RAMNARAIN RUIA AUTONOMOUS COLLEGE
Department of Physics
Internal Theory Examination Syllabus

Paper code	Paper title	Department of Physics Syllabus Description
TYBSc-PHYSICS-Syllabus		
RUSPHY501	**Mathematical Methods of Physics, Thermal & Statistical Physics**	**Mathematical Methods in Physics, Thermal & Statistical Physics** **Probability** Review of basic concepts: sample space, events, independent events, conditional probability, probability theorems, permutations and combinations, discrete and continuous random variables, binomial distribution, joint distributions and covariance, the normal distribution, the Poisson distribution **Differential Equations** Second-order non-homogeneous linear differential equations with constant coefficients: the method of successive integrations and the method of undetermined coefficients. Forced vibrations and resonance. The Laplace transform and its use in the solution of differential equations **CH – Sections 5.2.4, 8.2.1, 8.2.2, 8.2.4 MB – Sections 8.6, 8.8 and 8.9** Fourier series: Introduction, Fourier cosine and sine series, Change of interval, Fourier Integral,Complex form of the Fourier series **CH: 7.1, 7.1.1, 7.1.2, 7.1.3, 7.1.4, 7.2.** Fourier transforms: Introduction, Formal development of the complex Fourier transform, Cosine and Sine transforms, The transforms of derivatives (with proof) **CH: 8.1, 8.2.1, 8.2.2, 8.2.4, 8.2.5, 8.2.6**
RUSPHY502	**Solid State Physics**	**UNIT - III** **1. Conduction in Semiconductors** Electrons and Holes in an Intrinsic Semiconductor, Conductivity, Carrier concentrations in an intrinsic semiconductor, Donor and Acceptor impurities, Charge densities in a semiconductor, Fermi level in extrinsic semiconductors, Diffusion, Carrier lifetime, The continuity equation, Hall Effect **2.Magnetic Properties of matter:** Diamagnetism and Paramagnetism, The origin of permanent magnetic dipoles, Diamagnetism and Larmor precession, the static paramagnetic susceptibility **UNIT - IV** **1. Diode:** Semiconductor-diode Characteristics: Qualitative theory of the p-n junction, the p-n junction as a diode, Band structure of an open-circuit p-n junction The current components in a p-n junction diode, Quantitative theory of p-n diode currents, The Volt-Ampere characteristics, The temperature dependence of p-n characteristics, Diode resistance **2. Superconductivity:**

		survey, Mechanism of Superconductors, Effects of magnetic field, Critical Currents, The Meissner effect, the penetration depth, Type I and Type II Superconductors
RUSPHY503	**Atomic & Molecular Physics**	**Schrödinger's equation and Hydrogen atom** Schrödinger's equation for Harmonic oscillator, its solution by operatormethod. Graphical representation of its energy level and wave functions. **PTM: 5.2; AB: 8.7** Hydrogen atom: Schrödinger's equation for Hydrogen atom, Separation ofvariables, Quantum Numbers: Total quantum number, Orbital quantum number, Magnetic quantum number. Angular momentum, Electron probability density (Radial part) **AB: 9.1 to 9.9** **Electron Spin** Electron Spin: The Stern-Gerlach experiment, Pauli's Exclusion Principle, Symmetric and Antisymmetric wave functions. **AB: 10.1, 1.03** Spin orbit coupling, Hund's Rule, Total angular momentum, Vector atom model,L-S and j-j coupling. Origin of spectral lines, Selection rules. **AB:10.2,10.6,10.7, 10.8, 10.9; 11.1 and 11.2.** **Zeeman effect and Paschen-Back effect** Effect of Magnetic field on atoms, Zeeman effect, Earlier discoveries and developments, Experimental arrangement, The normal Zeeman effect and its explanation(Classical and Quantum) **HSA: 9.14, 9.15** The Lande g factor, Anomalous Zeeman effect; Paschen-Back effect, Paschen-Back effect of principal series doublet, Selectionrules for Paschen-Back effect. **HEW: 9.16, 9.17, 10.7, 10.8, 10.9**
RUSPHY504	**Electrodynamics**	**Unit-I----Electrostatics** Electric Field lines, Flux and Gauss' law, The divergence of **E**, Applications of Gauss' law, The curl of **E**. Introduction to potential, Comments on potential, Poisson's equation and Laplace's equation, The potential of a localized charge distribution, Review of Conductors & Faraday's Cage **DG: 2.2.1 to 2.2.4, 2.3.1 to 2.3.4. Greiner-1.1,1.2,1.3** First Uniqueness theorem (Without proof), The classic image problem- Infinite conducting plane **DG: 3.2.1 to 3.2.3.** **Greiner—**chapter2-Green's theorems, Green's function, Ex2.1(Image charge problem) **Unit-2- Polarisation & Magnetostatics** Dielectrics, Induced Dipoles, Alignment of polar molecules, Polarization, Bound charges and their physical interpretation, Gauss' law in presence of dielectrics, A deceptive parallel, Susceptibility, Permittivity, Dielectric constant, Energy in dielectric systems. **DG: 4.1.1 to 4.1.4, 4.2.1, 4.2.2, 4.3.1, 4.3.2, 4.4.1, 4.4.3.** Straight-line currents, The Divergence and Curl of B, Applications of Ampere's law in the case of a long straight wire and a long solenoid, Comparison of Magneto-statics and Electrostatics. **DG: 5.3.1 to 5.3.4.**

