UNIVERSITY OF KOTA

SCHEME OF EXAMINATION

AND

COURSES OF STUDY

Faculty of Science

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

First Semester (July-December, 2020)
Second Semester (January-June, 2021)

UNIVERSITY OF KOTA

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

INDIA

Edition: 2020

Bachelor of Science - Course Structure with Distribution of Marks

B.Sc. (Physics)-I 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.**
PHY01	TH	Paper-I: Mechanics	3 Hrs	3	-	3	15	60	75	06	24
PHY02	TH	Paper-II : Wave and Oscillations	3 Hrs	3	-	3	15	60	75	06	24
PHY03	PR	Paper III: Physics-Practical	6 Hrs	--	4	2	--	50	50	--	25

B.Sc. (Physics)-II 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.**
PHY04	TH	Paper-I: Electricity and Magnetism	3 Hrs	3	-	3	15	60	75	06	24
PHY05	TH	Paper-II : Optics	3 Hrs	3	-	3	15	60	75	06	24
PHY06	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

I Semester

PAPER I-Mechanics

Unit 1
Inertial frame of references, Motion and rest, Galilean transformations, transformation of displacement, velocity and acceleration, Special theory of relativity, Lorentz transformation and rotation in space-time, time like and space like vector, energy-mass relation.

Unit 2
Rotating frame of references, transformation of velocity and acceleration between rotating frames, Coriolis and centrifugal forces, effects of coriolis and centrifugal forces due to Earth's rotation, Foucault's pendulum.

Unit 3
Conservation Laws: Conservative forces, potential energy, Gravitational Potential, electric potential, center of mass and motion of center of mass of a system of particles, two particle system and reduced mass, conservation of linear momentum in Lab and CM system, collision of two bodies in one and two dimensions, slowing down of neutrons in a moderator, motion of a system with varying mass.

Unit 4
Dynamics of rigid body and motion under central forces: Rotational motion of a body, Moment of inertia, inertial coefficients, kinetic energy of rotation and concept of principal axes, Precessional motion of a spinning top and spin precession in constant magnetic field, motion under central forces, general solution under gravitational interaction, cases of elliptical and circular orbits, scattering of charged particles by heavy nucleus, planetary motion, Kepler's Laws.

Unit 5
Hooke's law, three moduli of elasticity, Young's modulus, Bulk modulus and modulus of rigidity, Poison's ratio, Relation between various elastic constants, torsion of a Cylinder, bending of beam, experimental determination of elastic constants by bending of beam and Searle's method, Modulus of rigidity by static and dynamic method and Poisson's ratio for rubber.

Text/Reference Books:

1. Mechanics by M P Saxena, P R Singh, S S Rawat and N S Saxena (4^{th} ed., College Book House, 1999)
2. Mechanics by D S Mathur (S. Chand & Co., 2001)
3. Berkley Physics Course Vol. I, Mc Graw Hill International, New York.
4. Mechanics by P. K. Srivasatava, New Age International Publisher, Delhi

PAPER II-Waves and Oscillations

Unit 1
Oscillations in a potential well, examples of harmonic motion - mass on a spring, torsional oscillators, LC circuit, energy of the oscillator, damping, viscous and solid friction damping, damped harmonic oscillator, power dissipation.

Unit 2
Forced harmonic oscillator with viscous damping, frequency response, phase relation, quality factor, resonance, electrical oscillation, anharmonic oscillator, simple pendulum as an example.

Unit 3
Equation of motion of two coupled simple harmonic oscillators, normal modes, motion in mixed modes, transient behavior, effect of coupling in mechanical systems, electrically coupled circuits, frequency response, reflected impedance, effect of coupling and resistive load.

Unit 4
Dynamics of number of oscillators with near-neighbour interactions, equation of motion for one dimensional monoatomic and diatomic lattices, acoustic and optical mode, dispersion relations, concept of group and phase velocities.

Unit 5
Wave Motion-Wave motion and its parameters, stationary waves, wave velocity and group velocity, production, properties and uses of ultrasonic waves, reverberation time, Sabine's formula.

Text/Reference Books:
1. Oscillations and Waves by M. P. Saxena and S. S. Rawat, College Book House,1997.
2. Berkley Physics Course Vol. I, Mc Graw Hill International, New York.
3. Vibration and Waves by A. P. French, CBS Publications, Delhi, 1987

PAPER III- PHYSICS PRACTICAL

1. Study of bending of a beam and determination of Young's modulus.
2. Modulus of rigidity by statical method and dynamical method.
3. Elastic constant by Searle's method.
4. Study of frequency of energy transfer as a function of coupling strength using coupled oscillator.
5. Determination of the Poisson's ratio of rubber tube.
6. Study of temperature variation of surface tension by Jeagger's method.
7. Low resistance by Carey-Foster' bridge.
8. Variation of magnetic field along the axis of circular coil and hence determine the radius of coil.
9. To study resonance in a series LCR circuit and determine Q of the circuit.
10. Conversion of Galvanometer into Ammeter.
11. Conversion of Galvanometer into Voltmeter.
12. Any other experiments of the equivalent standard can be set.

