ययन मंडल अध्यक्ष एवं समस्त सदस्य

1. Dr. Abhay Mishra, Prof & Head Applied Physics MITS, Gwalior.

2. Professor Dr. MADAN MOHAN BAJAJ,
CHANCELLOR: INTERNATIONAL KAMDHENU AHIMSA UNIVERSITY,
A122, VIKASPURI, NEW DELHI 110018
Mobile: 09182 93910

3. P. Rajaram, Professor, School of studies in Physics, Jiwaji University, Gwalior

4 Dr. Subhash C. Kaushik
Head, Dept of Physics & Comp. Sc.
Govt. P.G College (Auto.) Datia. M.P. 475661

5. Prof. A.K. Shrivastava
Dept Physics, Jiwaji Univ. Gwalior-474011

6 Prof. V. G. Telang
HOD Physics 474002

7) Meenal Gokhale

8) Sukriti Ghosh

9) Gajendra Raipuriya

सत्र - 2016 - 2017 के External Examiner की सूची

(1) Dr. U. P. Verma
(2) Dr. P. Rajaram
(3) Dr. A.K. Shrivastav
(4) Dr. D.C. Gupta
(5) Dr. Neeraj Jain
(6) Dr. R.K. Tiwari
(7) Dr. S.C. Kaushic
(8) Dr. Madhukar Upadhaya
(9) Dr Neelam Bhanagar
(10) Dr. Anju Nagar
(11) Dr. Sharad Bhodoriya
(12) Dr. Sanjeev Chaudhary
(13) Dr. Vijay Gupta
(14) Dr. B.K. Sharma
(15) Dr A.K. Upadhaya
(16) Dr. Hareesh Shrivastav
(17) Dr. S.S. Tomar
(18) Dr. A.K. Bariya
(19) Dr Vandna Chaturvedi
(20) Dr. N.K. Bhardwaj
(21) Dr. Anubha Jain
(22) Dr. Divakar Shrotiya

28/6/2016 28/6/16 28/6/16 28/06/2016 20.6.16 28.6.2016

28.6.16 Neetu M.C.L.

शासकीय कमलाराजा कन्या स्नातकोत्तर स्वशासी महाविद्यालय ग्वालियर (म.प्र.)
उच्च शिक्षा विभाग म.प्र. शासन
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Examination 2016-2017

B.Sc. (Electronics) I – semester

Components of electronics and Network Theory

M.M- 85

Note- The paper is divided into five units. The examiner should ask at least one question form each unit. Internal choice within the unit must be provided.

Unit –I Basic Components

Resistors: Resistor specifications, classification, linear, non linear resistors & its types, color code, tasting of resistor.

Inductor; types of inductor, symbols

Capacitor; specification, classification of capacitor; fixed, variable electrostatic and electrolytic and its types.

Unit –II A.C. Circuits

A.C. current and voltage and phase relation RMS and mean value, operator and it's application to ac circuit, phase diagram of LR,CR,LCR circuits (series resonant and parallel resonant circuit) choke coil.

Unit –III Network theorems and analysis

Kirchoff's current & voltage laws, voltage divison rule, current division rule. Principle of duality, reduction of a complicated network to T & Pi section. Application to electrical superpsition, recipriocity, Thevenin, Norton, maximum power transfer theorem (their derivation & application to electrical circuits)

Unit –IV Semiconductors and P.N. junction

Electron energy band theory in crystals, Insulators, Conductors and Semiconductors, types of semiconductors. Qualitative analysis of intrinsic & extrinsic semiconductors. Idea of drift and diffusion current, P.N. Junction barrier formation, biasiny of P.N. Junction, derivation of barrier potential and depiction width, Diode equation, I-V characteristics, junction capacitance, idea of zener and avalanche break down. Zener diode, LED, LCD,PHOTO Diode.

Unit –V Transistors

JEET; its construction, working, characteristics, comparison between FET &

BJT; construction, operation, characteristics in different configuration, thermal runway and heat sink.

MOSFET;types, depletion and enhancement type, working, characteristics.

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B.Sc. (Electronic) II Semester

Biasing Techniques and Instrumentation

M.M-85

Note- The paper is divided into five units. The examiner should ask at least one question from each unit. Internal choice within the units must be provided.

Unit-I Transistor biosing

Biasing of transistor, D C operating point (Q-point) and load line. Drawing of DC load line, factors affecting stability of Q-point, stability factor, different basing methods fixed bias (base bias), emitter feedback bias, collector feedback bias, self bias emitter bias, load line, Q-point and thermal stability in each case.

Unit –II BJT amplifier and circuit approximation

Transistor as an amplifier in CE, CB, CC and their relation merits and demerits of each configuration, current and voltage gain in different configuration and relation between them. Transistor as a black box, h-parameters and theirs measurements analysis of CE amplifier and emitter follower on the basis of h-parameters, input impendence current and voltage gain, output impendence and power gain.

Unit –III Idea of thyristors family

Dias, Triac, SCS, SCR and UJT construction, biasing and operation of SCR, elementary idea of SCR in power control and speed control, UJT its use as saw tooth generator.

Unit –IV Transformer

Basic transformer, Transformer construction, core type transformer, shell type transformer mutual induction, Elementary theory of an ideal transformer, voltage and current relationship, fundamental equation of transformer, Idea of single phase, mains, auto, isolation and instrument transformer, transformer losses, testing of transformer, open circuit or no load test.

Unit –V Analog meters and measuring instruments

Galvanometer sensitivity, Ammeter shunt dc voltmeter sensitivity and loading effect, series and shunt type ohmmeter, millimeter, calibration of dc instrument, ac meters electrody namometer, movements and its use in single phase watt meters, rectifier type ac instrument, watt hour meter, power factor meter frequency meter. Meghahm Bridge and very high impedance measurement.

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B.Sc. III Sem. Electronics
power supply, Operational Amplifier and oscillator

The paper is divided in five units

Unit I – Operational Amplifier

Theory of Differential Amplifier, DC and AC analysis of Differential Amplifier, differential gain, common mode again, CMRR Ideal opamp, Transfer characteristics, opamp characteristics, Input offset voltage Input offset Current input bias current Frequency Response Slew rate and power band width Idea of inverting and non inverting voltage and current feedback, Virtual ground inverting and non inverting voltage amplifier, voltage follower, adder and subtractor, integrator, differentiator, half wave rectifier, peak detector, clamper, comparator, window comparator, Schmitt trigger, waveform generator.

Unit – II Rectifiers, filters and regulators

Semiconductor diode as a rectifies series inductor, choke, shunt capacitor, LC pie type filters, their effect on ripple factor and regulation, comparative merits and demerits, basic principle of voltage regulation, temperature compensation in zenar regulator, emitter follower regulator, series pass regulator, series and parallel feedback regulator.

Unit – III MULTISTAGE AND POWER AMPLIFIER

Various types of coupling in amplifier, R-C, L-C transformer & direct coupling, their merits & demerits, RC couple amplifier, its working & its analysis, frequency response & effect of cascading on bandwidth, class A, B, AB, C operation (graphical explanation, their specific uses), AC load line, classification of power amplifier, class A power amplifier characteristics, power relations & its efficiency, class b power amplifier & its characteristics, power relation & its efficiency, class A class B push pull amplifier (without derivation), introduction to class c amplifier.

Unit – IV FEEDBACK

Feedback in amplifier, principle of feedback amplifier, advantage of negative feedback in amplifier, voltage current feedback circuit, derivation of input & output resistance in voltage & current series feedback in amplifier, gain stability, increased distortion, decreased noise, comparison of feedback connection.

Mrs Bajaj
Director

Unit – V OSCILLATORS

Comparison between an amplifier & an oscillator, classification of oscillators, application of sinusoidal oscillators, nature of sinusoidal oscillators, oscillatory circuit, frequency of oscillatory circuit, frequency stability of oscillator, positive feedback, the barkhausen criterion for sustained oscillations, basic principle of RC oscillator, phase shift oscillator, RC & wein bridge oscillator (qualitative study only), RF oscillators, Hartley oscillator, colpitt's oscillator (qualitative study only).

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B. Sc. IV SEM

OSCILLOSCOPE AND WAVESHAPING

Unit – I OSCILLOSCOPEO

oscilloscope block diagram (basic ORC circuit) ORT early CRT electrostatics energy reflection electrostatics deflection, post deflection acceleration, screen for CRT, CRT circuit vertical deflection system horizontal deflection system, function of delay time, multiple input or display, samplings oscilloscope, storage and digital storage oscilloscope.

Unit – II TRNSDUCERS

classification of transducer, selecting a transducer, strain gauge factor, basic requirement of transducer, idea of displacement transducer, capacitive & inductive transducer (their advantages & disadvantages & uses), variable differential transducer, piezoelectric transducer, potentiometric transducer, velocity transducer, resistance thermometer, thermocouple, thermister (characteristics & application), hall effect transducer.

Unit – III NON SINUSOIDAL OSCILLATOR

Transistor as a switch, transistor switching times, factors contributing to various time delay in a transistor, multivibrator, types of multivibrator, a stable, monostable & bitable multivibrator, Schmitt trigger.

Unit – IV LINEAR & NONLINEAR WAVESHAPING

The high pass RC circuit, high pass RC circuit as a differentiator, low pass RC circuit as a integrator, applications of integrating and differentiating circuit, PN junction diode switching times, diode clipper circuit, shunt diode clippers, series diode clipper, comparison of series & shunt diode clippers, double ended PN junction clipper, double ended clipper using zener diode clamping circuit voltage multipliers.

Unit – V TIMEBASE CIRCUIT

General features of a time base circuit, types of time base circuit, methods of generating a time base waveforms, exponential sweep circuit , sweep circuit using transistor switch, sweep circuit using unijunction transistor switch, a transistor constant current sweep, miller sweep circuit, bootstrap sweep circuit current time base generation.

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B. Sc. V SEM (ELEX)

DIGITAL ELECTRONICS & COMMUNICATION

Unit – 1: Number System

Number sys & codes: Decimal to binary addition, subtraction, complement, representation of no's binary multiplication & Division, Hexadecimal & Octal no. system, Binary Decimal no., gray codes and xs – 3 code, Gates and inverters : OR gate, AND gate, NAND gate, XOR gate, Boolean Function & truth tables for Boolean Function, Boolean Algebra, DeMorgan theorem, Vitchkarnaugh map method, SOP & POS Method to simplify Boolean function, TTLCkts, Digital Integrated Ckts: Specification 7400 Series, TTL NAND, TTL characteristics, AND, OR, INVERTER, Open collector gate, ECL, MOS, CMOS Logic.

Unit – 2: Combinational & sequential ckts

Encoder, Decoder, Mux, Demux, Half Adder, Full Adder, Half substracter, Full substracter, Parallel Binary Adder, BCD Adder, Parity Bit generator/ checker, Flip – Flops : RS, JK, Master slave, D & T, Conversion of FFS latch, Register : Shift registers, Counters:

Asynchronous, ripple counter, synchronous counter, up down counter, ring counter.

Unit – 3: Transmission Lines

Transmission lines: characteristic impedance, current & voltage equation, propagation constant, attenuation constant, distortion lines, reflection in a lines & reflection coefficient in distortion less VSWR.

Unit – 4: Amplitude Modulation

Types of Modulation, principle of amplitude modulation, methods of amplitude modulation, linear, square, balanced modulator, Double side band suppressed carrier modulation DSBSC: balanced modulator, ring modulator, Single side band generation: filter method, phase cancellation method, advantages & disadvantages of ssb transmission.

Unit – 5: Frequency Modulation

Frequency modulation, characteristics of FM waves, analysis of FM waves, Comparison of FM & AM, idea of phase modulation, principle of AM detection & classification of AM detecters, envelop diode detecter: linear diode detecterckt, frequency.

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B. Sc. 6 SEM (ELEX)

SMICROPROCESSSOR & COMMUNICATION

Unit – 1: Memory

Memory parameters (word, addressing, access time), S.C. RAM, bipolar RAM,

MOSRAM (dynamics & static), organization of S.C. memory chip, ROM, diode matrix ROM, Bipolar

ROM, MOSRAM, PROM, Idea of Cache memory, FD, HD, Charge coupled devices,

Architecture, systembus, ALU register, PC, Flags, timing & control unit, Up operational, block diagram of 8085, pin diagram of 8085, address bus, data bus.

Unit – 2: Electronics & Data Instruments

Electronics D.C. & A.C. Voltmeter, balanced bridge voltmeter VTVM, differecialvoltmeter, Amplified D.C. meter, chopperstablizedamplifier, true RMS RESPONDING VOLTMETER, Digital voltmeter, general characteristics, RAMP type, stair case, interfacing screen, seven segment display, Digital frequency meter R – 2R ladder type, D/A conversion, weighted register type, A/D conversion, counter type, dual slope type, sample & hold ckt.

Unit – 3: Principle of Wave Propagation

Troposphere, classification of ionosphere, means of radio wave propogation from transmitting of receiving stations, idea of space wave

Propogation, troposphericreflection, fading, dualpropogation, propogation of EM waves in absence of magnetic field through ionosphere.

Unit – 4: Transmitters & receivers

RF Transmission & band width, AM transmitter, frequency modulated transmitter, phase modulated type FM transmitter, process of phase modulation (Armstrong modulation), comparison of FM and AM system, characteristics of receivers, Amplitude modulated receivers (super heterodyne receivers), single side band receivers, superiority of FM reception over AM reception, frequency modulated receiver, phase lock loop and AFC.

M.Ed

Mr Bajaj Neeta

Unit – 5: Television

Principle of image transmission and reception, pick up instruments – iconoscope, imageadicon, vidicon, image scanning sequence, composite video signal, synchronizing circuit, TV Transmitter and receivers, vestigial side band transmission, vertical and horizontal deflection system, idea of color TV.

