GOVT. DIGVIJAY AUTO. PG COLLEGE
RAJNANDGAON (CHHATTISHGARH)

SYLLABUS AND MARKING SCHEME FOR B.Sc. WITH PHYSICS

SESSION 2025-26

SEMESTER - V

- **THEORY PAPER :**

Class	Paper	Course title	Course code	Credit value	Theory marks	Internal marks	Passing marks
Sem.-V	DSC	RELATIVITY AND QUANTUM MECHANICS	UBSDCT502	3	80	20	40
Sem.-V	DSE-I	ELEMENTS OF ATOMIC , MOLECULAR PHYSICS	UBSDET502	4	80	20	40
Sem -V	DSE-II	ELEMENTS OF CONDENSED MATTER PHYSICS	UBSDET503	4	80	20	40
Sem -V	SEC	COMMUNICATION SYSTEM	UBSEC513	2	40	10	50

- **PRACTICAL / PROJECT PAPER :**

Class	Paper	Course title	Course code	Credit value	Practical + viva marks+ Sessional	Internal assessment :	Passing marks
Sem.-V	DSC	RELATIVITY AND QUANTUM MECHANICS	UBSDCL502	1	40	10	20

GOVT. DIGVIJAY AUTO. PG COLLEGE
RAJNANDGAON (CHHATTISHGARH)

INSTRUCTION FOR QUESTION PAPER SETTING

❖ End Semester Exam (ESE) for DSC and DSE

There will be 03 sections of question of 80 marks.

Section A – Section A will be very short answer type questions consisting 8 questions of 2 marks each, two question from each unit .

Section B – Section B will be short answer type questions consisting 4 questions of 6 marks each, one question from each unit with internal choice.

Section C – Section C will be long answer type questions consisting 4 questions of 10 marks each, one question from each unit with internal choice.

❖ End Semester Exam (ESE) for SEC

There will be 8 questions of 8 marks each , out of which any 5 questions to be answer . Total marks will be 40 .

Minimum Pass Marks 40%

Section	Maximum Marks (80)		Maximum Marks (40)	
A	2 x 8 = 16	very short answer type questions consisting 8 questions of 2 marks each, two question from each unit	8 x 4 = 40	8 questions of 8 marks each, out of which any 5 questions to be answer
B	6 x 4 = 24	short answer type questions consisting 4 questions of 6 marks each, one question from each unit with internal choice.		
C	10 x 4 = 40	long answer type questions consisting 4 questions of 10 marks each, one question from each unit with internal choice		

Govt. Digvijay Autonomous PG College Rajnandgaon(CG)
FYUGP (CBCS/LOCF Course)
Department of Physics

Session 2025-2026	**Programme- UG**
Semester - V	**Subject- PHYSICS**
Course Type - DSC	**Course Code- UBSDCT502**
Course Title :	**RELATIVITY AND QUANTUM MECHANICS**
Credit – 3 (Theory) +1 (Lab) =4	**Lecture - 45**
MM - Theory -80 + IA-20 = 100	**Min Marks- 40 %**

Course Title	**RELATIVITY AND QUANTUM MECHANICS**
Course Learning Outcome:	• This basic course will form a firm basis to understand quantum many bodies problems • The interpretation of wave function of quantum particle and probabilistic nature of its location and subtler points of quantum phenomena are exposed to the student • The experiments using Sci-lab will enable the student to appreciate nuances involved in the theory • Demonstrate Knowledge and Broad understanding of Special Relativity.
Programe Specific Outcome:	**After completion of course the students will able to: -** • a fundamental/systematic or coherent understanding of the academic field of Physics, its different learning areas and applications in basic Physics. • procedural knowledge that creates different types of professionals related to the disciplinary/subject area of Physics, including professionals engaged in research, development and teaching. • Demonstrate the ability to use skills in Physics and its related areas of technology for formulating and tackling Physics-related problems.