II Semester

PAPER I-Electricity & Magnetism

Unit 1
Electric potential-Gradient of a scalar function, line integral of vector field, potential difference and potential function. Potential energy of a system, energy required to build a uniformly charged sphere, classical radius of an electron, Potential and field due to a short dipole.

Unit 2
Measurement of charge in motion, invariance of charge, electric field measured in different frames of reference, field of a point charge moving with constant velocity, force on a moving charge, interaction between a moving charge and other moving charges, Magnetic field, Amperes circuital law with applications, Ampere's law in differential form, vector potential, field of a current carrying conductor and deduction of Biot-Savart law.

Unit 3
The moment of a charge distribution, atomic and molecular dipoles, permanent dipole moments, potential and field due to a polarized sphere, dielectric sphere in a uniform field, the field of charge in a dielectric medium and Gauss's law, electric susceptibility and atomic polarizability, polarization in changing fields.

Unit 4
Bohr Magneton, electron spin and magnetic moment, magnetic susceptibility, the magnetic field due to magnetized matter, Faraday's laws in differential form, the displacement current, Maxwell's equations in differential and integral forms.

Unit 5
Maxwell's equations, Electromagnetic waves in isotropic medium, Properties of electromagnetic waves, Energy density, radiation pressure, momentum and poynting vector, radiation resistance of free space, Spectrum of electromagnetic waves.

Text/Reference Books:
1. Electricity and Magnetism by D C Tayal, Himalaya Publishing House, 2005.
2. Electricity and Magnetism by M P Saxena, College Book House, 1997.
3. Elements of Electromagnetics by Mathew N.O. Sadiku, New Delhi, Oxford Univ. Press
4. Berkley Physics Course - Volume 2, Singapore, McGraw Hill International.

PAPER II- Optics

Unit 1
Formation of images, sign convention, position of object and its image formed by refraction on spherical surfaces, lateral, axial and angular magnification, Abbe's sine condition, aplantic points, deviation produced by thin lenses, equivalent focal length, combination of two thin lenses, Abberations: chromatic, Achromatic Combination of lenses, spherical, method of reducing spherical aberrations, Eye-piece: Huygen's, Ramsden's.

Unit 2

Superposition of waves from two point sources, the necessity of coherence, spatial & temporal coherence, Effective size of a point source, Shape of interference fringes, Intensity distribution in space, Fresnel's biprism experiment, Interference by division of amplitude, Interference in thin films, colur of thin films in transmission and reflection, Newton's rings, Michelson's interferometer, fringes of different shapes Determination of λ and $\Delta\lambda$ with Michelson's interferometer.

Unit 3

Fraunhofer diffraction by a single slit, circular aperture, two parallel slits, Plane diffraction grating, transmission and reflection gratings, dispersion by grating, resolving power, Rayleigh's criterion of resolution, Resolving power of a grating, Resolving power of a telescope, Fresnel's diffraction, half-period zones, Fresnel's diffraction by a circular aperture, Straight edge and thin slit, Cornu's (geometrical) spiral to study Fresnel's diffraction, Zone plate.

Unit 4

Polarised light, Production and analysis of plane, circularly and elliptically polarised light, Huygen's theory of double refraction using Fresnel ellipsoidal surfaces (No mathematical derivation), Theory of polarized light, Quarter and half wave plates, Optical activity, Specific rotation, Fresnel's explanation for optical rotation, Biquartz and half shade Polarimeters.

Unit 5

Spontaneous and stimulated emission, Einstein's A and B coefficients, Laser Criterion, Condition for amplification, population inversion, methods of optical pumping, He-Ne Laser, Ruby lasers, Holography, Construction of hologram and reconstruction of the image, Basic characteristics of the optical fiber, total internal reflection, acceptance angle, acceptance cone, numerical aperture.

Text/Reference Books:

1. Optics by Brij Lal and Subrahmanium, S. Chand Publication, 2006.
2. Introduction to Fiber optics - A. Ghatak and K. Thyagarajan, Cambride University Press, Cambridge, 1988.
3. Introduction to Modern Optics- A. K. Ghatak, Tata McGraw Hill.

PAPER III- PHYSICS PRACTICAL

1. To determine the polarizing angle for the glass prism surface and to determine the refractive index of the material of prism using Brewster's law =tan (i_p).
2. To study the variation of charge and current in RC circuit for different time constants (using DC source).
3. To study the behavior of RC circuit with varying resistance and capacitance using AC Mains as a power source and also determine the impedance and phase relations.
4. To study the rise and decay of current in LR circuit with a source of constant emf.
5. To study the voltage and current behaviour of LR circuit with a AC power source also determine power factor, impedance and phase relation.
6. Determination of dispersive power of material of a prism using spectrometer.
7. Measurement of wavelength of monochromatic source of light by Newton's rings.
8. Measurement of wavelength of monochromatic source of light by plane transmission grating. Measurement of wavelength of monochromatic source of light by biprism.
9. Study of specific rotation by polarimeter.

10. Determination of resolving power of a plane transmission grating.
11. Determination of resolving power of telescope.
12. Any other experiments of the equivalent standard can be set.