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Class : **B.Sc.**
Semester : **I**
Subject : **Physics**
List of Practicals

For Regular Students

Practical	Sessional	Viva	Total
25	10	15	50

For Ex – Students

Practical	Sessional	Viva	Total
35	00	15	50

1. To verify laws of parallel and perpendicular axes for moment of inertia.
2. To determine acceleration due to gravity using compound pendulum.
3. To determine damping coefficient using a bar pendulum.
4. To determine Young's Modulus by bending of beam method.
5. To determine Young's Modulus using Cantilever method.
6. To determine coefficient of rigidity by static method.
7. To determine coefficient of rigidity by dynamic method.
8. To determine Surface Tension by Jaegar's method.
9. To determine Surface Tension of a liquid by capillary rise method.
10. To determine Viscosity of fluid using Poisellie's method.
11. To plot displacement/velocity/acceleration as a function of time using M.S. Excel or C++.
12. To plot gravitational energy as a function of distance between two particles with different masses using M.S. Excel or C++.

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उच्च शिक्षा विभाग म.प्र. शासन
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Class : **B.Sc.**
Semester : **II**
Subject : **Physics**

List of Practicals

For Regular Students

Practical	Sessional	Viva	Total
25	10	15	50

For Ex – Students

Practical	Sessional	Viva	Total
35	00	15	50

1. To study conversion of mechanical energy into heat using Calender & Barne's method.
2. To determine heating efficiency of electrical Kettle with various voltages.
3. To determine heating temperature coefficient of resistance using platinum resistance thermometer.
4. To determine thermo electromotive force by a thermocouple method.
5. To determine heating efficiency of electrical Kettle with various voltages.
6. To determine heat conductivity of bad conductors of different geometry by Lee's method.
7. To verify Newton's Laws of cooling.
8. To determine specific heat of Coefficient of thermal conductivity by Searl's method.

9. To determine specific heat of a liquid.

10. To compare Maxwell-Boltzmann, Bose Einstein and Fermi-Dirac Distribution function vs temperature using M.S. Excel / C++.

11. To plot equation of state and Vander-wall equation with temperature using M.S. Excel / C++.

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Class : **B.Sc.**
Semester : **III**
Subject : **Physics**
List of Practicals

For Regular Students

Practical	Sessional	Viva	Total
25	10	15	50

For Ex – Students

Practical	Sessional	Viva	Total
35	00	15	50

List of Experiments:

1. Study of interference using biprism.
2. Study of diffraction at straight edge.
3. Use of plane diffraction grating to determine D_1, D_2 lines of Sodium lamp.
4. Resolving power of telescope.
5. Polarization by reflection and verification of Brewster's Law.
6. Study of optical rotation in Sugar solution.
7. Refractive index and dispersive power of prism using spectrometer.
8. Absorption spectrum of material using constant deviation spectrograph.
9. Beam divergence of He-Ne Laser.
10. Determination of wavelength of Laser by diffraction.
11. Determination of radius of curvature of plano-convex lense by Newton's rings.

शासकीय कमलाराजा कन्या स्नातकोत्तर महाविद्यालय [illegible]
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-Class : **B.Sc.**
Semester : **IV**
Subject : **Physics**

List of Practicals

For Regular Students

Practical	Sessional	Viva	Total
25	10	15	50

For Ex – Students

Practical	Sessional	Viva	Total
35	00	15	50

List of Experiments:

1. Characteristics of a Ballistic galvanometer.
2. Setting up and using an electroscope or electrometer.
3. Measurement of low resistance by Carey-Foster bridge or otherwise.
4. Measurement of inductance using impedance at different frequencies.
5. Measurement of capacitance using, impedance at different frequencies.
6. Response curve for LCR circuits and response frequencies.
7. Sensitivity of a cathode- ray oscilloscope.
8. Use of a vibration magnetometer to study a field.
9. Study of Magnetic field due to current using Tangent Galvanometer.
10. Study of decay of currents in LR and RC circuits.
11. Study of Lissajous figures using CRO.

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Class : **B.Sc.**
Semester : **V**
Subject : **Physics**

List of Practicals

For Regular Students

Practical	Sessional	Viva	Total
25	10	15	50

For Ex – Students

Practical	Sessional	Viva	Total
35	00	15	50

List of Experiments:

1. Determination of Planck's constant.
2. Determination of e/m using Thomson's method.
3. Determination of e by Millikan's method.
4. Study of spectra of hydrogen and deuterium (Rydberg constant and ratio of masses of electron to proton).
5. Absorption spectrum of iodine vapour.
6. Study of alkali or alkaline earth spectra using concave grating.
7. Study of Zeeman effect for determination of Lande g-factor.
8. Study of Raman spectrum using laser as an excitation source.
9. Calculation of energy states of Hydrogen and Deuterium.
10. To draw B-H curve of ferro-magnetic material with the help of CRO.
11. Study of half wave and full wave rectification.

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Class : **B.Sc.**
Semester : **VI**
Subject : **Physics**
List of Practicals

For Regular Students

Practical	Sessional	Viva	Total
25	10	15	50

For Ex – Students

Practical	Sessional	Viva	Total
35	00	15	50

List of Experiments:

1. Characteristic of a transistor.
2. Characteristic of a tunnel diode.
3. Hysteresis curve a transformer core.
4. Hall probe method for measurement of resistivity.
5. Specific resistance and energy gap of a semiconductor.
6. Study of regulated power supply.
7. Study of RC coupled amplifiers
8. Analysis of a given band spectrum.
9. Study of crystal faces.
10. Characteristics of Zener diode.
11. Charging and discharging of capacitor.

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Mr Bajaj

Neeta

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Class	**: B.Sc.**
Max. Marks	**: 85 + (CCE) 15 = 100**
Semester	**: II**
Subject	**: Physics**
Title of Paper	**: Thermodynamics and Statistical Physics**

Unit-I: Thermodynamics - I उष्मागतिकी –I **[15 Lectures]**

Reversible and irreversible process, Heat engines, Definition of efficiency, Carnot's ideal heat engine, Carnot's cycle, Effective way to increase efficiency, Carnot's engines and refrigerator, Coefficient of performance, Second law of thermodynamics, Various statements of Second law of thermodynamics, Carnot's theorem, Clapeyron's latent heat equation, Carnot's cycle and its applications.
Steam engine, Otto engine, Petrol engine, Diesel engine.

उत्क्रमणीय एवं अनुत्क्रमणीय प्रक्रम, कार्नो का आदर्श चक्र, इसकी दक्षता बढ़ाने के प्रभावी तरीकें, कानो का उष्मीय इंजन व प्रशीतक, दक्षता गुणांक , उष्मागतिकी का द्वितीय नियम व इसके विभिन्न कथन, कार्नो का प्रमेय, क्लेपरियॉन की गुप्त उष्मा समीकरण, कार्नो चक्र एवं उसके अनुप्रयोग ।
उष्मीय इंजिन, ऑटो इंजिन, पेट्रोल इंजिन, डीजल इंजिन।

Unit II: Thermodynamics-II उष्मागतिकी –II **[15 Lectures]**

Concept of entropy, Change in entropy in adiabatic process, Change in entropy in reversible cycle. Principle of increase of entropy, Change in entropy in irreversible process.

T-S diagram, Physical significance of Entropy, Entropy of a perfect gas, Kelvin's thermodynamic scale of temperature, The size of a degree, Zero of absolute scale, Identity of a perfect gas scale and absolute scale.
Third law of thermodynamics, Zero point energy, Negative temperatures (not possible), Heat death of the universe.
Relation between thermodynamic variables (Maxwell's relations).

एन्ट्रापी की संकल्पना, रूद्धोष्म प्रक्रम में एन्ट्रापी का परिवतर्न , चक्रीय प्रक्रम में एन्ट्रापी का परिवर्तन, एन्ट्रापी के वृद्धि का सिद्धांत , उत्क्रमणीय व अनुत्क्रमणीय प्रक्रम में एन्ट्रोपी का परिवतर्न ।

T-S आरेख, एन्ट्रापी का भौतिक महत्व, आदर्श गैस की एन्ट्रापी, केलवीन का उष्मागतिक ताप पैमाना, परम
पैमाने का शून्य ताप, आदर्श गैस व परम ताप पैमाने में साम्यता।
उष्मागतिकी का तृतीय नियम, शून्य बिन्दू उर्जा, ऋणात्मक तापक्रम (सम्भव नही), ब्रहमाण्ड की उष्मीय समाप्ति।
उष्मागतिकी चरों में संबंध (मेक्सवेल के समीकरण)।

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28.6.16

M.M.Bajaj

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Unit-III: Statistical Physics-I सांख्यिकीय भौतिकी–**I** **[15 Lectures]**

Description of a system: Significance of statistical approach, Particle-states, System-states, Microstates and Macro-states of a system, Equilibrium states, Fluctuations, Classical & Statistical Probability, The equi-probability postulate, Statistical ensemble, Number of states accessible to a system, Phase space.

Micro Canonical Ensemble, Canonical Ensemble, Helmholtz free energy, Enthalpy, First law of thermodynamics, Gibbs free energy, Grand Canonical Ensemble.

निकाय का वर्णनः सांख्यिकीय अवधारणा का महत्व, कण की अवस्थाऐं, निकाय की सूक्ष्म एवं स्थूल अवस्थाऐं, साम्य अवस्थाऐं, विचलन, चिरसम्मत व सांख्यिकी प्रायिकता, पूर्व प्रायिकता सिद्धान्त, सांख्यिकी एन्सेम्बल, किसी निकाय के लिये अभिगम्य अवस्थाऐं, कला आकाश।

माइक्रो केनोनीकल एन्सेम्बल, केनोनीकल एन्सेम्बल, हेल्मोल्टज मुक्त उर्जा, एन्थलपी, ऊष्मागतिकी का
प्रथम नियम, गिब्स मुक्त उर्जा, ग्रेंड केनोनीकल एम्सेम्बल.

Unit-IV: Statistical Physics-II सांख्यिकीय भौतिकी–**II** **[15 Lectures]**

Statistical Mechanics: Phase space, The probability of a distribution, The most probable distribution and its narrowing with increase in number of particles,

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Maxwell-Boltzmann statistics, Molecular speeds, Distribution and mean, r.m.s. and most probable velocity, Constraints of accessible and inaccessible states.
Quantum Statistics: Partition Function, Relation between Partition Function and Entropy, Bose-Einstein statistics, Black-body radiation, The Rayleigh-Jeans formula, ThePlanck radiation formula, Fermi-Dirac statistics, Comparison of results, Concept of Phase transitions.

सांख्यिकी यांत्रिकी : कला आकाश, वितरण की प्रायिकता, अधिकतम संभाव्य वितरण व इसका कणों की
संख्या बढ़ने पर संकुचन, मेक्सवेल बोल्टजमैन सांख्यिकी, आणविक चाल का वितरण, औसत चाल, वर्ग–माध्य–मूल चाल और अधिकतम प्रसम्भाव्य वेग , प्रतिबंध, अभिगम्य एवं अनअभिगम्य अवस्थाओं के प्रतिबंध।

क्वांटम सांख्यिकी : पार्टीशन फलन, एंट्रापी व पार्टीशन फलन में संबंध, बोस आइन्सटीन सांख्यिकी, कृष्ण
पिण्ड विकिरण, रेले जीन्स सूत्र , प्लांक विकिरण सूत्र , फर्मी–डिराक सांख्यिकी, परिणामों की तुलना, फेस
संक्रमण की संकल्पना।

Unit-V: Life and Contributions of Physicists (भौतिकविदों का जीवन परिचय व उनका योग दान) **[15 Lectures]**

S.N. Bose, M.N. Saha, Maxwell, Clausius, Boltzmann, Joule, Wien, Einstein, Planck, Bohr, Heisenberg, Fermi, Dirac, Max Born, Bardeen.

Useful links for Unit-V:

1. http://en.wikipedia.org/wiki/History of Physics
2. http://en.wikipedia.org/wiki/Nobel Prizes in Physics

एस.एन. बोस, एम.एन. साहा, मैक्सवेल , क्लासियस, बोल्टजमैन , जूल , वीन, आइन्सटीन, प्लांक , बोहर,
हाईजनबर्ग, फर्मी, डिराक, मेक्सबार्न, बार्डीन।

Text and Reference Books:

1. **Heat and Thermodynamics:** Mark W. Zemansky, Richard H. Dittman, Seventh Edition, McGraw-Hill International Editions.

2. **Thermal Physics (Heat & Thermodynamics):** A.B. Gupta, H.P. Roy, Books and Allied (P) Ltd, Calcutta.
3. **Heat and Thermodynamics:** Brijlal and N. Subrahmanyam, S. Chand & Company Ltd, New Delhi.
4. **Thermal and Statistical Physics:** K.M. Jain, South Asian Publication.
5. **Concept of Physics:** H.C. Verma, Bharati Bhavan Publishers.

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28.6.16

Mhu Bajaj

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Semester : **III**
Subject : **Physics**
Title of Paper : **Optics**

Unit-I **[15 Lectures]**

Geometrical Optics

Reflection and refraction: Fermat's Principle, Refraction at a spherical surface, Aplanatic points and its applications, Lens formula, Combination of thin lenses and equivalent focal length.

Optical instruments: Dispersion and dispersive power, chromatic aberration and achromatic combination, different types of aberration (qualitative) and their remedy. Need for multiple lenses in eyepieces, Ramsden and Huygens eye-piece.