Unit	**Lecture**	**Contents/Topic**	**Credits**
I	**10**	**Relativity-**Reference system, inertial frames, gallilean invariance & conservation laws, propogation of light, Michelson-Morley experiment, search for eather. Postulates for the special theory of relativity, Lorentz transformation, length contraction, time dilation, velocity addition theorem, variation of mass with velocity, mass-energy equivalance, particle with zero rest mass, Compton Effect.	**03**
II	**13**	**Origin of quantum theory:** Failure of classical physics to explain the phenomena such as black body spectrum, Photoelectric Effect. Wave-particle duality & Uncertainty principle, De Broglie's hypothesis for matter wave: The concept of wave & group velocity, Experimental demonstration of matter waves, Davisson & Germer's experiment. Consequence of de Broglie's concepts, Quantization in hydrogen atom, Energies of a particle in a box, Wave packets Consequence of the Uncertainty Relation: Gamma ray microscope, Diffraction at a slit.	
III	**12**	**Schrodinger's equation** – Schrodinger's wave equation, Time dependent and Time Independent Schrodinger's equation, Physical and Probabilistic interpretation of wave function, Properties of wave function, Degeneracy of wvae function, Normalization of wave function, Eigen value equation, Operators, Expectation value of dynamical variables, Postulator basis of quantum mechanics.	

IV	11	**Applications of Schrodinger's equation** - –Solution of Schrodinger's equation for a free Particle , Schrodinger's equation for a particle enclosed in a one and three Dimensional Box, Reflection of a particle through a potential step, Reflection From one dimensional potential well, Simple Harmonic Oscillators, Hydrogen atom: Schrodinger's equation, Eigen Function, eigen value of Energy, n, l and m quantum numbers.	
Total	**45**	**04 Unit**	

❖ **TEXT AND REFRENCE BOOKS :-**

1. Quantum mechanics By L.I. Schiff.
2. Introduction to Quantum Mechanics by D.J. Griffiths
3. Quantum mechanics by Zettli
4. Moderrn Quantum Mechanics by J.J. Sakurah
5. Advanced Quantum Mechanics By Satya Prakash
6. Generak relativity By Leonard susskind .

❖ **PHYSICS LAB: DSC – 01 Credits (UBSDCL502)**

LAB: RELATIVITY AND QUANTUM MECHANICS - 15 Lectures

1. Determination of Planck's constant.
2. Determination of e/m by using Thomson tube.
3. Determination of e by Milikan's method.
4. Study of spectra of Hydrogen & deuterium.
5. Absorption spectrum of iodine vapour
6. Study of Raman spectrum using laser as an excitation source.
7. Study statistics in radioactive measurement
8. Coniometric study of crystal faces.
9. Hysteresis curve of transformer core.
10. Hall-Probe method for measurement of magnetic field.
11. Specific resistance & energy gap of a semiconductor.
12. Youngs modulus of glass by carnu's method
13. Brewster's angle and Refractive index of glass using He-Ne Laser.

❖ Reference Books (Practical)

- Advanced Practical Physics for students, B.L. Flint and H.T. Worsnop, 1971, Asia Publishing House.
- A Text Book of Practical Physics, I. Prakash& Ramakrishna, 11th Ed., 2011, Kitab Mahal.
- Advanced level Physics Practical's, Michael Nelson and Jon M. Ogborn, 4th Edition, reprinted 1985, Heinemann Educational Publishers.
- A Laboratory Manual of Physics for undergraduate classes, D.P. Khandelwal, 1985, VaniPub.

Name & Signature of Members of Board of Studies	
V.C. Nominee	**DEPARTMENTAL MEMBER**
Subject Expert	• **HOD/ Dr. Priti Bala Taunk**.....
Subject Expert.....	• **Dr. Suresh Kumar Patel**.....
Specialist from Industry	• **Mr. Lekha Prasad Urvasha**.....
Alumni (Member)	

Govt. Digvijay Autonomous PG College Rajnandgaon(CG)
FYUGP (CBCS/LOCF Course)
Department of Physics

Session 2025-2026	Programme- UG
Semester - V	Subject- PHYSICS
Course Type – DSE-I	Course Code- UBSDET502
Course Title :	ELEMENTS OF ATOMIC ,MOLECULAR PHYSICS
Credit – 3 (Theory) +1 (Tutorial) =4	Lecture - 45
MM - Theory -80 + IA-20 = 100	Min Marks- 40 %

