UNIVERSITY OF KOTA

SCHEME OF EXAMINATION

AND

COURSES OF STUDY

Faculty of Science

Bachelor of Science (B.Sc.)
Physics-Pass Course

Third Semester (July-December, 2022)
Fourth Semester (January-June, 2023)

UNIVERSITY OF KOTA

MBS Marg, Near Kabir Circle, KOTA (Rajasthan)-324 005

INDIA

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Bachelor of Science - Course Structure with Distribution of Marks

B.Sc. (Physics)-III Semester

Code, Nature & Nomenclature of Paper			Duration of Exam.	Teaching Hrs/Week & Credit			Distribution of Marks			Min. Pass Marks	
Code	**T/P**	**Nomenclature**		**L**	**P**	**C**	**Conti. Assess.**	**Sem. Assess.**	**Total Marks**	**Conti. Assess.**	**Sem. Assess.**
PHY07	TH	Paper-I: Thermal Physics	3 Hrs	3	-	3	15	60	75	06	24
PHY08	TH	Paper-II : Electronics	3 Hrs	3	-	3	15	60	75	06	24
PHY09	PR	Paper III: Physics-Practical	6 Hrs	--	4	2	--	50	50	--	25

B.Sc. (Physics)-IV Semester

Code, Nature & Nomenclature of Paper			Duration of Exam.	Teaching Hrs/Week & Credit			Distribution of Marks			Min. Pass Marks	
Code	**T/P**	**Nomenclature**		**L**	**P**	**C**	**Conti. Assess.**	**Sem. Assess.**	**Total Marks**	**Conti. Assess.**	**Sem. Assess.**
PHY10	TH	Paper-I: Statistical Physics	3 Hrs	3	-	3	15	60	75	06	24
PHY11	TH	Paper-II : Mathematical Physics-I	3 Hrs	3	-	3	15	60	75	06	24
PHY12	PR	Paper III: Physics-Practical	6 Hrs	--	4	2	--	50	50	--	25

Objectives of the Course:

Innovation and Employability-Science is concerned with the study of the universe from the smallest to the largest scale, why it is the way it is and how it works. Such knowledge is basic to scientific progress. Scientist have to be able to design and build new instruments, from satellites to measure the properties of planetary atmospheres to record-breaking intense magnetic fields for the study of condensed matter. Many of the conveniences of modern life are based very directly on the understanding provided by physics. Many techniques used in medical imaging are derived directly from physics instrumentation. Even the internet was a spin-off from the information processing and communications requirement of high-energy particle physics.

This Bachelor of Science programme of University is a pioneering model in Indian science and education, imparting education in Physics while simultaneously encouraging a participation in research. This course shall provide the thorough knowledge of branches of Physics with extensive theoretical and experimental knowledge in major areas of Physics such as Material science, Plasma science, Advanced Electronics, Energy Studies etc. at Masters' level. This course also emphasizes on the Communication & Presentation skills of the students. The students after completing the course shall be placed in premier research institutes and companies in India and abroad, qualify NET/GATE/JEST examinations and eligible for M.Tech., PhD and teaching.

Duration of the Course:

The course B.Sc. [Bachelor of Science] shall consist of three academic years divided in to six semesters. After completing the course after three years, he/she shall get degree of B.Sc..

Eligibility for Admission:

The basic eligibility for admission to the course is XII with Physics, Chemistry and Mathematics for B.Sc. (Mathematics)/ XII with Physics, Chemistry and Bilogy with minimum marks for GEN category candidates of Rajasthan-50%; Other state-60%; SC/STOBC/SOBC- Minimum Pass Marks. The admission in the course is based on merit of XII class.

Structure of the Programme:

The B.Sc. programme consists of:

(i) Core and applied courses of theory as well as practical papers which are compulsory for all students.

Maximum Marks:

Maximum marks of a theory and practical paper shall be decided on the basis of their contact hours/credit per week. One teaching hour per week shall equal to one credit and carry 25 maximum marks and therefore, two teaching hours/credit per week shall carry 50 maximum marks for each theory paper/course. Each four contact hours per week for laboratory or practical work shall be equal to two credits per week and carry 50 maximum marks.