Unit-II **[15 Lectures]**

Interference of light

The principle of superposition, two slit interference, coherence requirement for the sources, optical path retardations, Lateral shift of fringes, Rayleigh refractometer and other applications. Localised fringes, thin films, interference by a film with two nonparallel reflecting surfaces, Newton's rings.

Haidinger fringes (Fringes of equal inclination), Michelson interferometer, its application for precision determination of wavelength, wavelength difference and thewidth of spectral lines. Intensity distribution in multiple beam interference, Fabry-Perot interferometer and Etalon.

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Unit-III

[15 Lectures]

Diffraction

Fresnel diffraction: Fresnel's theory of half period zone, diffraction at straight edge, rectilinear propagation.

Fraunhoffer diffraction: Diffraction at a slit, phasor diagram and integral calculus methods. Diffraction at a circular aperture and a circular disc, Rayleigh criterion of resolution of images. Resolving power of telescope and microscope. Outline of phase contrast microscopy.

Diffraction Grating: Diffraction at N-parallel slits, Intensity distribution, Plane diffraction grating, Concave grating and its mountings. Resolving power of a grating and comparison with resolving power of prism and of a Fabry Parot etalon.

Unit-IV

[15 Lectures]

Polarisation

Transverse nature of light waves, Polarization of electromagnetic (em) waves, Plane polarised light – production and analysis, Description of Linear, circular and elliptical polarisation.

Propagation of em waves in anisotropic media, uniaxial and biaxial crystals, symmetric nature of dielectric tensor, Double refraction, Hygen's principle, Ordinary and extraordinary refractive indices, Fresnel's formula, light propagation in uniaxial crystal, Nicol prism, Production of circularly and elliptically polarized light, Babinet compensator and applications, Optical rotation, Optical rotation in liquids and its measurement through Polarimeter.

Unit-V

[15 Lectures]

Lasers and Photo Sensors

A brief history of lasers, characteristics of laser light, Einstein prediction, Relationship between Einstein's coefficients (qualitative discussion only), Pumping schemes, Resonators, Ruby laser, He-Ne laser, Applications of lasers, Principle of Holography.

28.6.16

Mr. Bajaj
Lecturer

Light Sensors: Photodiodes, Phototransistors, and Photomultipliers.

References Books *(for Unit-I to Unit-IV)*:

1. Fundamentals of Optics: F.A. Jenkins and H.E. White, 1976, McGraw-Hill.
2. Principles of Optics: B.K. Mathur, 1995, Gopal Printing.
3. Fundamentals of Optics: H.R. Gulati and D.R. Khanna, 1991, S.Chand Publication.
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उच्च शिक्षा विभाग म.प्र. शासन
स्नातक स्तर पर सेमेस्टर पद्धति के अन्तर्गत एकल प्रश्न पत्र प्रणाली अनुसार पाठयक्रम
केन्द्रीय अध्ययन मण्डल द्वारा अनुशंसित तथा म.प्र. के महामहिम राज्यपाल द्वारा अनुमोदित
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Class	**: B.Sc.**
Max. Marks	**: 85 + (CCE) 15 = 100**
Semester	**: III**
Subject	**: Physics**
Title of Paper	**: Optics (प्रकाशिकी)**

इकाई–1 **[15 Lectures]**

ज्यामितीय प्रकाशिकी

परावर्तन और अपवर्तन: फर्मेट का सिद्धांत, गोलाकार सतह पर अपवर्तन, अपलेनेटिक बिन्दु एवं अनुप्रयोग , लैंस सूत्र , पतले लैंसों का संयोजन व समतुल्य फोकस दूरी।

प्रकाशीय उपकरण: विक्षेपण व विक्षेपण क्षमता, वर्ण विपथन व अवर्णक संयोजन। विभिन्न प्रकार के विपथन (गुणात्मक) एवं उनका समाधान, नेत्रिका में बहुल लैंस निकाय की आवश्यकता। रेम्सडन व हाइगन नेत्रिकाएं।

इकाई–2 **[15 Lectures]**

प्रकाश का व्यतिकरण

अध्यारोपण का सिद्धांत , द्विस्लिट व्यक्तिकरण, स्त्रोतों की कला संबद्धता की आवश्यकता, प्रकाशीय पथ का मंदन, फ्रिजों का पार्श्विक विस्थापन, रेले का रिफ्रेक्ट्रोमीटर व अन्य अनुप्रयोग ,स्थानीकृत फ्रिंजे, पतली फिल्म, दो असमानान्तर परावर्तक सतह से बनी फिल्म से व्यतिकरण, न्यटून वलय।

हैडिन्जर फ्रिंजे (समान झुकाव की फ्रिंजे) , माइकल्सन व्यतिकरणमापी, इसके द्वारा प्रकाश की

M.Cl 28.6.16

Mrs Bajaj Neetu

तरंगदैर्ध्य (λ), दो अत्यंत समीपस्थ तरंगदैर्ध्य का अंतर तथा वर्णक्रम रेखा की चौड़ाई का परिशुद्ध निर्धारण। बहुल पुंज व्यतिकरण में तीव्रता का वितरण, फेब्री पैरो व्यतिकरणमापी एवं इटालॉन।

इकाई–3 **[15 Lectures]**

विर्वतन

फ्रेनल विर्वतनः फ्रेनल के अर्द्धकालिक कटिबंध का सिद्धांत, सीधी कोर पर विर्वतन, सरलरेखीय गमन।

फ्रानहॉफर विर्वतनः एकल झिरी पर विर्वतन का आरेख एवं समाकलन विधिया, वृत्तीय द्वारक, वृत्तीय चकती पर विवर्तन, प्रतिबिम्बों के विभेदन की रैले की कसौटी। दूरदर्शी व सूक्ष्मदर्शी की विवेदन क्षमता, फेज़ कन्ट्रास्ट सूक्ष्मदर्शी की सामान्य रूपरेखा।

विवर्तन ग्रेटिंग : N समानान्तर झिर्रियों पर विवतर्न , तीव्रता विवरण, समतल विवर्तन ग्रेटिंग , परावतर्न ग्रेटिंग, अवतल ग्रेटिंग व विभिन्न आरोपण विधियाँ। ग्रेटिंग की विभेदन क्षमता तथा इसकी प्रिज्म व फेब्री पैरो इटलॉन की विभेदन क्षमता से तुलना।

इकाई–4 **[15 Lectures]**

ध्रुवण

प्रकाश तरंग की अनुप्रस्थ प्रकृति, विद्युत चुम्बकीय तरंग का ध्रुवण, समतल ध्रुवित प्रकाश – उत्पादन व विश्लेषण। रेखिक, वृत्तीय व दीर्घवृत्तीय ध्रुवण का वर्णन।

विद्युत चुम्बकीय तरंग का असंमागी माध्यम में संचरण, एक–अक्षीय व द्वि–अक्षीय क्रिस्टल, परावैद्युत टेन्सर की सममित प्रकृति, द्वि–अपर्वतन, हाइगन का सिद्धांत, साधारण व असाधारण वर्तनांक , फ्रेनल का सूत्र, एक अक्षीय क्रिस्टल में प्रकाश संचरण। निकॉल प्रिज्म, वृत्तीय व दीर्घवृत्तीय प्रकाश का उत्पादन व विश्लेशण, बेबिनटे संकारक व अनुप्रयोग , प्रकाशीय धूर्णन व पोलारीमीटर से इसका मापन।

इकाई–5 **[15 Lectures]**

लेज़र व फोटो सेन्सर्स

लेज़र का संक्षिप्त इतिहास, लेज़र प्रकाश के अभिलाक्षणिक गुण, आइन्सटीन की संकल्पना, आइन्सटीन गुणांको में सम्बन्ध (गुणात्मक विवेचना), पम्पिंग प्रणालियाँ, रेज़ोनेटर्स, रूबी लेज़र , हीलियम–निआन लेज़र, लेज़र के उपयोग, होलोग्राफी का सिद्धांत।

प्रकाश सेन्सर्सः फोटोडायोड , फोटो ट्रांजिस्टर व फोटो मल्टीप्लायर।

28.6.16

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Class : **B.Sc.**
Max. Marks : **85 + (CCE) 15 = 100**
Semester : **IV**
Subject : **Physics**
Title of Paper : **Electrostatics, Magnetostatics and Electrodynamics**

Unit-1 **[15 Lectures]**

Electrostatics

Coulombs law in vacuum expressed in vector forms, calculations of electric field **E** for simple distributions of charge at rest, dipole and quadruple fields. Work done on a charge in an electrostatic field expressed as a line integral, conservative nature of the electrostatic field. Relation between electric field & electric potential ($\mathbf{E} = -\nabla V$), torque on a dipole in a uniform electric field and its energy, flux of the electric field, Gauss's law and its application for finding **E** for symmetric charge distributions, Gaussian pillbox, fields at a surface of a conductor,
screening of **E** field by a conductor.

Capacitors, electrostatic field energy, force per unit area of the surface of a conductor in an electric field, conducting sphere in a uniform electric field, point charge in front of a grounded infinite conductor. Dielectrics, parallel plate capacitor with a dielectric, dielectric constant, polarization and polarization vector **P**, relation between displacement vector **D**, **E** and **P**.
Molecular interpretation of Claussius-Mossotti equation, boundary conditions satisfied by **E** and **D** at the interface between two homogenous dielectrics, illustration through a simple example.

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Unit-2 **[15 Lectures]**

Magnetostatics

Force on a 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 gyromagnetic ratio, Biot and Savart's law, calculation of **H** for simple geometrical situations such as Solenoid, Anchor ring. Ampere's Law, $\nabla \times \mathbf{B} = \mu 0 \mathbf{J}$, $\nabla . \mathbf{B} = 0$. Field due to a magnetic dipole, free and bound currents, magnetization vector (**M**), relationship between **B**, **H** and **M**. Derivation of the relation $\nabla \times \mathbf{M} = \mathbf{J}$ for non-uniform magnetization.

Unit-3 **[15 Lectures]**

Current Electricity and Bio electricity

Current Electricity: Steady current, current density **J**, non-steady currents and continuity equation, Kirchoff's laws and analysis of multiloop circuits, growth and decay of current in LR and CR circuits, decay constants, LCR circuits. AC circuits, complex numbers and their applications in solving AC circuits problems, complex impedance and reactance, series and
parallel resonance. Q-factor, power consumed by an A.C. circuit, power factor, Y and Δ networks and transmission of electric power.

Bioelectricity: Electricity observed in living systems, Origin of bioelectricity, Sodium and potassium transport, Resting potential and action potential, Nernst's equation, Conduction velocity, Origin of compound action potential, Neuron structure and function, An axon as cable, Membrane resistance and capacitance.

Unit-4 **[15 Lectures]**

Motion of Charged Particles in Electric and Magnetic Fields

(Note: The emphasis here should be on the mechanical aspects and not on the details of the apparatus mentioned which are indicated as applications of principles involved.)

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E as an accelerating field, electron gun, discharge tube, linear accelerator. **E** as deflecting field - CRO, Sensitivity of CRO. Transverse **B** field; 180° deflection, Mass spectrograph and velocity selector, Curvatures of tracks for energy determination for nuclear particles; Principle and working of Cyclotron.
Mutually perpendicular and parallel **E** & **B** fields; Positive ray parabolas, Discovery of isotopes, Elements of Mass Spectrographs, Principle of magnetic focusing (lenses).

Unit-5

[15 Lectures]

Electrodynamics

Electromagnetic induction, Faraday's Laws, Electromotive force, Integral and differential forms of Faraday's laws, Self and mutual inductance, Transformers, Energy in a static magnetic field, Maxwell's displacement current, Derivations of Maxwell's equations, Electromagnetic field energy density.

Poynting vector, Electromagnetic wave equation, Plane electromagnetic waves in vacuum and dielectric media, Reflection at a plane boundary of dielectrics, Fresnel's Laws, Polarization by reflection and total internal reflection, Waves in a conducting medium, Reflection and refraction by the ionosphere.