Course Title	ELEMENTS OF ATOMIC ,MOLECULAR PHYSICS
Course Learning Outcome:	• Atomic and molecular learning can help students develop skills in describing the structure of atoms, the properties of atoms, • Understand the basic properties of nuclear decays and nuclear reactions • Able to describe the nature and structure of atoms as well as its electronic structure.
Programe Specific Outcome:	**After completion of course the students will able to:-** • a fundamental/systematic or coherent understanding of the academic field of Physics, its different learning areas and applications in basic Physics. • procedural knowledge that creates different types of professionals related to the disciplinary/subject area of Physics, including professionals engaged in research , development and teaching . • Demonstrate the ability to use skills in Physics and its related areas of technology for formulating and tackling Physics-related problems .

Unit	Lecture	Contents/Topic	Credits
I	10	Spectra of hydrogen and spectral series ,bohrs Theory Sommar fields Atom model , fine structure of H-alfha line ,Spectra of duetron ,different series alkali spectra ,spinning electron, doublet fine structure ,screening conctants, Selection Rules.	03
II	13	Discrete set of electronic energies of molecules, vibrational energy level, quantisation of vibrational & rotational energies, determination of internuclear distance, pure rotational specta , rotation vibration spectra, , transition rules , Raman effect, stokes & anti stocks lines, Application of raman effect comparison between Raman &infrared spectra.	
III	12	Interaction of charged particles & neutrons with matter, working of nuclear detectors, G-M counter, proportional counter & scintillation counter, cloud chamber, spark chamber, emulsions. Struture of nuclei, basic properties (I, μ, Q and binding energy), deutron binding energy, p-p & n-p scattering and general concepts of nuclear forces.	
IV	11	Beta decay, range of alpha particle, Geiger-nuttal law, Gamow's explanation of beta decay, alpha decay and continues & discrete spectra. Nuclear reactions, channels, compound nucleus, direct reaction(concepts),shell model & liquid drop model, fission & fusion(concepts),energy production in stars by p-p & carbon cycles(concepts).	
Total	45	04 Unit	

❖ TEXT AND REFRENCE BOOKS

1. Atomic physics –Raj kumar
2. Atomic physics –J b rajam
3. Introduction to atomic spectra -H.E.white
4. R.R. ROY and B.P. NIGAM, Nuclear physics, Wiley-Easterm ltd 1983,
5. M.K.PAL theory of nuclear structure, affiliated East West, Madrras1982

Tutorial Works / Topics For Create Projects - 15 LECTURE (01 Credits)	
Topics	1. Spectral Analysis of Hydrogen and Alkali Metals using Emission Spectra. 2. Comparative Study of Raman and Infrared Spectra for Organic Molecules. 3. Simulation of Neutron Interactions and Nuclear Detectors. 4. Modeling Nuclear Fusion and Fission in Stars.

Name & Signature of Members of Board of Studies	
V.C. Nominee ..... **Subject Expert** ..... **Subject Expert**..... **Specialist from Industry** ..... **Alumni (Member)**	**DEPARTMENTAL MEMBER** • **HOD/ Dr. Priti Bala Taunk**..... • **Dr. Suresh Kumar Patel**..... • **Mr. Lekha Prasad Urvasha**.....

Govt. Digvijay Autonomous PG College Rajnandgaon(CG)
FYUGP (CBCS/LOCF Course)
Department of Physics

Session 2025-2026	**Programme- UG**
Semester – V	**Subject- PHYSICS**
Course Type – DSE-II	**Course Code- UBSDET602**
Course Title :	**ELEMENTS OF CONDENSED MATTER PHYSICS**
Credit – 3 (Theory) +1 (Tutorial) =4	**Lecture - 45**
MM - Theory -80 + IA-20 = 100	**Min Marks- 40 %**