Scheme of Examinations:

The examination shall be divided into two parts in which first part is continuous assessment or internal assessment and second part is semester assessment or external assessment. The schemes for the internal and external examinations shall be as under:

a) The assessment of the student for theory paper shall be divided into two parts in which first part is continuous assessment or internal assessment (20% of maximum

marks) and second part is semester assessment or external assessment (80% of maximum marks). For practical papers there will be only one external assessment (100% of maximum marks).

b) The internal assessment for each theory paper shall be taken by the teacher concerned in the Department during each semester. There will be two components of internal assessment; one by test having 2/3 weightage (10 marks) and another by seminar / assignment / presentation / quiz / group discussion / vivo of 1/3 weightage (05 marks), for theory papers in each semester. Internal assessment test shall be of one hour duration for each paper and shall be taken according to academic calendar notified by the University / Departments. There will be no internal examination in the practical paper.

c) A student who remains absent (defaulter) or fails or wants to improve the marks in the internal assessment may be permitted to appear in the desired paper(s) (only one time) in the same semester with the permission of the concerned Head of the Department. A defaulter / improvement fee of Rupees 250/- per paper shall be charged from such candidates. Duly forwarded application of such candidates by the teacher concerned shall be submitted to HOD who may permit the candidate to appear in the internal assessment after depositing the defaulter/ improvement fee. A record of such candidates shall be kept in the Department.

d) The external assessment shall be of three hours duration for each theory paper and six hours duration for practical paper. The practical examination shall be taken by the panel of at least one external and one internal examiner at the end of each semester.

e) The syllabus for each theory paper is divided into five independent units and each theory question paper will have the format as mentioned below:

There will be ten long answer type questions covering all units but not more than two questions from each unit, descriptive type, answer in about 400 words. *Students have to attempt* 5 questions, taking one from each unit. *Paper setter shall be instructed to design question paper covering from all five units.*

f) The pattern of question paper of internal and external shall be as follows:

(A) Continuous or Internal Assessment-20% weightage of Maximum Marks

The internal assessment for each theory paper shall be taken by the teacher concerned in the Department during each semester. There will be two internal assessment tests/Seminars/Quiz Presentations etc. of 20% weightage, for theory papers in each semester of one hour duration.

(B) Semester or External Assessment-80% weightage of Max. Marks

Duration of Examination: 3 Hours **Max. Marks: 60**

There will be ten long answer type questions covering all units but not more than two questions from each unit, descriptive type, answer in about 400 words. *Students have to attempt* 5 questions, taking one from each unit. *Paper setter shall be instructed to design question paper covering from all five units.*

Unit – I

Q. No. 1 12 Marks

or

Q. No. 2 12 Marks

Unit – II

Q. No. 3 12 Marks

or

Q. No. 4 12 Marks

Unit – III

Q. No. 5 12 Marks

or

Q. No. 6

Unit – IV

Q. No. 7 12 Marks

or

Q. No. 8 12 Marks

Unit – V

Q. No. 9 12 Marks

or

Q. No. 10 12 Marks

Distribution of Marks for Practical Examinations:

Duration of Exam: 06 Hours **Maximum Marks: 50**

S. No.	Name of Exercise	Marks
1.	Exercise No. 1	20
2.	Exercise No. 2	20
3.	Viva-voce	05
4.	Practical Record	05
	Total Marks	**50**

Rules regarding determination of results:

Each semester shall be regarded as a unit for working out the result of the candidates. The result of the each semester examination shall be worked out separately (even if he/she has appeared at the paper of the lower semester along with the papers of higher semester) in accordance with the following conditions:

a) The candidate shall be declared as pass in a semester examination, if he/she secures at least 40% marks in each theory paper separately in external & internal examination and 50% marks in each practical paper/project/dissertation with 40% aggregate marks in that semester.