References:

1. **Introduction to Electrodynamics:** David J. Griffiths, 4th Edition, Printice Hall.
2. **Classical Electrodynamics:** Jhon David Jackson, Jhon Wiley & Sons.
3. **Electrodynamics:** Emi Cossor & Bassin Lorraine, Asahi Shimbunsha Publishing Ltd.
4. **From Neuron to Brain:** Kuffler and Nicholas, Sinauer Associates, Inc Pub. Sunderland, Masschuetts *(Reference for topics of Bioelectricity)*

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इकाई–1 **[15 Lectures]**

स्थिरविद्युतिकी

निर्वात में कूलम्ब का नियम – सदिश रूप में, विद्युत क्षेत्र **E** की स्थिर आवेश के सरल द्विध्रुव व चतुर्ध्रुव आधूर्ण वितरण हेतु गणना। स्थिर विद्युत क्षेत्र में किसी आवेश पर किया गया कार्य एवं उसे रेखिक समाकलन रूप में लिखना, स्थिर विद्युत क्षेत्र की संरक्षी प्रकृति। विद्युत क्षेत्र और विभव में संबंध ($\mathbf{E} = -\nabla V$), एक समान विद्युतीय क्षेत्र में द्विध्रुव का आधूर्ण व इसकी उर्जा। विद्युत क्षेत्र का फ्लक्स, गॉस का नियम व इसका सममित आवेश वितरण हेतु **E** के परिकलन में उपयोग । गॉसियन पीलबाक्स, चालक की सतह पर क्षेत्र, चालक द्वारा **E** क्षेत्र की स्क्रीनिंग ।

संधारित्र, स्थिर विद्युत क्षेत्र उर्जा, किसी विद्युत क्षेत्र में रखे चालक की सतह के इकाई क्षेत्रफल पर उर्जा, समरूप विद्युत क्षेत्र में गोलकार चालक, किसी पृथ्वीकृत अनन्त चालक के सम्मुख बिन्दु पर आवेश। पराविद्युत, पराविद्युत की उपस्थिति में समानांतर प्लटे संधारित्र, परावैद्युतांक ध्रुवण व ध्रुवण सदिश **P**, विस्थापन सदिश **D**ए **P** एवं **E** में संबंध, क्लासियस–मोसाटी समीकरण की आणविक व्याख्या, दो समांगी माध्यमों की सतह पर **E** व **D** सदिश द्वारा सीमांत शर्तो का संतुष्टीकरण, उदाहरण द्वारा व्याख्या।

Mm Bajaj Neeta
28.6.16

इकाई–2

[15 Lectures]

स्थिर चुम्बकत्व

किसी गतिमान आवेश पर बल, लारेंज बल समीकरण एवं **B** की परिभाषा, सीधे धारावाही चालक को चुम्बकीय क्षेत्र में रखने पर बल, धारा लूप पर बल आधूर्ण, चुम्बकीय बल आधूर्ण, कोणीय संवेग व जाइरोमैग्नेटिक अनुपात, बायोट–सेवार्ट का नियम, सरल ज्यामितीय परिस्थितियों में **H** की गणना (परनलिका एवं एंकर वलय), एम्पीयर का परिपर्थीय नियम, $\nabla\times\mathbf{B} = \mu 0\mathbf{J}$ व $\nabla.\mathbf{B} = 0$, चुम्बकीय द्विध्रुव द्वारा बद्ध व मु त धाराएँ, चुम्बकन सदिश **(M)**; **B, H** एवं **M** में संबंध, असमरूप से चुम्बकित पदार्थ हेतु $\nabla\times\mathbf{M} = \mathbf{J}$ का निगमन।

इकाई–3

[15 Lectures]

विधुत धारा व बायो – इलेक्ट्रीसिटी

स्थाई धारा, धारा घनत्व **J**, अस्थाई धारा समीकरण एवं सांतत्य समीकरण, किरचॉफ के नियम व मल्टीलूप परिपथ विश्लेशण, LR व CR परिपथ में धारा की वृद्धि व क्षय, क्षय–नियतांक , LCR परिपथ। AC परिपथ, सम्रिश्र संख्याएं और उनके अनुप्रयोग द्वारा AC परिपथ में सम्रिश्र प्रतिबाधा, रीएक्टेंस , श्रेणी एवं समानांतर अनुनाद को हल करना। Q गुणांक , AC परिपथ द्वारा शक्ति का उपयोग , शक्ति गुणांक , Y एवं Δ नेटवर्क व विद्युत शक्ति का प्रेषण।

जैव विद्युतः जैविक निकायों में विद्युत का अवलोकन, जैव विद्युत की उत्पति, सोडियम और पोटेशियम परिवहन, स्थिर विभव एवं क्रियात्मक विभव, नर्नस्ट समीकरण, चालक वेग , यौगिक क्रिया विभव की उत्पति, तंत्रिका कोशिका की रचना एवं कार्य, केबल के रूप में एक्सॉन, झिल्ली विभव एवं धारिता।

इकाई–4

[15 Lectures]

विद्युत व चुम्बकीय क्षेत्र में अविशित कणों की गति

(यहाँ उपकरणों के वर्णन की अपेक्षा उनके यांत्रिकीय पक्ष पर अधिक ध्यान दिया जाना चाहिए।)

त्वरण क्षेत्र के रूप में **E**, इलेक्ट्रान गन, विर्सजन नलिका, रेखीय त्वरक, **E** विक्षेपक क्षेत्र के रूप में CRO, CRO की सुग्राहिता। अनुप्रस्थ **B** क्षेत्र ; 180° विचलन, द्रव्यमान स्पेक्ट्रोग्राफ या वेग सिलेक्टर, नाभिकीय कणों के संसूचन हेतु कणों के पथों की वक्रता, साइक्लोट्रॉन (उर्जा मापन) का सिद्धांत व कार्य पद्धति, समानान्तर व लम्बवत **E** व **B** क्षेत्र, धन–किरण के परवलय, आइसोटोप की खोज , द्रव्यमान स्पेक्ट्रोग्राफ के मूल तत्व, चुम्बकीय फोकस का सिद्धांत (लैंस)।

इकाई–5

[15 Lectures]

विद्युत गतिकी

विद्युत चुम्बकीय प्रेरण, फेराडे के नियम, विद्युत बाहक बल, फेराडे नियम के अवकलन व समाकलन रूप, स्वः व अन्योन्य प्रेरण, ट्रान्सफार्मर, स्थिर विद्युत क्षेत्र में उर्जा, मेक्सवैल की विस्थापन धारा घनत्व की संकल्पना, मैक्सवेल की समीकरणों की स्थापना, विद्युत चुम्बकीय क्षेत्र का उर्जा धनत्व।

पॉयंटिग सदिश, विद्युत चुम्बकीय तरंग समीकरण, निर्वात एवं परावैधुत माध्यम में समतल विद्युत चुम्बकीय तरंग , परावैद्युत की समतल सतह से परावर्तन, फ्रेनेल के नियम, परावतर्न से ध्रुवण व पूर्ण आंतरिक परावर्तन, चालक माध्यम में तरंग, आयनमण्डल के द्वारा परावर्तन व अपवर्तन।

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शासकीय कमलाराजा कन्या स्नातकोत्तर स्वशासी महाविद्यालय ग्वालियर (म.प्र.)
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Session- 2016–17

Class : **B.Sc.**
Max. Marks : **85 + (CCE) 15 = 100**
Semester : **V**
Subject : **Physics**
Title of Paper : **Quantum Mechanics and Spectroscopy**

Unit-I: **15 Lectures**

QUANTUM MECHANICS-1

Particles and Waves: Photoelectric effect. Black body radiation. Compton effect. De Broglie hypothesis. Wave particle duality. Davisson-Germer experiment. Wave packets. Concept of phase and group velocity. Two slit experiment with electrons. Probability. Wave amplitude and wave functions. Heisenberg's uncertainty principle with illustrations. Basic postulates and formalism of Schrodinger's equation. Eigenvalues. Probabilistic interpretation of wave function. Equation of continuity. Probability current density. Boundary conditions on the wave function. Normalization of wave function.

Unit-II: **15 Lectures**

QUANTUM MECHANICS-2

Time independent Schrodinger equation: One dimensional potential well and barrier.Boundary conditions. Bound and unbound states. Reflection and transmission coefficients for a rectangular barrier in one dimension. Explanation of alpha decay. Quantum phenomenon of tunneling. Free particle in one-dimensional box, eigen functions and eigen values of a free particle. One-dimensional simple

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harmonic oscillator, energy eigen values from Hermite differential equation, wave function for ground state. Particle in a spherically symmetric potential. Rigid rotator. Orbital angular momentum, azimuthal quantum numbers and space quantization. Radial solutions and principle quantum number. Hydrogen atom.

Unit-III: **15 Lectures**

ATOMIC SPECTROSCOPY

Atoms in electric and magnetic fields: Quantum numbers, Bohr model and selection rules. Stern-Gerlach experiment. Spin as an intrinsic quantum number. Incompatibility of spin with classical ideas. Orbital angular momentum. Fine structure. Total angular momentum. Pauli exclusion principle. Many particles in one dimensional box. Symmetric and anti-symmetric wave functions. Atomic shell model. Spectral notations for atomic states. Spin-orbit coupling, Vector model L-S and J-J coupling. Doublet structure of alkali spectra. Zeeman effect. Continuous and characteristic X-rays. Mossley's law.

Unit-IV: **15 Lectures**

MOLECULAR SPECTROSCOPY

Spectra: Various types of spectra. Rotational spectra. Intensity of spectral lines and determination of bond distance of diatomic molecules. Isotope effect. Vibrational energies of diatomic molecules. Zero point energy. Anharmonicity. Morse potential. Raman effect, Rotational Raman spectra and Vibrational Raman spectra. Stokes and anti-Stokes lines and their intensity difference. Electronic spectra. Born-Oppenheimer approximation. Frank- Condon principle, singlet and triplet states. Fluorescence and phosphorescence.

Unit-V: **15 Lectures**

NUCLEAR PHYSICS

Interaction of charged particles and neutrons with matter, working of nuclear detectors, G-M counter, proportional counter, Scintillation counter, Cloud chamber.

Basic properties of nucleus: Shape, Size, Mass and Charge of the nucleus. Stability of the nucleus and Binding energy. Alpha particle spectra – velocity and energy of alpha particles. Geiger-Nuttal law. Nature of beta ray spectra. The neutrino. Energy

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levels and decay schemes. Positron emission and electron capture. Selection rules. Beta absorption and range of beta particles. Kurie plot. Nuclear reactions, pair production. Q-values and threshold of nuclear reactions. Nuclear reaction cross-sections. Examples of different types of reactions and their characteristics. Compound nucleus, Bohr's postulate of compound nuclear reaction, Semi empirical mass formula, Shell model, Liquid drop model, Nuclear fission and fusion (concepts).

References:

1 Quantum Mechanics: V. Devanathan, Narosa Publishing House, New Delhi, 2005.

2 Quantum Mechanics: B. H. Bransden, Pearson Education, Singapore, 2005.

3 Quantum Mechanics: Concepts and Applications, Nouredine Zettili, Jacksonville State University, Jacksonville, USA, John Wiley and Sons, Ltd, 2009.

4 Introductory Quantum Mechanics & Spectroscopy: K.M. Jain, South Asian Publications.

5 Physics of Atoms & molecules: B.H. Bransden & C.J. Joachaim, Pearson Education, Singapore, 2003

6 Fundamentals of Molecular Spectroscopy: C.M. Banwell & M. McCash, McGraw Hill (U.K. edition)

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इकाई–1 **15 Lectures**

क्वाटंम यांत्रिकी–1

कण एवं तरंग : प्रकाश विद्युत प्रभाव, कृष्ण पिण्ड विकिरण, क्राम्पटन प्रभाव, डी–ब्रोगली परिकल्पना, तरंग –कण द्वैतता, डेवीस जर्मर प्रयोग , तरंग पैकेट , तरंग व समूह वेग की अभिधारणा, इलेक्ट्रॉन का द्वि–स्लिट प्रयोग , प्रायिकता, तरंग आयाम व तरंग फलन, हाइजऩ बर्ग का अनिश्चितता का सिद्धांत व उदाहरण, श्रोडिंज़र समीकरण व उसकी मूलभूत अवधारणाएँ। आइगन मान, तरंग फलन की प्रायिकता आधारित व्याख्या, सातत्य समीकरण, प्रायिकता धारा धनत्व, तरंग फलन पर सीमांत शर्ते। तरंग फलन का प्रसामान्यीकरण।

इकाई–2 **15 Lectures**

क्वाटंम यांत्रिकी–2

समय अनिर्भर श्रोडिंज़र समीकरणः एक–विमीय विभव कूप व प्राचीर, सीमांत शर्ते, बद्ध व अबद्ध अवस्थाएँ, आयाताकार प्राचीर (I-D) से परावर्तन व पारगमन गुणांक । α–क्षय की व्याख्या, सुरंगन की क्वाटंम घटना। एक–विमीय बाक्स में मुक्त कण, मुक्त कण हेतु आइगन फलन एवं आइगन मान। एक विमीय सरल आवर्त दौलित्र, हरमाइट अवकल समीकरण से उसके आइगन मान, मूल अवस्था का आइगन फलन, गोलीय सममित विभव में कण, दृढ़ धूर्णक, दृढ. अक्षीय कोणीय संवेग , एजीमूथल क्वांटम संख्या, स्पेस क्वांटीकरण, त्रिज्यीय हल, मुख्य क्वांटम संख्यांक , हायड्रोजन परमाणु।

Dr. Bajaj
28.6.16

इकाई–3 **15 Lectures**

परमाणु स्पेक्ट्रोस्कापी

विद्युतीय व चुम्बकीय क्षेत्र में परमाणु – क्वांटम संख्यांक , बोहर मॉडल व वरण (Selection) के नियम, स्टर्न–गर्लक प्रयोग , चक्रण – मूलभूत (Intrinsic) क्वांटम संख्या। चक्रण की चिरसम्मत सिद्धांत से असंगति। कक्षीय कोणीय संवेग , फाइन स्ट्रेक्चर कुल कोणीय संवेग , पाऊली का अपर्वजन सिद्धांत । एक विमीय बाक्स में बहुलकण–सममिती व असममिती तरंग फलन, परमाणु कोश मॉडल। परमाण्वीय अवस्था हेतु स्पेक्ट्रमी संकेतन, स्पिन आरबिट कपलिंग, वेक्टर परमाणु मॉडल, L-S व J-J युग्मन, क्षारीया–स्पेक्ट्रम में द्विक संरचना। ज़ीमन प्रभाव। सतत व अभिलाक्षणिक X- किरण स्पेक्ट्रा, मोसले का नियम।

इकाई–4 **15 Lectures**

आणविक स्पेक्ट्रोस्कापी

विभिन्न प्रकार के स्पेक्ट्रा (वर्णक्रम), धूर्णी स्पेक्ट्रा, वर्णक्रम रेखाओं की तीव्रता व द्वि–परमाणविक अणु की बद्ध दूरी, समस्थानिक प्रभाव/द्वि–परमाणविक अणु की कम्पन उर्जा, शून्य बिन्दु उर्जा, अनहार्मोनिसीटी (अनावृति)। मोर्स विभव, रमन प्रभाव, धूर्णी व काम्पनिक रमन प्रभाव। स्टोक व प्रति स्टोक रेखाएँ व इनकी तीव्रता, इलेक्ट्रॉनिक वर्णक्रम। बार्न ऑपनहायमर सन्निकटता, फ्रेंक कार्डन सिद्धांत, एकल व त्रिक अवस्थाएँ, प्रतिदीप्ति व स्फुरदीप्ति।