Course Title	**ELEMENTS OF CONDENSED MATTER PHYSICS**
Course Learning Outcome:	• To study some of the basic properties of the condensed phase of matter especially solids. • To focus on understanding of the motion and equation of motion of macroscopic bodies. • To learn to use the functional mathematical notations that's allows precise understanding of fundamental properties of condensed matter physics. • To establish fundamental concepts in condensed matter physics, and applies the physics.
Programe Specific Outcome:	**After completion of course the students will able to:-** • A fundamental/systematic or coherent understanding of the academic field of Physics, its different learning areas and applications in basic Physics. • Procedural knowledge that creates different types of professionals related to the disciplinary/subject area of Physics, including professionals engaged in research , development and teaching . • Demonstrate the ability to use skills in Physics and its related areas of technology for formulating and tackling Physics-related problems .

Unit	**Lecture**	**Contents/Topic**	**Credits**
I	**10**	**Crystal structure**-Amorphous & crystalline solids, elements of symmetry, seven crystal system, cubic lattices, Unit cell, crystal planes & Miller indices, Reciprocal lattice , X-ray diffraction, Laue's equation for X-ray diffraction, Bragg's law, bonding in solids, classification of solids, Cohesive energy of solid, Madelung constant, evaluation of Parameters.	**03**
II	**13**	Specific heat of solids, classical theory (Dulong-Petit's law), Einstein & Debye theories, Vibrational modes of one dimensional monoatomic lattices, Dispersion relation, Brillouin zone, Free electron model of a metal, solution of one dimensional Schrodinger equation in a constant potential, density of states, Fermi energy, kronig Penny model, Metals, Insulators & Semiconductors, Hall effect.	
III	**12**	Dia, Para & Ferromagnetic materials, Classical Langevin's theory of dia& para magnetism, Quantum mechanical treatment of paramagnetism ,Curie-Weiss law, Qualitative description of ferromagnetism(magnetic domains),B-H curve & Hysteresis loss.	
IV	**11**	**superconductivity** occurrence of superconductivity, Meissener effect, , isotope effect, Type I & Type II superconductors London equation& Penetration depth, Coherence length, Cooper pairing due to phonons, BCS theory of superconductivity, BCS ground state, flux quantization of superconducting ring.	
Total	**45**	**04 Unit**	

❖ **TEXT AND REFRENCE BOOKS :**

1. Principle of Condensed Matter Physics by Chalking and Lubensky
2. Introduction to solid state physics: C Kittel
3. Solid State physics: A.J. Dekkar
4. Solid State Physics by S.O.Pillai
5. Solid state Physics by Puri and Bubber

Tutorial Works / Topics For Create Projects - 15 LECTURE (01 Credits)	
Topics	1. X-ray Diffraction and Bragg's Law: Structure Determination of Crystals. 2. Simulation of Free Electron Model and Density of States in Metals. 3. Modeling Magnetic Hysteresis and B-H Curves of Ferromagnetic Materials. 4. Understanding Superconductors and the Meissner Effect Through Simulation.

Name & Signature of Members of Board of Studies	
V.C. Nominee..... **Subject Expert** ..... **Subject Expert**..... **Specialist from Industry** ..... **Alumni (Member)**	**DEPARTMENTAL MEMBER** • **HOD/ Dr. Priti Bala Taunk**..... • **Dr. Suresh Kumar Patel**..... • **Mr. Lekha Prasad Urvasha**.....

Govt. Digvijay Autonomous PG College Rajnandgaon(CG)

FYUGP (CBCS/LOCF Course)

Department of Physics

Session 2025-26	**Programme- UG**
Semester - V	**Subject - PHYSICS**
Course Type - SEC	**Course Code – UBSEC513**
Course Title:	**COMMUNICATION SYSTEM**
Credit – 2	**Lecture - 30**
MM - 50 (ESE 40+IA 10)	**Min Marks- 40%**

Course Title	COMMUNICATION SYSTEM
Course Learning Outcome:	• Difference between Analog and Digital signal ,and understand their working mechanism. • He also would have gained knowledge about Communication system and how the communication system is working around us . • He also able to understand how signals are Modulated and Demodulated and their mechanism . • Its explain the difference between the Amplitude, Frequency and Phase Modulation . • How to EM Wave propagate by different propagation Techniques.
Programe Specific Outcome:	**After completion of course the students will able to:-** • A fundamental/systematic or coherent understanding of the academic field of Physics, its different learning areas and applications in basic Physics . • procedural knowledge that creates different types of professionals related to the disciplinary/subject area of Physics, including professionals engaged in research , development and teaching . • Demonstrate the ability to use skills in Physics and its related areas of technology for formulating and tackling Physics-related problems.