TYBSc-Applied Component-Electronic Instrumentation-Syllabus		
RUSACEI	Unit 2	**a) Active filters:** Introduction, Active Filters, 2nd order Low Pass Butterworth filter, 2nd order High Pass Butterworth filter, Band pass Filters, Wide band pass Filter, Wide band rejection filter and narrow band rejection filter. **b) Power Supplies** i) Principle, block diagram, working, important specifications and Operating procedures for- Fixed voltage power supply, variable power Supply, dual power supply, CV and CC supply, SMPS, DC to DC Converter, UPS.
	Unit III: Analysis Techniques-I	Optical spectroscopy: Optical absorption spectroscopy, Photoluminescence ,FTIR, Raman spectroscopy Electron spectroscopy: XPS, Ultraviolet photo spectroscopy, Rutherford back scattering spectroscopy(RBS), Secondary ion mass spectroscopy(SIMS)
SYBSc-PHYSICS--SYLLABUS		
RUSPHY301	**RUSPHY301----Mechanics and thermodynamics**	
	Unit-I Mechanics	Compound pendulum: Expression for period, maximum and minimum time period, centers of suspension and oscillations, reversible compound pendulum. Kater's reversible pendulum, Advantages of a compound pendulum over a simple pendulum; Problems from all topics HP: 9.1.1 (pages 279 to 289) Center of Mass, Motion of the Center of Mass, Linear momentum of a Particle, Linear momentum of a System of Particles, Linear momentum with respect to CM coordinate (i.e. shift of origin from Lab to CM), Conservation of Linear Momentum , Some Applications of the Momentum Principle , System of Variable Mass Halliday and Resnick -Physics part I 9.1, 9.2, 9.3, 9.4, 9.5, 9.6
	Unit II-Thermodynamics	Heat engine, Carnot's cycle, Second law of Thermodynamics, Statement, Equivalence of Kelvin & Planck Statement, Carnot's Theorem, Reversible & Irreversible Process, Absolute scale of Temperature. Clausius theorem, Entropy, Entropy of a cyclic process, Reversible process, Entropy change, Reversible heat transfer, Principle of increase in entropy, generalized form of first and second law, entropy change of an ideal gas, entropy of steam, entropy and unavailable energy, entropy and disorder, absolute entropy