इकाई–5 **15 Lectures**

नाभिकीय भौतिकी

नाभिक के मूलभूत गुणः न्युट्रॉन तथा आवेशित कणों की द्रव्य के साथ अनुक्रिया, नाभिकीय संसूचक–आयनन कोष्ठ, गाइगर मूलर गणक, अनुपातिक गणक, प्रस्फुरण गणक, अभ्रकोष्ठ। नाभिक के मूल गुण, नाभिक की आकृति, संहति, आवेश तथा आकार, नाभिक का स्थायित्व एवं बंधन ऊर्जा, अल्फा–कण का वेग एवं ऊर्जा, गाइगर–नेटल नियम, बीटा–किरण वर्णक्रम की प्रकृति, न्यूट्रिनो, ऊर्जा स्तर एवं क्षय पद्धति, पोजीट्रान उत्सर्जन एवं इलेक्ट्रॉन प्रग्रहण, चयन (वरण) नियम, बीटा अवशोषण एवं बीटा कण का परास, क्यूरी आरेख, नाभिकीय अभिक्रियाएँ, युग्म उत्पादन, Q- मान एवं नाभिकीय अभिक्रिया की देहली, नाभिकीय अभिक्रिया का अनुप्रस्थ काट, विभिन्न प्रकार की अभिक्रियाओं के उदाहरण एवं अभिलाक्षणिक, यौगिक नाभिक, यौगिक नाभिकीय अभिक्रिया की बोहर अभिकल्पना, अर्धमूलानुपाती सूत्र, द्रव बूंद मॉडल, कोश मॉडल, नाभिकीय विखंडन एवं संलयन।

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Class	**: B.Sc.**
Max. Marks	**: 85 + (CCE) 15 = 100**
Semester	**: VI**
Subject	**: Physics**
Title of Paper	**: SOLID STATE PHYSICS AND DEVICES**

Unit-I: **15 Lectures**

SOLID STATE PHYSICS-1

Crystal Structure and bonding: Crystalline and amorphous solids. Translational symmetry. Lattice and basis. Unit cell. Reciprocal lattice. Fundamental types of lattices (Bravias Lattice). Miller indices Lattice planes. Simple cubic. Face centered cubic. Body centered cubic lattices. Laue and Bragg's equations. Determination of crystal structure with X-rays, X-ray spectrometer. Ionic, covalent, metallic, van der Waals and hydrogen bonding. Band theory of solids. Periodic potential and Bloch theorem. Kronig-Penny model (Qualitative).

Unit-II:

SOLID STATE PHYSICS-2 **15 Lectures**

Lattice structure and properties: Dulong Petit, Einstein and Debye theories of specific heats of solids. Elastic and atomic force constants. Dynamics of a chain of similar atoms and chain of two types of atoms. Optical and acoustic modes. Electrical resistivity. Specific heat of electron. Wiedemann-Franz law. Hall effect. Response of substances in magnetic field, dia-, para- and ferromagnetic materials. Classical Langevin theory of dia and paramagnetic domains. Curie's law. Weiss'

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theory of ferromagnetism and ferromagnetic domains. Discussion of BH hysteresis.

Unit-III:

15 Lectures

SEMICONDUCTOR DEVICES-1

Electronic devices: Types of Semiconductors (p and n). Formation of Energy Bands, Energy level diagram. Conductivity and mobility. Junction formation, Barrier formation in p-n junction diode. Current flow mechanism in forward and reverse biased diode (recombination), drift and saturation of drift velocity. Derivation of mathematical equations for barrier potential, barrier width. Single p-n junction device (physical explanation, current voltage characteristics and one or two applications). Two terminal devices. Rectification. Zener diode. Photo diode. Light emitting diode. Solar cell. Three terminal devices. Junction field effect transistor (JFET). Two junction devices. Transistors as p-n-p and n-p-n. Physical mechanism of current flow. Characteristics of transistor.

Unit-IV:

15 Lectures

SEMICONDUCTOR DEVICES-2

Amplifiers (only bipolar junction transistor). CB, CE and CC configurations. Single stage CE amplifier (biasing and stabilization circuits), Q-point, equivalent circuit, input impedance, output impedance, voltage and current gain. Class A, B, C amplifiers (definitions). RC coupled amplifiers (frequency response). Class B push-pull amplifier. Feedback amplifiers. Voltage feedback and current feedback. Effect of negative voltage series feedback on input impedance. Output impedance and gain. Stability, distortion and noise. Principle of an Oscillator, Barkhausen criterion, Colpitts, RC phase shift oscillators. Basic concepts of amplitude, frequency and phase modulations and demodulation.

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Unit-V:

15 Lectures

NANO MATERIALS

Mrs Bajaj
Neeta

Nanostructures: Introduction to nanotechnology, structure and size dependent properties. 3D, 2D, 1D, 0D nanostructure materials and their density of states, Surface and Interface effects. Modelling of quantum size effect. Synthesis of nanoparticles - Bottom Up and Top Down approach, Wet Chemical Method. Nanolithography. Metal and Semiconducting nanomaterials. Essential differences in structural and properties of bulk and nano materials (qualitative description). Naturally occurring nano crystals. Applications of nanomaterials.

References:

1 Introduction to Solid State Physics, C. Kittel, VIIIth Edition, John Wiley and Sons, New York, 2005.

2 Intermediate Quantum theory of Crystalline Solids, A. O. E. Animalu, Prentice–Hall of India private Limited, New Delhi 1977

3 Solid State Physics, N. W. Ashcroft, and N. D. Mermin, Harcourt Asia (P) Ltd. 2001

4 The Physics and Chemistry of Nanosolids: Frank J. Owens, and Charles P. Poole Jr., Wiley Inter Science, 2008

5 Physics of Low Dimensional Semiconductors: An introduction; J.H. Davies, Cambridge University Press, U.K., 1998

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इकाई–1 **15 Lectures**

ठोस अवस्था भौतिकी

क्रिस्टलीय, सरंचना एवं आबंधनः क्रिस्टलीय व अक्रिस्टलीय ठोस, स्थानांतरण सममिति, जालक व आधार, इकाई सेल , व्युत्क्रम जालक, जालकों के मौलिक प्रकार (ब्रेवाइस लेटिस), मिलर सूचकांक, जालक तल। सरल घनाकार, फलक केन्द्रित घनाकार, अन्तः केन्द्रित घनाकार लेटिसेस। लॉवे व ब्रगे का समीकरण, X- किरणों से क्रिस्टल की संरचना ज्ञात करना, X-किरण स्पेक्ट्रममापी। आयनिक, सह–संयोजक, धात्विक वॉण्डरवाल एवं हायड्रोजन बंधन। ठोस पदार्थो के लिए बैण्ड सिद्धांत , आवर्ती विभव एवं ब्लॉच प्रमेय । क्रोनिंग–पैनी मॉडल (गुणात्मक विवेचना)।

इकाई–2 **15 Lectures**

जालक संरचना एवं गुण

विशिष्ट उष्मा का ड्यूलोंग –पेटिट, आइन्सटीन व डिबाई सिद्धांत , प्रत्यास्थ एवं परमाण्विक बल नियतांक । एक परमाण्विक व द्विपरमाण्विक कड़ी (Chain) का गतिक समीकरण, प्रकाशीय व ध्वनिकी विधाएँ, विद्युतीय प्रतिरोधकता, इलेक्ट्रॉन की विषिष्ट उष्मा, वाइडमेन –फ्रेंज नियम। हॉल प्रभाव, चुम्बकीय क्षेत्र में पदार्थों की अनुक्रिया। प्रति, अनु एवं लौह चुम्बकीय पदार्थ। प्रति एवं अनु चुम्बकीय डोमेन्स का चिरसम्मत सिद्धांत । क्यूरी का नियम, लौह चुम्बकत्व एवं लौह चुम्बकीय डोमेन्स के लिए Weiss का सिद्धांत। B-H शैथिल्यता की विवेचना।

इकाई–3 **15 Lectures**

अर्धचालक युक्तियां– 1

28.6.16

ऊर्जा बैण्डों का बनना, ऊर्जा स्तर का डायग्राम, अर्धचालक के प्रकार (p व n), चालकता और गतिशीलता, संधि का बनना, p-n संधि, डायोड में रोधिका विभव का बनना, अग्र व पश्च अभिनति डायोड में धारा प्रवाह (पुनः संयोजन), अनुगमन वेग व अनुगमन वेग की संतृप्तता, रोधिका विभव के गणितीय समीकरण की व्युत्पत्ति, रोधिका चौड़ाई, एकल p-n संधि । डायोड (भौतिकीय विवेचना), धारा–विभव अभिलाक्षणिक (एक–दो अनुप्रयोग), द्वि–टर्मीनल युक्ति, दिष्टकरण, जेनर डायोड, फोटो डायोड, प्रकाष उत्सर्जक डायोड, सोलर सेल, त्रि–टर्मीनल युक्ति, संधि क्षेत्र प्रभाव ट्रांजिस्टर (JFET) द्वि–संधि युक्तियाँ, p-n-p व n-p-n ट्रांजिस्टर, धारा–प्रवाह की भौतिकीय प्रक्रिया, ट्रांजिस्टर के अभिलाक्षणिक वक्र।

इकाई–4

अर्धचालक युक्तियां– 2 **15 Lectures**

प्रवर्धक (द्वि–ध्रुव संधि ट्रांजिस्टर) CB, CE व CC विधा, एकल स्टेज (चरण) CE प्रर्वधक (अभिनन व स्थायीकरण परिपथ), Q बिन्दु समतुल्य परिपथ, निवेशी व निर्गत प्रतिबाधा, विभव एवं धारा लाभ।

वर्ग A, B, C प्रवर्धक (परिभाषा), RC युग्मित प्रवर्धक (आवृत्ति अनुक्रिया वक्र), वर्ग–B पुश–पुल प्रवर्धक, पुर्ननिवेशन प्रवर्धक, विभव एवं धारा, पुर्ननिवेशन, निवेशी प्रतिबाधा पर ऋणात्मक विभव, श्रेणी फीडबेक, निर्गमन प्रतिबाधा एवं लाभ। स्थायित्व, विकृति व शोर, दोलित्र का सिद्धांत तथा बार्क–हाउसन का प्रतिबन्ध, कॉलपिट दोलित्र RC कला विस्थापी दौलित्र, आयाम, आवृति एवं कला माडुलेशन एवं संसूचक की मूल अवधारणा।

इकाई–5

नैनो पदार्थ **15 Lectures**

नैनों संरचनाएंः नैनो टेक्नॉलाजी की प्रस्तावना, संरचना, आकार निर्भर गुण। 3D, 2D, 1D, 0D नैनो सरंचना प्रदार्थ एवं उनकी अवस्थाओं का घनत्व, सतह एवं अंतराफलक प्रभाव, क्वांटम आकार प्रभाव का प्रतिरूपण, नैनो कणों का संश्लेशण–नीचे से ऊपर (बॉटम अप) और ऊपर से नीचे (टॉप डाउन) विधियॉं, वेट रसायनिक विधि, नैनो लिथोग्राफी (नैनो मुद्रण), धातु एवं अर्द्ध चालकों के नैनो पदार्थ (गुणात्मक विवरण), विस्तृत (Bulk) और नैनो पदार्थों की संरचना एवं गुणों में अन्तर (गुणात्मक विवरण), प्राकृतिक रूप में पाये जाने वाले नैनो क्रिस्टल। नैनो पदार्थों के अनुप्रयोग।

M.C. 28.6.16

Mm Bajaj

Neeta

PT – 101 METHODS IN MATHEMATICAL PHYSICS

Max. Marks: 85 **Pass Marks: 29**

Note: This paper has been divided into FIVE units. The paper will be set as per existing examination norms covering uniformly all the units and providing to the examinee sufficient choice in each unit.

Unit –I Tensor Analysis

Definition of Tensor and its rank, Transformation laws of covariant, contra variant and mixed tensors, Fundamental Operations with tensors (addition, subtraction and multiplication), Inner and outer product, Contraction of tensors, Associated tensors, Christoffel symbols, covariant differentiation of tensor.

Unit – II Elements of Complex Variable

Functions of a complex variable, the derivative and the Cauchy-Riemann differential equations, line integrals of complex functions, Cauchy's integral theorem, Cauchy's integral formula, Taylor's series, Laurent's series, residues; Cauchy's residue theorem, singular points of an analytic function, the point at infinity, evaluation of residues, evaluation of definite integrals, Jordon-Lemma.

Unit –III Theory of Fourier and Laplace Transforms

Fourier series analysis, evaluation of constants, Fourier sine, cosine and complex transforms, transforms of derivatives, Convolution theorem, Parseval's relation, Momentum representation: examples from optics, Electromagnetism and quantum mechanics, Laplace transforms of simple function and derivatives, LT solution of simple differential equations, convolution theorem.

Unit – IV Special Functions

Singularity structure of a general second order homogenous differential equation: ordinary points, regular and irregular points, indicial equation, the point at infinity, series expansion method for solving differential equations, series solutions, generating functions and recurrence relations and orthogonality of Legendre and Hermite polynomials.

Unit – V Partial Differential Equations

Laplace equation, 2-D study flow of heat, circular harmonics, conducting cylinder in a uniform field, the potential of a ring, the potential about a spherical surface, the equation of heat, conduction or diffusion, variable linear flow, two-dimensional heat conduction, temperature inside a circular plate.