Unit	Lecture	Contents/Topic	Credits
I	8	Communication system, Transducers and signal, Analog and Digital signal, Difference between Analog and Digital signal, Basic terminology used in electronic Communication system, Elements of Communication System.	02
II	6	Mode of Communication System, Bandwidth of Signals, Bandwidth of Transmission Medium, Anteena and it's types, Classification of Radio waves.	
III	8	Propagation of Electro Magnetic Waves : Ground wave propagation, Sky wave propagation, Space wave propagation, Communication satellite, Geostationary satellite.	
IV	8	Modulation and it's Need, Types of Modulation : Amplitude modulation(AM), Phase modulation(PM), Frequency modulation(FM) , Difference between AM and FM, AM Transmitter and Receiver Demodulation and detection. Internet and it's generation , GPS	
Total	24	04 Unit	

❖ **Reference Books:**

- Communication systems (Analog and Digital) – Dr. Sanjay Sharma
- Principles of communication systems – Herbert Taub, Donald Schilling, Goutam Saha
- Advanced Communication system – Brijesh verma , pragyan verma
- Communication systems (2nd edition) – R P Singh S D Sapre

Name & Signature of Members of Board of Studies	
V.C. Nominee	**DEPARTMENTAL MEMBER**
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Subject Expert.....	• **Dr. Suresh Kumar Patel**.....
Specialist from Industry	• **Mr. Lekha Prasad Urvasha**.....
Alumni (Member)	

GOVT. DIGVIJAY AUTO. PG COLLEGE
RAJNANDGAON (CHHATTISHGARH)

SYLLABUS AND MARKING SCHEME FOR B.Sc. WITH PHYSICS
SESSION 2025-26
SEMESTER - VI

- **THEORY PAPER :**

Class	Paper	Course title	Course code	Credit value	Theory marks	Internal marks	Passing marks
Sem.-VI	DSC	SOLID STATE DEVICE AND ELECTRONICS	UBSDCT602	3	80	20	40
Sem.-VI	DSE-I	MATHEMATICAL PHYSICS -I	UBSDET602	4	80	20	40
Sem -VI	DSE-II	NUCLEAR PHYSICS	UBSDET603	4	80	20	40

- **PRACTICAL / PROJECT PAPER :**

Class	Paper	Course title	Course code	Credit value	Practical + viva marks+ Sessional	Internal assessment :	Passing marks
Sem.-VI	DSC	SOLID STATE DEVICE AND ELECTRONICS	UBSDCL602	1	40	10	20
Sem.-VI	SEC	PHYSICS INTERNSHIP	UBSEC613	2	40	10	20

28/6/25

GOVT. DIGVIJAY AUTO. PG COLLEGE
RAJNANDGAON (CHHATTISHGARH)

INSTRUCTION FOR QUESTION PAPER SETTING

❖ End Semester Exam (ESE) for DSC and DSE

There will be 03 sections of question of 80 marks.

Section A – Section A will be very short answer type questions consisting 8 questions of 2 marks each, two question from each unit .

Section B – Section B will be short answer type questions consisting 4 questions of 6 marks each, one question from each unit with internal choice.

Section C – Section C will be long answer type questions consisting 4 questions of 10 marks each, one question from each unit with internal choice.

❖ End Semester Exam (ESE) for SEC

There will be 8 questions of 8 marks each , out of which any 5 questions to be answer . Total marks will be 40 .