b) A candidate declared as fail/absent in one or more papers at any odd semester examination shall be permitted to take admission in the next higher semester (even semester) of the same academic session.

c) A candidate may be promoted in the next academic session (odd semester) if he/she has cleared collectively at least 50% of the papers of both semesters of previous academic session. The candidate who does not fulfill the above condition will remain as an ex-student and will reappear in the due papers along with next odd/even semester exams.

d) If any student who is provisionally admitted in higher odd semester but could not secure prescribed minimum marks in previous semesters will be treated as ex-student and his/her admission fee will be carry forwarded to the next odd semester of forthcoming academic session.

e) If a candidate, who is declared as pass, wishes to improve his/her performance in the theory papers of previous semester, he/she may re-appear only one time in these papers in next odd/even semester examinations.

f) Candidate shall not be permitted to re-appear or improve the marks obtained in the external examination of practical / dissertation in any condition.

g) If the number of papers prescribed in a semester examination is an odd number, it shall be increased by one for the purpose of reckoning 50% of the papers for considering the student pass/fail.
h) A candidate may be given only two additional chances for passing the semester thus maximum tenure for completing for three years under-graduate programme up to five years and so on.
i) The marks secured in the Gen Hindi, Gen English, Elementary Computer applications and Environment studies shall not be counted in awarding the division to a candidate. The candidate shall have to clear the compulsory subjects in the additional three chances and non-appearance or absence in the examination of compulsory subjects shall be counted as chance and shall be declared fail in that examination.
j) The grace marks scheme shall be applicable as per University norms.

Classification of Successful Candidates:

The classification of successful candidates after last semester examination shall be as under:

Description of Marks Obtained	Division / Result
• 75% and above marks in a paper.	Distinction in that paper.
• A candidate who has secured aggregate 60% and above marks	First Division
• A candidate who has secured aggregate 50% and above but less than 60% marks	Second Division
• A candidate who has secured aggregate 40% and above but less than 50% marks	Pass

III Semester

PAPER I-Thermal Physics

Unit 1

General Thermodynamical interaction, Dependence of the number of states of external parameters, General relations in equilibrium, infinitesimal quasistatic process, Entropy of an ideal gas, Equilibrium of an isolated system, Equilibrium of a system in contact with reservoir (Gibb's free energy).

Unit 2

Equilibrium between phases, Clausius-Clapeyron equation, Triple point, Vapour in equilibrium with liquid or solid, equilibrium conditions for a system of fixed volume in contact with heat reservoir (Helmholtz free energy), for a system at constant pressure in contact with a heat reservoir (Enthalpy), Maxwell's relations.

Unit 3

Thermal interactions of macroscopic systems, first law of thermodynamics and infinitesimal general interaction, Concept of temperature and quantitative idea of temperature scale (thermodynamical parameter), Distribution of energy.

Unit 4

Second law of thermodynamics, Claussius and Kelvin's statements, partition function (Z), mean energy of an ideal gas and mean pressure, Heat engine and efficiency of the engine, Carnots cycle, thermodynamical scale as an absolute scale.

Unit 5

Production of Low Temperatures and Application, Joule Thomson expansion and J.T.coefficients for ideal as well as Van-der Waal's gas, Temperature inversions, Regenerative cooling and cooling by adiabatic expansion and demagnetization, Liquid He, He –I and He-II, superfluidity, quest for absolute zero, Nernst heat theorem.

Text/Reference Books:

1. Heat and Thermodynamics, M.W. Zemansky, Richard Dittman, 1981, McGraw-Hill.
2. A Treatise on Heat, Meghnad Saha, and B.N.Srivastava, 1958, Indian Press
3. Thermal Physics, S. Garg, R. Bansal and Ghosh, 2nd Edition, 1993, Tata McGraw-Hill
4. Modern Thermodynamics with Statistical Mechanics, Carl S. Helrich, 2009, Springer.
5. Thermodynamics, Kinetic Theory & Statistical Thermodynamics, Sears & Salinger.
6. 1988, Narosa.
7. Concepts in Thermal Physics, S.J. Blundell and K.M. Blundell, 2nd Ed., 2012, Oxford
8. University Press.
9. Thermal Physics, A. Kumar and S.P. Taneja, 2014, R. Chand Publications.