BOOKS RECOMMENDED

1) Applied Mathematics for Engineers and Physicist : Pipes
2) Mathematical Physics : Harper
3) Advanced Engineering Mathematics : Kreyszig
4) Schaum Series for Transforms, Complex Variables and Tensors
5) Mathematical Methods : Arfken
6) Elements of Complex variables : Churchill

M.A 28.6.16

Mr. Bajaj

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PT – 103 **CLASSICAL MECHANICS**

Max. Marks: 85 **Pass Marks: 29**

Note: This paper has been divided into FIVE units. The paper will be set as per existing examination norms covering uniformly all the units and providing to the examinee sufficient choice in each unit.

Unit –I Lagrangian Mechanics

Mechanics of a particle, Mechanics of a system of particles, Constraints, Generalized coordinates, De Alembert's principle and Lagrangian equations, Lagrangian for a charged particle in an electromagnetic field, application of Lagrangian formulation to (a) single particle in space, (b) Atwood's machine.

Unit –II Variational Principle

Hamilton's principle, some techniques of the calculus of variation, application to (a) geodesics in a plane (b) minimum surface of revolution, Derivation of Lagrange's equation from Hamilton's principle, Conservation laws and corresponding symmetry principles

Unit –III Two body central force problem and scattering

Reduction of two body force problem to the equivalent one body problem, the equation of motion and the first integrals, classification of orbits, the virial theorem, the Kepler problem, scattering in a central force field, Rutherford scattering, transformation of the scattering problem to laboratory coordinates.

Unit –IV Small oscillations

Formulation of the problem, the eigen value equation, frequencies of free vibration, free vibration of a linear tri atomic molecule, transition from a discrete to a continuous system, the Lagarangian formulation for continuous system.

Unit –V Transformation and equation of motion

Lagendre transformations and the Hamilton equations of motion, cyclic coordinates and conservation theorem, Hamilton's equation from variational principle, equation of canonical transformation, Poisson brackets: Definition and identity relation, equation of motion and conservation theorem in the Poisson bracket formulation, the Hamilton-Jacobi equation for Hamilton's principal function, the Harmonic oscillator problem as an example of Hamilton-Jacobi method.

BOOKS RECOMMENDED

1. Classical Mechanics : Goldstein
2. Classical Mechanics : Takwale

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PT – 103 **ELECTROMEGNATISM AND LASER OPTICS**

Max. Marks: 85 **Pass Marks: 29**

Note: This paper has been divided into FIVE units. The paper will be set as per existing examination norms covering uniformly all the units and providing to the examinee sufficient choice in each unit.

Unit- I **Application of Maxwell Equations**

Maxwell's equation, Field energy, Poynting theorem, Plane wave solution of Maxwell's equations, Reflection and Refraction at a plane boundary of dielectrics, Polarization by reflection and total internal reflection, waves in a conducting medium, Reflection and refraction by the ionosphere.

Unit-II **Electromagnetic Waves in Anisotropic Medium**

The dielectric tensor of an anisotropic medium, structure of a monochromatic plane wave in an anisotropic medium: The phase velocity and the ray velocity, Fresnel's formulae for the propagation of E.M. wave in crystals, Geometrical constructions for determining the velocities of propagation and directions of vibrations, optical properties of uniaxial and biaxial crystals: The optical classification of crystals, E.M wave propagation in uniaxial crystals.

Unit- III **Electromagnetic Wave Interactions**

E.M. wave propagation in biaxial crystals Reflection in crystals: double refraction, internal and external conical refraction, experimental demonstration of double refraction and conical refraction, Acoustic-optic interaction: Raman-Nath theory of ultrasonic diffraction of E.M. waves, magneto-optic interaction: Faraday Effect, Electro-optic interaction: Kerr effect, interaction with matter: (a) normal and anomalous dispersion (b) Rayleigh scattering.

Unit- IV **Elements of Laser Physics**

The Laser amplifier: Amplifier gain, amplifier phase shift, Amplifier power source: Rate equation, four and three level pumping schemes, Examples of laser amplifiers, Characteristics of the laser output: Power, spectral distribution, Spatial distribution and polarization, Mode selection, Characteristics of common lasers.

Unit- V **Nonlinear Optics**

Nonlinear optical media, Second order nonlinear optics Second harmonic and rectification, The electro-optics effect, Three-wave mixing, Third order nonlinear optics, Third harmonic generation and self pulse modulation, four wave mixing, optical pulse conjugation.

Books Recommended

1. Introduction of electrodynamics: Griffith
2. Foundation of electromagnetic Theory: Reitz, Millford and Christy.
3. Plasma physics by F.F. Chen
4. Electromagnetic waves and radiation systems: Jordan and ball man
5. Classical electrodynamics: Jackson

M.Cl 28.6.16

PT – 104 **SEMICONDUCTOR ELECTRONICS**

Max. Marks: 85 **Pass Marks: 29**

Note: This paper has been divided into FIVE units. The paper will be set as per existing examination norms covering uniformly all the units and providing to the examinee sufficient choice in each unit.

Unit- I **Biasing Techniques and Linear Amplifier**

Continuity equation and its application to p-n junction under forward and reverse bias, Solution of Continuity equation for reversed and forward biased abrupt p-n junctions, Derivation of Einstein's equation, Load line for a transistor, Location of Q-point for the bipolar transistor, variation of bias current, Fixed and emitter feedback bias, Design idea of emitter feedback bias, Stability index, Stabilization against variation in I_{co}, V_{Be}, and β, The band pass amplifier, High frequency equivalent circuit, RC coupled CE amplifier, its frequency response and gain frequency plot, Gain band product, cascading of amplifiers, common source FET amplifier.

Unit-II **Power Amplifier and Oscillators**

Operating conditions for power amplifier, power relations, The ideal transformer, voltage limitations of the transformer, non-linear distortion, idea of inter modulation distortion, The class A power amplifier, The push-pull amplifier, Feedback requirements of oscillations, Basic oscillator analysis, Harltley and Colpitt oscillators, Piezo-electric, frequency control, RC oscillators.

Unit-III Wave Shaping Circuits

Linear wave shaping, High pass RC circuit, High pass RC circuit as a differentiator, Low pass RC circuit, Low pass RC circuit as a integrator, Non-linear wave shaping, Shunt diode elipper and series diode clippers, Double ended p-n junction and Zener diode clipper circuits, Clamping circuits, Zero level and given level clamping, Fundamentals of voltage and current sweep generators, sweep wave forms, Miler integrating sweep circuits, Blocking and Triggered transistor blocking oscillator

Unit-IV Basics of Differential and Operational Amplifiers

Differential amplifier, Differential amplifier circuit configuration, Dual input balance output differential amplifier, Voltage gain, differential input resistance, inverting and non- inverting inputs, common mode rejection ratio, Operational amplifier, input offset voltage, input offset currents, input bias currents, differential input resistance, input capacitance, offset voltage supply, rejection ratio, Ideal OP Amp, equivalent circuit of an OP Amp, ideal voltage transfer curve, inverting, dual and non-inverting amplifier, measurement of OP Amp Parameters, frequency response.

Unit-V **Application of Operational Amplifier**

Use of OP Amp as sign changer, scale changer, phase shifter, voltage to current converter differential ac amplifier, bridge amplifier, ac voltage follower, analog integration and differentiation, electronic analog computation, Non-linear function generator, series and shunt regulator.

BOOKS RECOMMENDED

1. Electronics Fundamental and Application : J.D. Ryder
2. Solid State Electronic Devices : B.G. Streetman
3. Electronic Principles : Malvino
4. Principals of Microwave : Atwarter
5. Electromagnetic Wave and Radiating System : Jorden and Ballmon
6. Electronic Devices and Circuits: Millman and Halkius

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PT – 201 **CLASSICAL ELECTODYNAMICS, PLASMA AND ANTENNAE PHYSICS**

Max. Marks: 35 **Pass Marks: 12**

Note: This paper has been divided into FIVE units. The paper will be set as per existing examination norms covering uniformly all the units and providing to the examinee sufficient choice in each unit.

UNIT- I **Dipole Radiation**

Maxwell's equations in terms of scalar and vector potential, Gauge transformations: I.orentz gauge and Coulomb gauge, Retarded potentials, Radiation from oscillating electric and magnetic dipoles with simple applications.

UNIT-II **Radiation from a point Charge**

Lienard-Wiechart potentials, Fields due to point charge in uniform and accelerated motions, Power radiated by a point charge (in non relativistic limit), Radiation reaction: Abraham Lorentz formula, Physical origin of the radiation reaction.

UNIT-III **Plasma Physics**

Occurrence of Plasma in nature, Definition of plasma, Concept of temperature, Debay shielding, The Plasma Parameter, Criteria for plasma, plasma diagnostics by Langmuir probe and by microwave techniques, Plasma oscillatings, adiabatic invariants, Plasma confinement by magnetic mirrors and by pinch effect condition for reflection by mirrors.

UNIT-IV **Single Particle Theory & Wave Propagation**

Hydro magnetic description of plasma, Hydro magnetic waves, Magneto sonic and Alfven waves, Motion of charged particle in Electric Magnetic E and B fields, Gravitational field, time varying fields, Phase velocity, Group velocity, Cutoff and resonance for electromagnetic wave propagating parallel and perpendicular to the magnetic field.

UNIT-V **Antenna Arrays**

Two element array, Horizontal pattern in broadcast array, Linear array, Multiplication of patterns, Bionomial arrays, Antenna gain, Effective area; Antenna terminal Impendance, Idea of super directive arrays, Radiation from current sheet.

Books Recommended:

1. Classical Electro dynamics by J.D. Jakson
2. Introduction to plasma physics by F.F. Chen
3. E.M. Waves and Radiating systems by Jorden and Ballman
4. Introduction to Classical Electro dynamics by Griffth

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PT – 202 NONRELATIVISTIC QUANTUM MECHANICS – I

Max. Marks: 35 **Pass Marks: 12**

Note: This paper has been divided into FIVE units. The paper will be set as per existing examination norms covering uniformly all the units and providing to the examinee sufficient choice in each unit.

Unit- I **Fundamentals**

Correspondence principle, Complementarily, Uncertainty, Schrodinger wave equation, Statistical interpretation, Normalization, Probability current density, Expectation value, Ehrenfest's theorem, Eigenfunctions and eigenvalues, Energy eigenfunctions, Separation of the time dependent wave equation, Stationary states, Significance of the separation constant E, Boundary and continuity conditions, Boundary conditions for infinite potential energy, Dynamical variables as operator's, Hermitian operators and their properties, Orthonormality, Free particle solution, One-dimensional step potential (finite and infinite), Particle in a one-dimensional square potential well (finite and infinite), parity, Schmidt orthogonalization, Schwarz inequality, Momentum eigenfunctions, Linear harmonic oscillator parity, zero point energy, Correspondence with classical theory, the rectangular potential barrier.

Unit- II **Three-dimensional systems**

Particle in a three-dimensional box, The Dirac delta-function, Orbital angular momentum, Commutation relations, Eigenfunctions and Eigenvalues of L^2 and L_z, Infinitesimal rotations, Central force problem in three dimensions, Separation of the wave equation, Parity, Series solution, generating functions, recurrence relations and orthogonallity of Laguerre polynomials, Bessel equation, Series solution, Generating function, Integral order, Recurrence relations, Intergral representation, Orthogonality, Neumann functions, Spherical Bessel and Neumann functions (definition only), Bound states in a three- dimensional square potential well, Solution for $l \approx 0$, Interior and exterior solutions for arbitratry 'l', The hydrogen atom, Reduced mass, Asymptotic behavior, Hydrogen atom wave functions, Energy levels, Degeneracy Energy eigenvalues of a three-dimensional harmonic oscillator, Energy eigenvalues of (a) plane rigid rotator (b) 3-D rigid rotator, Partial wave expansion of a free particle wave function.

Unit-III **Matrix Theory**

Postulates of quantum mechanics, Commuting operators and commutator algeora, virial theorem, Derivation of uncertainty through operators Matrix formulation of quantum theory, Liner vector spaces, Vectors and operators, Matrix representation of vectors and operators, Bra and ket notatiom, Projection operator change of basis and unitary operators, matrix theory of the linear harmonic oscillator (energy representation), Raising and lowering operators, Matrix for a, x, p and H, Transformation to coordinate representation, Spin: Pafuli spin matrix and their algebra, matrix formulation of angular momentum, Matrix for J^2 and J_z, Addition of two angular momenta (elementary discussion).

Unit- IV Approximation Methods

The WKB approximation, Classical limit, Approximate solutions, Connection formulae Application to the problem of i) penetration though a potential barrier ii) energy levels in a potential well, Formulation of variational approximation method, Application to helium atom ground state, Linear combination of atomic orbitals, Application to the ground of H_2.

Unit- V Approximation Methods for Bound States – I

Stationary penturbation theory , Nondegenerate case, Formulation upto second order, Penurbation of a linear harmonic oscillator (i) estimation of correction to second order for penturbation terms depending on x and $x^{2\,(ii)}$ first order correction to energy by x^3 and x^4 type terms, Ground state of Helium atom, Stark effect of a plane rigid rotator.

Books Recommended:

1. Quantum Mechanics: L.I Schiff
2. Quantum Mechanics: J.T. Powell Crasemann
3. Quantum Mech. & Field Theory by "Agarwal".
4. Quantum Mechanics A.K. Ghatak and S. Loknathan.
5. Intro. To quantum mechanics by pauling and Wilson.

M. Gokhal 28.6.16

Neeta

PT -203 **CODENSED MATTER PHYSICS – I**

Max. Marks: 35 **Pass Marks: 12**

Note: This paper has been divided into FIVE units. The paper will be set as per existing examination norms covering uniformly all the units and providing to the examinee sufficient choice in each unit.