Minimum Pass Marks 40%

Section	Maximum Marks (80)		Maximum Marks (40)	
A	2 x 8 = 16	very short answer type questions consisting 8 questions of 2 marks each, two question from each unit	8 x 4 = 40	8 questions of 8 marks each, out of which any 5 questions to be answer
B	6 x 4 = 24	short answer type questions consisting 4 questions of 6 marks each, one question from each unit with internal choice.		
C	10 x 4 = 40	long answer type questions consisting 4 questions of 10 marks each, one question from each unit with internal choice		

28/6/24

Govt. Digvijay Autonomous PG College Rajnandgaon(CG)
FYUGP (CBCS/LOCF Course)
Department of Physics

Session 2025-2026	**Programme- UG**
Semester - VI	**Subject- PHYSICS**
Course Type - DSC	**Course Code- UBSDCT602**
Course Title :	**SOLID STATE DEVICE AND ELECTRONICS**
Credit – 3(Theory) +1 (Lab) =4	**Lecture - 45**
MM - Theory -80 + IA-20 = 100	**Min Marks- 40 %**

Course Title	**SOLID STATE DEVICES AND ELECTRONICS**
Course Learning Outcome:	• Understand the working of selected Tunnel diode, Zener diode, Light emitting diode , FET,MOSFET • Understand the basic physics of semiconductor electronis devices. • The importance of electrons and holes in semiconductor, the charge density and distribution, the charge transport mechanisms. • Difference between Analog and Digital circuits, Number systems, their inter conversions, Basic logic gates.
Programe Specific Outcome:	**After completion of course the students will able to:-** • a fundamental/systematic or coherent understanding of the academic field of Physics, its different learning areas and applications in basic Physics. • procedural knowledge that creates different types of professionals related to the disciplinary/subject area of Physics, including professionals engaged in research , development and teaching . • Demonstrate the ability to use skills in Physics and its related areas of technology for formulating and tackling Physics-related problems .

Unit	**Lecture**	**Contents/Topic**	**Credits**
I	**11**	Semiconductor, Intrinsic semiconductor, Fermi level in an intrinsic semiconductor, Extrinsic semiconductor, carrier concentration in thermal equilibrium, Fermi level, impurity, semiconductor, donor & acceptor levels, diode equation, P-N junctions, junction breakdown, Depletion width & junction capacitance, Hall effect & Hall coefficient.	**03**
II	**10**	Tunnel diode, Zener diode, Light emitting diode, Schottky diode, Solar cell, bipolar transistors, pnp&npn transistors, characteristics of transistors, different configurations, current amplification factor, FET,MOSFET.	
III	**12**	Half & Full wave rectifier, rectifier efficiency, ripple factor, Bridge rectifier, filters, inductor filter, T & π filter, , regulated power supply Applications of transistors, Bipolar transistor as amplifier, Single stage & CE small signal amplifiers, emitter followers, transistor power amplifier, transistor as oscillator, Wein-Bridge oscillator & Hartley oscillator.	

GOVT. DIGVIJAY COLLEGE
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28/6/2025

IV	**12**	Digital circuit: difference between analog and digital circuit, binary number, decimal to binary and binary to decimal conversion, AND, OR and NOT gate, NAND and NOR gate as universal gate, XOR and XNOR gate, De-Morgan's theorem, Booleen law, simplification of logic circuit using Boolean algebra, digital to analog converter, analog to digital converter.	
Total	**45**	**04 Unit**	

❖ TEXT AND REFRENCE BOOKS :

1. Introduction to solid state physics: C Kittel
2. Solid State physics: A.J. Dekkar
3. Electronic Circuits: Mottershead
4. Electronic Circuits: Millman &Halkis
5. Semiconductor Devices: S.M. sze

• PHYSICS LAB: DSC – 01 Credits (UBSDCL602)

LAB: SOLID STATE DEVICE AND ELECTRONICS

1. Characteristics of Transistor.
2. Characteristics of Tunnel diode.
3. Study of voltage regulation system.
4. Study of Regulated Power Supply.
5. To study the Characteristics of FET
6. Study of VTVM.
7. Study of RC & TC coupled amplifiers.
8. Study of AF & RF oscillators.
9. To Study the CB circuit..
10. To Study the CC circuit
11. To Study the CE circuit
12. Characteristics of Zenar diode
13. Study of lissajous figures using a CRO
14. To study the De-Morgan's law and verify their truth table
15. To study the Characteristics of a LDR
16. To study the Characteristics of a LED
17. To study the different types of logic gate and verify their truth table .
18. To perform X-OR gate using universal gate.
19. To perform X-NOR gate using universal gate.