RUSPHY302	**RUSPHY302------Vector calculus, Analog and Digital Electronics**	
	Vector calculus, Analog and Digital Electronics	**Vector calculus, Analog and Digital Electronics** **Vector Calculus** Line, Surface and Volume Integrals, The Fundamental Theorem of Calculus: The Fundamental Theorem of Gradient, The Fundamental Theorem of Divergence, The Fundamental Theorem of Curl (Statement and Geometrical interpretation is included, Proof of these theorems are omitted). Problems based on these theorems are required to be done. **DG: 3.1, 3.2, 3.3, 3.4, 3.5** Curvilinear Coordinates: Spherical Coordinates, Cylindrical Coordinates **DG: 4.1, 4.2**
	Unit II **Analog Electronics**	Transistor Biasing, Inherent Variations of Transistor Parameters, Stabilization, Essentials of a Transistor Biasing Circuit, Stability Factor, Methods of Transistor Biasing, Base Resistor Method, Emitter Bias Circuit, Circuit analysis of Emitter Bias, Biasing with Collector Feedback Resistor, Voltage Divider Bias Method, Stability factor for Potential Divider Bias. General amplifier characteristics: Concept of amplification, amplifier notations, current gain, Voltage gain, power gain, input resistance, output resistance, general theory of feedback, reasons for negative feedback, loop gain. Practical circuit of transistor amplifier, phase reversal, frequency response, Decibel gain and Band width.
RUSPHY303	**RUSPHY303------Applied Physics I**	
	Unit I **Acoustics, Lasers and fiber optics**	1) **Acoustics of Buildings**: Reverberation, Sabine's formula (without derivation) Absorption coefficient, Acoustics of Buildings, factors affecting Acoustics of Buildings, Sound distribution in an auditorium. **Reference**: Properties of matter and Acoustics – R Murugeshan and K. Shivaprasath, S Chand &Co.Ltd. (2005-Ed)—5.9,5.10, 5.12,5.13,5.14, 5.15 2) **Laser** : Introduction, transition between Atomic energy states (without derivation), Principle of Laser, Properties of Laser, Helium–Neon Laser, Application of Laser, Holography. **Reference**:- Modern Physics Concept and Applications – SanjeevPuri, Narosa Publication—9.1 to 9.6 , 9.10, 9.11 3) **Fiber Optics**: Light propagation through Fibers, Fiber Geometry, Internal reflection, Numerical Aperture, Step-Index and Graded-Index Fibers, Applications of Fibers. **Reference**: Modern Physics Concept and Applications – SanjeevPuri, Narosa Publication— 13.3, 13.5, 13.9

	Unit-III **Materials – properties and applications**	**Materials – properties and applications** Classification and selection of materials: Classification of materials, organic, inorganic and biological materials, semiconductor materials, current trends and advances in materials. Material structure and examination, selection of materials. Crystal geometry and structure: Crystals, single crystal, Whiskers, lattice point and space lattice. Unit cell, primitive cell, Atomic radius, Density of crystal

RAMNARAIN RUIA AUTONOMOUS COLLEGE

Department of Physics

M.Sc.-II (2020-21)

Semester-03 Internal Theory Examination Syllabus

Sr. No.	Paper Title & Paper code	Unit	Topics
1	**Statistical Mechanics RPSPHY301**	I	The Statistical Basis of Thermodynamics-The macroscopic and the microscopic states, contact between statistics and thermodynamics, the classical ideal gas, The entropy of mixing and the Gibbs paradox, the enumeration of the microstates. Elements of Ensemble Theory-Phasespace of a classical system, Liouville's theorem and its consequences. The micro-canonical ensemble - Examples Quantum states and the phase space
		II	The Canonical Ensemble-Equilibrium between a system and a heat reservoir, a system in the canonical ensemble, physical significance of the various statistical quantities in the canonical ensemble, expressions of the partition function, the classical systems, energy fluctuations in the canonical ensemble, correspondence with the microcanonical ensemble, the equipartition theorem and the virial theorem, system of harmonic oscillators, statistics of paramagnetism, thermodynamics of magnetic systems.
2	**Nuclear Physics RPSPHY302**	I	All static properties of nuclei (charge, mass, binding energy, size, shape, angular momentum, magnetic dipole momentum, electric quadrupole momentum, statistics, parity, isospin), Measurement of Nuclear size and estimation of R_0(mirror nuclei and mesonic atom method) Q-value equation, energy release in fusion and fission reaction. Deuteron Problem and its ground state properties, Estimate the depth and size of (assume)square well potential, Tensor for ceasan example of non-central force, nucleon-nucleon scattering-qualitative discussion on results, Spin-orbit strong interaction between nucleon, double scattering experiment.