Unit- I Crystal Structure

A review of concepts of space and crystal lattice, Primitive vectors and cells; Symmetry elements, Miller indices for planes and axes, space groups and point groups, Bragg's law, Construction of reciprocal lattice, reciprocal lattice vectors, Brillion zones, Reciprocal lattice of SC, BBC and FCC, Structural and atomic factors

Unit- II Lattice Dynamics and Thermal Properties

Vibrations of one dimensional monoatomic and diatomic lattices, Quantization of lattice vibrations, Phonon momentum, Qualitative description of phonos in three dimensional lattice, phonon density of states, Einstein and Debye models of lattice specific heat, Anharmonic effects in crystals: thermal expansion of solids, Equation of states of solids, Phonon-phonon interaction and thermal conductivity.

Unit- III Electronic Energy Bands

A brief review of properties of free electron gas, Hall effect, The periodic potentials, Bloch theorem and Born-von Kramer boundary conditions, General remarks about Bloch theorem, Fermi surface, Electron density of states, Kroning-Penny model, Equation for electron wave in a periodic potential: solution of central equation, approximate solution near zone boundary, Construction of Fermi surfaces, The tight binding approximation for bond structure, Effective mass in solids

Unit- IV Elements of Semiconductor Physics

Examples of semiconductors, Typical band structure of a semiconductor, Number of carriers in thermal equilibrium, Intrinsic (non- degenerate) semiconductors, Extrinsic semiconductors, Effect of doping, Impurity levels, Fields and carrier densities in equilibrium, p-n junctions, Elementary picture of rectification by p-n junction.

Unit-V Optical Properties of Solids

Optical reflectance, Kramers-Kroning relations, Electronic intra and inter band transitions, Direct and indirect transitions, Absorption of light in metals and semiconductors, Idea of excitons, Elements of Raman effects in solids, Energy loss by fast moving particle in solids

BOOKS RECOMMENDED

1. Introduction to solid state physics: Kittel
2. Solid State Physics: Ashcroff and Mermin
3. An introduction to x-ray crystallography: woolfson
4. Solid state Physics: Azaroff
5. Intermediate quantum theory of crystalline solids: Aniamalu
6. Solid state Physics: Epifanov

M. Gokhal 28.6.16

Mm Bajaj

Neeta

PT – 204

DIGITAL ELECTRONICS, NUMERICAL ANALYSIS AND COMPUTER PROGRAMMING

Max. Marks: 35

Pass Marks: 12

Note: This paper has been divided into FIVE units. The paper will be set as per existing examination norms covering uniformly all the units and providing to the examinee sufficient choice in each unit.

Unit- I Binary Logic, Digital Switching Circuits, Counter

Binary number systems and other codes, Binary arithmetic, Boolean theorem, synthesis of Boolean functions, Karnaugh diagram, half and full adders, demultiplexers, Multiplexers, D/A and A/D converters.

Transistor as a switch, Clock generator, RS flip flop, T flip flop, JK flip flop, Master- Slave flip flop, Ship register, Ripple counter, Decade counter, up-down counter, divide by counters, Synchronous counters, Applications of counters, Dynamic MOS circuit, two phases of MOS shift register and MOSROM

Unit- II Numerical Solutions, Least Square Fits and Error Analysis

Numerical solutions of Transcedental equations: Bisection method, False Position and Newton Raphson method, Numerical solutions of simultaneous linear equations: Gauss Elimination and Gauss Seidle method, Least Square fits: Linear and polynomial regression, Error analysis: Basic concepts of errors and their types with special reference to numerical methods

Unit-III Interpolation, Numerical Integration and Solution of Differential Equations

Forward, Backward and Central differences and their symbolic relation with shift operator, Newton's forward and backward interpolation, Gauss central difference interpolation formula, Trapezoidal formula and Simpson 1/3 rule, Solution of Differential equation: Picard's method, Eulers and Runga-Kutta methods (second and fourth order)

Unit- IVComputer Programming

Introduction to modern digital computers, Organization to a digital computer, Computer instruction and programs, Motivation of high level languages, Basic elements of any programming language, Arithmetic expressions, operators, Standard arithmetic functions, Input and Output statements, various types of control statements, loops, nesting of loops, concept of main program, subprograms, declarations statements

Unit- V Programming in 'c'

Introduction to modern digital computers, Organization to a digital computer, Computer instruction and programs, Motivation of high level languages, Basic elements of any programming language, Arithmetic expressions, operators, Standard arithmetic functions, Input and output statements, various types of control statements, loops, nesting of loops, concepts of main program, subprograms, declarations statements

Books Recommended

1. Digital principals and applications: Malvino & Leach
2. Electronic Devices and Circuits: Millman and Halkius
3. Numerical Analysis: Rajaram
4. Computer programming by S.S. Sastri
5. Programming in C: Balaguruswami
6. Numerical Computational methods by Patil and Verma

M. Gokhal 28.6.16

Ram Bajaj

Neeta

PT – 301 QUANTUM MECHANICS – II

Max. Marks: 35 **Pass Marks: 12**

Unit- I Approximation methods for bound states-II

Formulation of first order time independent perturbation theory for degenerate levels, Application to first order Stark effect of a hydrogen like atom, Fine structure splitting of atomic energy levels, Zeeman Effect with and without electron spin.

Unit- II Approximation methods for time dependent problems

Time dependent perturbation theory, first order transition probability, constant perturbation, harmonic perturbation, Fermi Golden Rules, Atom in a radiation field, Einstein's A and B coefficients, Plane electromagnetic waves, Electric dipole transitions, selection rules.

Unit- III Identical Particles

Indistinguishability , Exchange degeneracy, Symmetric and antisymmetric wave functions for many particle systems, Spin and statistics, Computation of interaction energy for two-particle systems, Exchange interaction, Application to ground state of a helium-like atom, Structure of wave function for excited states of a helium-like atom, Pauli exclusion principle (qualitative), Collisions of identical particles Allowed states of 2-particle systems.

Unit- IV scattering theory

Scattering cross section, Laboratory and center -of-mass coordinate systems, Transformation of variables from one system to another, asymptotic behavior, scattering b spherically symmetric potentials, Partial waves and phase shifts, Partial wave expansion of differential cross section, Total cross section, Ramsauer- Townsend effect scattering by a perfectly rigid sphere, scattering by a square potential well, Green's functions in scattering theory, Born approximation, Application to scattering by (i) a square potential well (ii) Yukawa potential, Hyper geometric functions, scattering in a coulomb field (separation in parabolic coordinates), Rutherford formula.

Unit-V Elements of relativistic quantum mechanics

Klein – Gordon equation, Free particle solutions, Dirac equation for a free particle, Free particle solution, Negative energy, Hole theory, Reduction of Dirac equation into covariant form, Gamma matrices and their algebra, Existence of spin, Electromagnetic potentials in Dirac equation, Existence of magnetic moment.

Books Recommended:

1. Quantum Mechanics: L.I.Schiff
2. Quantum Mechanics: J.L. Powell and Crasmann\
3. Introduction to Quantum Mechanics: Pauling and Wilson
4. Quantum Mechanics and Field Theon: B.K Agrawal
5. Quantum Mechanics: A.K. Ghatak and S. Loknathan
6. The Principles of Quantum Mechanics: Dirac
7. Practical Quantum Mechanics: Flugge.

M. Gokhal 28.6.16

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PT – 302 **ATOMIC & MOLECULAR PHYSICS AND NUCLEAR INSTRUMENTATION**

Max. Marks: 35 **Pass Marks: 12**

Note: This paper has been divided into FIVE units. The paper will be set as per existing examination norms covering uniformly all the units and providing to the examinee sufficient choice in each unit.

Unit- I **Atomic Physics**

Quantum states of one electron atom, atomic orbitals, Hydrogen spectrum, spectra of alkali elemements, spin orbit interaction and fine structure of alkali spectra, normal and anomalous Zeeman effect, Pschenback effect, Startk effect, two electron system, equivalent and non equivalent electrons, Pauli's exclusion principle, interaction energy, L-S and J-J coupling, Hyperfine structure, line broadening mechanisms.

Unit- II **Rotational Spectra**

Type of molecules: Linear, Non-linear, symmetric top, asymmetric top, spherical top; rotational spectra of diatomic molecules as a rigid rotator, energy level diagram and spectra, rotational spectra of non rigid rotator, energy level diagram and spectra, intensity of rotational lines, applications of rotational spectra and pure rotational spectra.

Unit- III **Vibrational and Vibrational-ratational Spectra**

Vibrational energy of diatomic molecules, diatomic molecule as a simple oscillator, its energy level diagram and spectrum, Morse potential energy curve, molecules as vibrating rotator, vibration spectrum of diatomic molecules, PQR branches, infrared spectrometry, vibrational Raman spectroscopy, structure determination from Raman and IR spectroscopy.

Unit- IV **Fluorescence Spectroscopy**

Vibronic interaction, Herzberg Teller thepry, fluorescence spectroscopy, Kasha's rule, Quantum yield, non radiative transition, Jablonski diagram, time resolved fluorescence and determination of excited state life time.

Unit- V **Nuclear Instrumentation**

Ionization of matter by charge particles, interaction of electromagnetic radiation with matter, stopping power and range, photo electric effect, Compton effect and pair production, radiation detection, gas filled counters, solid state counters, scintillation counter, photomultiplier tube, Cerenkov detector, nuclear emulsions, Betatron, electron sysnchrontron and proton sysnchrotron.

BOOKS RECOMMENDED

1. Introduction to Atomic Physics: H.E. white
2. Fundamentals of Molecular spectroscopy: C.N.Banwell and E.M. Mc Cash
3. Spectra of diatomic molecules: Herzberg
4. Spectroscopy Vol. I&II : Walker and Straughen
5. Nuclear Physics : Kaplan

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PT – 303 **CONDENSED MATTER PHYSICS – II**

Max. Marks: 35

Pass Marks: 12

Note: This paper has been divided into FIVE units. The paper will be set as per existing examination norms covering uniformly all the units and providing to the examinee sufficient choice in each unit.

Unit- I **Point Defects and Alloys**

Lattice vacancies, Interstial and their thermodynamical calculations, Features of point defects, Color centers, Formation of alloys, Order-disorder transformation, Elementary theory of order

Unit- II **Dielectric and Ferroelectric**

Static polarization: various types of polarization, Local fields, Clausius-Mossotti relation, Time dependent polarization and dielectric relation, Lyddane-Sachs-Teller relation, Ferroelectric crystals, Classification of ferroelectric crystals, polarization catastrophe, First and second order phase transitions, Idea of antiferroelecticity, Piezo-electricity and ferroelectricity

Unit-III **Magnetic Properties of Solids**

Quantum theory of paramagnetism and ferromagnetism, exchange integral and Heissenberg interaction, Magnon and magnon dispersion relation, Antiferromagnetic and ferromagnetic orders, Anisotrophy energy, Bloch Walls, Idea of ferrites

Unit- IV **Superconductivity – I**

Concept of superconducting state, Thermodynamical properties of superconductors, London's equation and penetration depths, Magnetic properties and critical magnetic fields, Meissner effect, Flux quantization, Microwave and infrared properties, Conherence length

Unit- V **Superconductivity – II**

Two fluid model for superconductiong state, Ginzburg-Landau theory, Basic features of Piaprd's non local theory, elements of BCS theory of superconductivity, Isotpe effect, Single particle tunneling, DC and AC Josephson effects, Josephson tunneling, a Qualitative description of high Te supercon-ducitvity in ceramic oxides.

BOOKS RECOMMENDED

1. Introduction to solid state physics: Kittel
2. Solid state Physics: Ashcroff and Marmin
3. Solid state Physics: Epicfanov
4. Superconductivity: Parks
5. Intermediate quantum theory of crystalline solids: Animalu
6. Solid state Physics: Zimam

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PT -304A **MICROWAVE AND OPTICAL COMMUNICTION**

Max. Marks:

Pass Marks: 12

Note: This paper has been divided into FIVE units. The paper will be set as per existing examination norms covering uniformly all the units and providing to the examinee sufficient choice in each unit.

Unit- I Microwave Generators and Solid State Devices

Transit time effect at high frequency, failure of triodes/diodes at high frequency, concept of velocity modulation and current modulation, Klystron, Operation and characteristics, Reflex Klytron, Magnetron, Principle of operation and microwave characteristics of Gunn diode and Impatt diode

Unit- II Microwave Propagation and Components

Wave propagation in circular wave-guide, solution of wave guides, power transmission and losses in circular wave guide, Cavity resonators, Wave-guide Tee's (Magic Tee), S- parameters

Unit- III Microwave Integrated Circuits

Characteristics impendence of microstrip lines, effective dielectric constant, Losses in microstrip lines, Dielectric losses, Ohmic losses, Radiation Losses, The quality factor Q of the transmission line, microstrip line discontinuities, idea of capacitance and inductors, Idea of material used for integrated circuit, Brief idea about microwave integrated circuit

Unit-IV Optical Fibers

Basic optical laws and definitions, Optical fiber modes and configuration, Mode theory for circular waveguides, solution of wave equation for index fibers, Power flow in step index fibers, Graded index fibers, Modes in graded index fibers

Unit- V Integrated optics

Idea of modes in asymmetric planer wave guide, strip waveguide, Phase modulators, Mach-Zehnder interferometer modulator, optical directional couples, PIN diode photodetectors, Avalanche photodiode detectors, Idea of optical fiber communication system

BOOKS RECOMMENDED

1. Radio and electrical engineering: Terman
2. Microwave devices and circuits: Lio
3. Microwave: Atwarter
4. Microwave Engineering: Rizzi
5. Microstrip lines: K.C. Gupta
6. Optical fibre system: C.K. Kao
7. Optical fibre communication system: Kaiser
8. Optical fibre communication system: Gower
9. Optical electronics: Ghatak
10. An introduction to optical fibres: Cherian

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PT – 401 **NUCLEAR PHYSICS**

Max. Marks: 35 **Pass Marks: 12**

Note: This paper has been divided into FIVE units. The paper will be set as per existing examination norms covering uniformly all the units and providing to the examinee sufficient choice in each unit.