PAPER II-Electronics

Unit 1

Recapitulation of semiconductor, intrinsic and extrinsic semiconductor, charge density of semiconductors generation and recombination of charges, diffusion, the continuity equation, Injected minority carrier charges, potential variation with in a graded, p-n junction, current component volt Ampere characteristic-temperature dependency, space charge, diffusion capacitance.

Unit 2
Rectification and Power Supply, Half-wave, full wave and bridge rectifiers, Ripple factor, efficiency and regulation, Filters-Shunt capacitor, LC and RC filters regulation and stabilization, Zener diode, Voltage multiplier.

Unit 3
Transistor and Transistor Amplifiers:Notations and Volt-ampere relations for bipolar junction transistor, Concept of load line and operating point, Hybrid parameters, Field effect Transistor and their circuit characteristics, Configurations and their equivalent circuits, Analysis of Transistor amplifiers using hybrid parameters and its frequency response, Fixed and emitter bias, bias stability.

Unit 4
Concept of feedback, stabilization of gain by negative feedback, Effect of feedback on output and input resistance, Reduction of nonlinear distortion by negative feedback, Voltage and current feedback circuits, Frequency resonance, Feedback requirements for oscillators, circuit requirement for oscillation, basic oscillators, Colpitt, Hartley, R-C oscillators, Piezo-electric frequency control.

Unit 5
Operational Amplifier: Differential amplifier, DC level shifter, Input and output impedances, Input offset current, Applications : Unit gain buffer, Adder, Subtractor, Integrator and differentiator, Comparator, Idea of wave form generator, Voltage regulator using integrated amplifiers, Boolean Algebra, De Morgon theorem, Basic and Universal logic Gates.

Text/Reference Books:

1. Principles of Electronics by V.K. Mehta, S. Chand, 2002.
2. Integrated Electronics: Analog and Digital Circuits and Systems by J. Millman and C.C. Halkias.

PAPER III- PHYSICS PRACTICAL

1. Study of dependence of velocity of wave propagation on line parameters using torsional wave apparatus.
2. Study of variation of refection coefficient with nature of termination using torsional wave apparatus.
3. Using platinum resistance thermometer to find the melting point of a given substance.
4. Using Michelson's interferometer: Find out the wavelength of a given monochromatic source (sodium light);Determine difference in wave length ofD1and D2 lines.
5. Determine the thermodynamic constant (r=Cp/Cv) using Clement's and Desormes methods.
6. Determine Thermal conductivity of a bad conductor by Lee's method.
7. Determination of Ballistic constant of Ballistic galvenometer.
8. Determination of high resistance by method of leakage.
9. Study the variation of total thermal radiation with temperature.
10. Any other experiments of the equivalent standard can be set.

IV Semester

PAPER I- Statistical Physics

Unit 1

Kinetic theory of gases: Maxwell' Bolzman's Statistics, Distribution of molecular velocities, Energy distribution function, most probable, average & r.m.s. velocities, principle of equipartition of energy, specific heat of gases, classical theory of specific heat capacity, Specific heat of Solids, Einstein's and Debye's Model (No Derivation).

Unit 2

Classical Statistics: Phase space, Micro and Macro states, Thermodynamic probability, Entropy and probability, The Monoatomic ideal gas, Entropy of mixing, Gibb's paradox, Ensembles: canonical, micro canonical and grand canonical.

Unit 3

Quantum Statistics: Failures of Classical statistics (black body radiation and various laws of distribution of radiation, qualitative discussion of Wien's and Rayleigh Jean's (No derivation) laws, postulates of quantum statistics, indistinguishability of wave function and exchange degeneracy, apriorprobability.