		IV	Introduction to the elementary particle Physics, The Eight fold way, the Quark Model, the November revolution and aftermath, The standard Model, Revision of the four forces, cross sections, decays and resonances, Introduction to Quantum Eletrodynamics, Introduction to Quantum Chromodynamics. Weak interactions and Unification (qualitative description), Revision of Lorentz transformations, Four-vectors, Energy and Momentum. Properties of Neutrino, helicity of Neutrino, Parity, Qualitative discussion on Parity violation in beta decay and Wu's Experiment, Charge conjugation, Time reversal, Qualitative introduction to CP violation and TCP theorem. Schemes
3	**Microcontrollers and Interfacing RPSPHY303**	**I**	Programming 8051 Timers, Counter **Reference book:** The 8051 Microcontroller & Embedded Systems by M.A. Mazidi, J.G. Mazidi and R.D. Mckinlay, Second Edition, Pearson(MMM)
		II	16C61/71 PIC Microcontrollers: Overview and Features, PIC 16C6X/7X, PIC Reset Actions, PIC Oscillator Connections, PIC Memory Organization, PIC 16C6X/7X Instructions, Addressing Modes, I/O Ports, Interrupts in PIC 16C61/71, PIC 16C61/71 Timers, PIC 16C71 Analog-to-Digital Converter. *AVD- Ch. 9: 9.1 to 9.11* **Reference book** Microcontrollers by Ajay V. Deshmukh, Tata-Mcgraw Hill Publication (AVD)
		III	Introduction, Pin Diagram, STATUS Register, Power Control Register (PCON), OPTION Register, Program memory, Data memory, I/O Ports *AVD – Ch. 10: 10.1, 10.2, 10.3, 10.4, 10.5, 10.6, 10.7, 10.10* **Reference book:** Microcontrollers by Ajay V. Deshmukh, Tata-Mcgraw Hill Publication (AVD)
4	**Programming using C++,VC++, Embedded Systems and RTOS RPSPHY304**	**I**	**Programming Using C++:** Introduction to Computers and programming, Introduction to C++, Expressions and interactivity, Making decisions, Looping. *TG: Ch.1: 1.3 to 1.7, Ch.2: 2.1 to 2.14, Ch.3:3.1 to 3.11, Ch.4: 4.1 to 4.15, Ch.5: 5.1to 5.13* **Reference book:** Starting out with C++ from Control structures through objects, by Tony Gaddis, Sixth edition Penram International Publications, India (TG)
		III	**Introduction to Embedded Systems**: What is an embedded system, Embedded System v/s General Computing System, Classification of Embedded Systems, Major Application Areas of Embedded Systems, Purpose of Embedded Systems, Smart Running Shoes. **The typical Embedded system:** Core of embedded system

			Characteristics and quality Attributes of Embedded Systems: Characteristics of an Embedded System, Quality Attributes of Embedded Systems **Embedded Systems-Application and Domain–Specific:** Washing Machine, Automatic- Domain, Specific examples of embedded system *SKV – Ch. 1: 1.1, 1.2, 1.3, 1.4, 1.5, 1.6, 1.7, Ch.2:2.1, Ch. 3: 3.1, 3.2, Ch. 4: 4.1, 4.2* **Design Process and design Examples**: Automatic Chocolate Vending machine (ACVM), Smart Card, Digital Camera, Mobile Phone, A Set of Robots *RK - Ch. 1: 1.10.2, 1.10.3, 1.10.4, 1.10.5, 1.10.6, 1.10.7* **Reference books** Introduction to embedded systems by Shibu K.V.,Sixth Reprint 2012,Tata Mc Graw Hill (SKV) Embedded Systems Architecture, Programming and Design, by Raj Kamal, Second Edition, The McGraw-Hill Companies(RK)
		IV	Operating system Basics, Types of Operating Systems. *SKV: Ch.–10: 10.1, 10.2* **Reference book:** Introduction to embedded systems by Shibu K.V.,Sixth Reprint 2012,Tata Mc Graw Hill (SKV)

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