Unit – I Nucleus its Properties

The constitution of the nucleus and its general properties: proton electron hypothesis, Nucleus as a quantum system, Proton neutron hypotheses, Nuclear mass, Basic components of mass spectroscopy, Mirror nuclei and isotopic spin (introductory), Packing fraction and binding energies, Nuclear radius its determination and interpretation of result (experimental details not required), Natural radioactivity, successive radioactive transformation, radioactive equilibrium, Gamow theory of alpha decay, nuclear spin, parity, magnetic moments, electric dipole and quadruple moments (experimental details not required).

Unit – II Two body Problems

Binding energies and the saturation of nuclear forces, charge independence of nuclear force, the ground state of the deuteron (central forces), Comparison with experimental data on deuteron, Spin dependence of nuclear force, Tensor force, Neutron – Proton scattering length, Spin dependence of nuclear force singlet and triplet potentials, Effect of chemical binding, Coherent scattering of neutrons by protons (scattering by ortho and Para hydrogen), Proton – Proton scattering at low energies (elementary theory), Exchanges force (elementary Yukawa theory).

Unit – III Nuclear Models

Liquid drop model, Semi empirical mass formula, isobaric mass parabola, Nuclear fission, the mass and energy distribution of the fission products, The energy release in fission, Application of liquid drop model to fission, Magic numbers, Single particle model of the nucleus, Spin – orbit coupling, Application to prediction of spin and magnetic moments (Schmidt values).

Unit IV Nuclear Decay

Beta particle spectra, The continuous spectrum, Neutrino hypothesis, Fermi theory of beta – decay (nonrelactivistic), Kurie plots, Comparative half lives, Allowed and forbidden transitions, Selection rules, Symmetry laws and the non – Conservation of parity in beta – decay, Gamma transitions, Multiple moments (mathematical results of theory to be assumed), selection rules conversion (qualitative only), Nuclear isomerism.

Unit– V Nuclear Reactions

Conservation laws for nuclear reactions, Q – value, the compound nucleus, Independence hypothesis, Resonances, Single level Breit – Wigner formula, Direct reaction (introductory ideas about stripping and pickup reactions).

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Books Recommended:

1. Nuclear physics: Kaplan
2. Nuclear physics: Enge
3. Nuclear physics: Evans

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4. Nuclear Physic: Blatt and WIsskopf

PT – 402 INSTRUMENTATION AND COSMIC RAYS

Max. Marks: 35 **Pass Marks: 12**

Note: This paper has been divided into FIVE units. The paper will be set as per existing examination norms covering uniformly all the units and providing to the examinee sufficient choice in each unit.

Unit – I Measurement of Temperature

Temperature scales, mechanical temperature sensors, liquid filled sensors, platinum resistance thermometer, principle and construction of resistance thermometer circuits, thermistors and its measuring circuits, thermocouple and its circuits, solid state sensors, temperature measurement by radiation methods, optical pyrometers.

Unit – II X – Ray spectroscopy and crystal Growth Techniques

X – Ray spectrum, X – Ray generatic equipment, monochromators, powder and single crystal diffractometer, X – Ray absorption meter, basic properties and uses of ESCA, electron problemicroanalyser.

Theories of crystal growth, Growth of single crystals from melt, Czocharlski method, Concept of annealing and quenching, Thin film deposition, Vacuum evaporation and chemical vapour deposition.

Unit – III Biomedical instrumentation

Electrocardiography, ECG amplifiers, electrodes and leads, ECG recorder principles, type of ECG recorders, measurement of blood flow, magnetic blood flow recorder, ultrasonic blood flow meter, principles of ultrasonic measurement, basic modes of transmission, ultrasonic imaging.

Unit – IV Elements of high resolution spectroscopy

Principles of Mossbauer spectroscopy, applications of Mossbauer spectroscopy : chemical shift , quadrupole effects, effect of magnetic field; spin resonance spectroscopy: nature of spinning particles, interaction between spin and magnetic field, Larmor precession; introduction to magnetic resonance spectroscopy and its applications.

Qualitative description of AFM, SEM and TEM.

Unit – V Cosmic Rays

Nature, composition, charge and energy spectrum of primary cosmic rays, production and propagation of secondary cosmic rays, Rossi curve cascade showers, physical properties of elementary particles, fundamental interactions and conservation laws, associated production and strangeness, leptons and hadrons, Quark model – SU(2) and SU(3) MULTIPLETS, Gellmann – Okubo mass formula.

BOOKS RECOMMENDED:

1. Instrumentations devices and system: G.S. Rangan et al
2. Handbook of X – Ray: Kelbel

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PT – 403 STATISTICAL MECHANICS

Max. Marks: 35 **Pass Marks: 12**

Note: This paper has been divided into FIVE units. The paper will be set as per existing examination norms covering uniformly all the units and providing to the examinee sufficient choice in each unit.

Unit-I Micro canonical Ensemble

Concept of μ and ¥ phase spaces, Liouville's theorem, Concept of Gibb's ensembles: micro canonical ensemble, canonical and grand canonical ensembles, Thermo dynamical functions and their relations, Partition function of micro canonical ensembles and its application to (a) classical ideal gas (b) Gibb's paradox, Sackur Tetrode equation

Unit-II Canonical Ensemble

Canonical ensemble, Maxwell Boltzmann distribution, Maxwell's distribution of velocities and speeds, Boltzmann energy equipartition theorem, Rotational and vibrational partition function, their application to diatomic molecules

Unit- III Grand Canonical Ensemble-I

Grand canonical partition function, Derivation of Bose Einstein statistics, Weak and strong degeneracy, Applications of Bose Einstein statistics to Bose Einstein condensation and phase transition, Thermo dynamical properties of an ideal Bose Einstein gas, Liquid helium and its properties, Two fluid model for liquid helium

Unit- IV Grand Canonical Ensemble- II

Grand canonical partition function and derivatives of FD statistics, Application of FD statistics to (a) FD degeneracy of electron gas in metals, Boltzmann transport equation and its application to Sommerfeld theory of electrical conductivity and thermal conductivity: Weidemann-Franz law.

Unit- V Fluctuations

Elementary discussion of fluctuations, fluctuations in ensemble: (Microcanonical, canonical, grand canonical), One-dimensional random walk problem, Brownian motion, Electrical noise: (Nyquist theorem)

Books Recommended

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1. Statistical Mechanics: ESR Gopal
2. Statistical Mechanics; Huang
3. Statistical Mechanics: Mendle

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PT – 404A **INTEGRATED ELECTRONICS**

Max. Marks: 35 **Pass Marks: 12**

Note: This paper has been divided into FIVE units. The paper will be set as per existing examination norms covering uniformly all the units and providing to the examinee sufficient choice in each unit.

Unit-I Materials for Integrated Circuits

Electronic grade Silicon, Purification of metallurgical grade Silicon, Float zone crystal growing method, Czechralski method, Silicon lapping and polishing and Wafer preparation, Vapor phase epitaxy, Liquid phase epitaxy, Oxidation: thermal, dry and wet, Plasma oxidation

Unit-II Integrated circuit fabrication technology

Optical lithography, photo mask, photo resist and process of lithography, idea of electron beam and X-ray lithography, wet chemical etching reactive plasma etching

Unit- III Growth of Thin Films

Evaporation theory, physical vapour deposition method, design construction of high vacuum coating unit, flash electron beam evaporation system, idea of DC sputtering system, idea of thick film circuits.

Unit- IV Diffusion and Ion Implantation

Doping by diffusion, idea of diffusion profile, Error function and Gaussian profile methods, Ion implantation, advantages and disadvantages of ion implantation. Neutron doping, Basic monolithic integrated circuit, Fabrication of integrated and thin film resistor and capacitors: their equivalent circuits, Integrated inductor.

Unit-V Monolithic circuit fabrication

Fabrication of monolithic diodes in various configuration, fabrication of integrated transistors, Idea of buried layer, fabrication, Monolithic circuit layout design rules, isolation method, Monolithic FET, MOS FET processing, advantages and limitations of MOS devices, CCD devices, Idea of large and medium scale Integration.

Books Recommended:

1. Fundamentals of Electronics: Millman and Halkias
2. Fundamental of Electronics: Botkar

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3. Biomedical Instrumentation: I. Cromwell et al
4. Plasma Physics: F.F. Chen

PT – 404B MATERIALS SCIENCE – II

Max. Marks: 35 **Pass Marks: 12**

Note: This paper has been divided into FIVE units. The paper will be set as per existing examination norms covering uniformly all the units and providing to the examinee sufficient choice in each unit.

Unit – I Dislocation and Plastic Deformation of Materials

Concept of dislocation, Dislocation of Movement, Strees field and strain energy of a dislocation, Forces on dislocation and between dislocations, Homogeneous nucleation of dislocations, Typical tensile stress strain curve strength of a material, Work hardening by impurity atoms, yield drops, Shear strength of perfect and real solids, Creeps and their mechanism, Toughness, Fatigue, Methods of observing dislocations (their introduction, merits and demerits).

Unit – II Transport Properties of Solids

Electrical conductivity of metals and alloys, Extrinsic, intrinsic semiconductors and amorphous semiconductors, Scattering of electrons by phonons, impurity etc, Relaxation time, Carrier mobility and its temperature dependence, Mathiesson's rule for resistivity, temperature dependence of metallic resistivity.

Unit – III Degradation of material electronic properties in magnetic field

Mechanism of Oxidation resistant materials, Corrosion and protection against it, classical theory of magneto conductivity, Cyclotron resonance K – Space analysis of motion in uniform magnetic field, de Hass von Alphon effect, Ultrasonic attenuation and skin effect.

Unit – IV Many Electron Problem in Solids

Interacting electron gas; concept of many electron systems, Thomas – Fremi Theory, Hartree and Hartree – Fock approximation, Correlation energy, Lindhardt theory, and Thomas Fermi theory of screening, Plasma oscillations in free electron gas, Dielectric function of an electron gas in random phase approximation, strongly interacting Fermi system, Idea of Landau's quasi – particle theory of Fermi liquid.

Unit – V Electron Phonon interaction And Superconductivity

Interaction of electron with acoustic and optical phonon, polarons, Superconductivity, Manifestation of energy gap, Isotope effect, Cooper Pairing due to Phonons, BCS theory, Ginsburg – Landau theory and application to Josephson effect (D.C. and A.C. both), Macroscopic quantum interference, Vortices and Type II Superconductors, Idea of high TC superconductivity.

BOOKS RECOMMENDED

1. INTRODUCTION TO Dislocations: Hull
2. Material Science and Engineering: Raghwan

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3. Solid State Physics: Ashcroft and Mormin
4. Introduction to Solid Slate Physics – Kittle
5. Introduction to Superconductivity – Roseinnes and Rhodrick
6. Quantum theory of Solids – Kittle
7. Theoretical Solid State Physics – Huang.

PT – 404c computer applications in physics – II

Max. Marks: 85 **Pass Marks: 29**

Note: This paper has been divided into FIVE units. The paper will be set as per existing examination norms covering uniformly all the units and providing to the examinee sufficient choice in each unit.

Unit – I Networking and Multimedia

Network types of architecture: LAN, WAN, MAN topology interfaces and devices, multimedia technique of data Compression, voice, video, interactive video-on-demand over the net, mobile computing, Fundamental of network and management (NM), elements of NM its need and functional areas, configuration, performance and security managements.

Unit – II Computer Graphics – I (2-D)

Types of graphic devices, CRT display , Random and raster scan graphics, DDA, Line drawing, Algorithms, Bresenham's algorithms Generation of Circles, Cell encoding, Frame buffers, Raster addressing, Line and character display, Transformation of points, Lines and objects, Homogeneous coordinate system and transformation matrices for various operations, Sequential transformation, Viewport planning, Window clipping, Window to Viewport mapping, Physical device coordinates, Zooming.

Unit – III Computer Graphics II (3-D)

Need for 3 – Dimensional Imaging, Techniques for 3 – Dimensional displaying, 3 D transformations: Translational, Rotational and Scaling; Clipping in three – dimension, 3- D viewing transformation, 3 – D Parallel Projections, Perspectives projection, quadratic surfaces, removing hidden surfaces, Perspective view of cube.

Unit – IV Assembly Language programming

Concept of machine and assembly languages Assembler, introduction to 8085 processor, op-codes and mnemonics, instruction sets in 8085; addressing modes, classification of instructions sets on the bases of the types of instructions and various groups. Simple assembly language programming.

Unit – V Simulation Programs and development of scientific Soft Wares

Knowledge about input processing and output related to following problems for writing computer programs and showing result in the form of list or plots charging of capacitor, Discharging of capacitor, Resonance in LC circuit, Drawing potential energy curve, expressing various shape wav functions as a Fourier series. Obtaining numerical solution to ordinary differential equations using different initial conditions; Solution of Schrodinger equation for different potential: Potential well problem in one-dimension, penetration of charge particles through a potential barrier.

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BOOKS RECOMMENDED

1. Computer graphics, TATA McGraw Hill Publications by S.Harrington
2. Computer graphics, prentice Hall of India (Indian Edition) by D. Hearn and P.M. Baker
3. Procedural elements for computer graphics, McGraw – Hill by D.F. Rogers
4. Numerical Computational methods, Narosa publication by Patil and Verma
5. Computer Graphics, tata McGraw Hill by Amrendra Sinha, Arun Udaiss

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