Unit 4

Bose-Einstein Statistics: B-E distribution law, Thermodynamic functions of a strongly Degenerate Bose Gas, Bose Einstein condensation, properties of liquid He (qualitative description), Radiation as a photon gas and Thermodynamic functions of photon gas, Bose derivation of Planck's law.

Unit 5

Fermi-Dirac Statistics: Fermi-Dirac Distribution Law, Thermodynamic functions of a Completely and strongly Degenerate Fermi Gas, Fermi Energy, Electron gas in a Metal, Specific Heat of Metals, Relativistic Fermi gas, Chandrasekhar Mass Limit.

Text/ Reference Books:

1. Statistical Mechanics, R.K. Pathria, Butterworth Heinemann: 2nd Ed., 1996, Oxford
2. University Press.
3. Statistical Physics, Berkeley Physics Course, F. Reif, 2008, Tata McGraw-Hill
4. Statistical and Thermal Physics, S. Lokanathan and R.S. Gambhir. 1991, Prentice Hall
5. Thermodynamics, Kinetic Theory and Statistical Thermodynamics, Francis W. Sears and Gerhard L. Salinger, 1986, Narosa.
6. Modern Thermodynamics with Statistical Mechanics, Carl S. Helrich, 2009, Springer
7. An Introduction to Statistical Mechanics & Thermodynamics, R.H. Swendsen, 2012, Oxford Univ. Press

PAPER II- Mathematical Physics-I

Unit 1

Curvilinear Coordinate systems, Del, Divergence, Curl, and Laplacian operators in curvilinear coordinate systems, Dirac-Delta Function and its properties, Fourier series, computation of Fourier coefficients, applications to simple periodic functions like square wave, saw tooth wave and rectifier out put.

Unit 2
Transformation of covariant, contravariant and mixed tensor, Addition, Multiplication and contraction of tensors, Quotient law, pseudo tensor, Metric tensor, transformation of Tensors.

Unit 3
Four vector formulation, energy-momentum four vectors, relativistic equation of motion, Orthogonality of four forces and four velocities, transformation of four wave vector, longitudinal and transverse Doppler's effect.

Unit 4
Transformation between laboratory and center of mass systems, four momentum conservation, Kinematics of decay products of an unstable particle and reaction thresholds, pair production, inelastic collision of two particles, Compton effect.

Unit 5
Electromagnetic field tensor, transformation of four potentials, four currents, electric and magnetic field between two inertial frames of reference, Lorentz force, equation of continuity, conservation of charge, tensor description of Maxwell's equations.

Text/ Reference Books:

1. Mathematical Methods for Physicists, G.B. Arfken, H.J. Weber, F.E. Harris, 2013,7th Edn., Elsevier.
2. Mathematical Tools for Physics, James Nearing, 2010, Dover Publications.
3. Mathematical methods for Scientists and Engineers, D.A. McQuarrie, 2003, Viva Book
4. Mathematical Physics, Goswami, 1st edition, Cengage Learning
5. Engineering Mathematics, S.Pal and S.C. Bhunia, 2015, Oxford University Press
6. Essential Mathematical Methods, K.F.Riley & M.P.Hobson, 2011, Cambridge Univ. Press

PAPER III- PHYSICS PRACTICAL

1. Plot thermo emf versus temperature and find the neutral temperature.
2. Study of power supply using two diodes/ bridge rectifier using various filter circuits.
3. Study of half wave rectifier using L and pi section filters.
4. Characteristics of given transistor PNP/ NPN (common emitter, common base and common collector configurations).
5. Determination of band gap using a junction diode.
6. Determination of power factor of a given coil using CRO.
7. Study of single stage transistor audio amplifier(variation of gain with frequency)
8. Study of diode as integrator with different voltage wave forms.
9. Determination of e\m of electron by Thomson's method.
10. Determination of velocity of sound using CRO, microphone and speaker by standing wave method.
11. Determination of self inductance of a coil by Anderson's bridge method.
12. Determination of unknown capacity by De'sauty-bridge method and to determine dielectric constant of a liquid.
13. Any other experiments of the equivalent standard can be set.