28/6/2025

❖ Reference Books (Practical)

- Advanced Practical Physics for students, B.L. Flint and H.T. Worsnop, 1971, Asia Publishing House
- A Text Book of Practical Physics, I. Prakash& Ramakrishna, 11th Ed., 2011, Kitab Mahal
- Advanced level Physics Practical's, Michael Nelson and Jon M. Ogborn, 4th Edition, reprinted 1985, Heinemann Educational Publishers .
- A Laboratory Manual of Physics for undergraduate classes, D.P.Khandelwal, 1985, VaniPub.

Name & Signature of Members of Board of Studies	
V.C. Nominee	**DEPARTMENTAL MEMBER**
Subject Expert	• **HOD/ Dr. Priti Bala Taunk**.....
Subject Expert.....	• **Dr. Suresh Kumar Patel**.....
Specialist from Industry	• **Mr. Lekha Prasad Urvasha**.....
Alumni (Member)	

Govt. Digvijay Autonomous PG College Rajnandgaon (CG)
FYUGP (CBCS/LOCF Course)
Department of Physics

Session- 2025-26	**Programme- UG**
Semester - VI	**Subject- PHYSICS**
Course Type – DSE-I	**Course Code- UBSDET602**
Course Title :	**Mathematical Physics -I**
Credit – 3(Theory) +1 (Tutorial) =4	**Lecture - 45**
MM - Theory -80 + IA-20 = 100	**Min Marks- 40 %**

Course Title	**Mathematical Physics -I**
Course Learning Outcome:	➢ Revise and apply the knowledge of calculus, vectors, vector calculus. probability and probability distributions in various cases. ➢ Illustrate proficiency in writing and solving Differential equation and solving them for a given physical system. ➢ Apply and interpret the curvilinear coordinates in problems with spherical and cylindrical symmetries. ➢ Use Dirac Delta function for various physical situation, especially in quantum mechanical approaches.
Programme Specific Outcome:	**After completion of course the students will able to:-** • Understand and solve problems related to limits, continuity, differentiation, and integration, including applications in real-world scenarios. • Compute partial derivatives, use Lagrange multipliers for constrained optimization, and apply calculus in multiple coordinate systems. • Work with probability distributions (binomial, Gaussian, and Poisson), calculate mean and variance, and apply Bayes' theorem for decision-making. • Solve first and second-order differential equations, use integrating factors, and apply mathematical concepts to physical and engineering problems.

Unit	**Lecture**	**Contents/Topic**	**Credits**
I	**13**	**Calculus:** **Recapitulation:** Limits, continuity, average and instantaneous quantities, differentiation. Plotting functions, Intuitive ideas of continuous, differentiable, etc. functions and plotting of curves. Approximation: Taylor and binomial series (statements only). **Calculus of functions of more than one variable**: Partial derivatives, exact and inexact differentials. Integrating factor, with simple illustration. Constrained Maximization using Lagrange Multipliers. **Origin and Evolution of Mathematical concepts in Ancient India:** Bhaskaracharya, the Inventor of Calculus: some examples on calculus.	**03**
II	**12**	**First Order and Second Order Differential equations:** First Order Differential Equations and Integrating Factor. Homogeneous Equations with constant coefficients. Wronskian and general solution. Statement of existence and Uniqueness Theorem for Initial Value Problems. Particular Integral. **Orthogonal Curvilinear Coordinates:** Orthogonal Curvilinear Coordinates. Derivation of Gradient, Divergence, Curl and Laplacian in Cartesian, Spherical and Cylindrical Coordinate Systems.	
III	**10**	**Introduction to probability:** Independent random variables: Probability distribution functions; binomial, Gaussian, and Poisson, with examples. Mean and variance. Dependent events: Conditional Probability. Bayes' Theorem and the idea of hypothesis testing.	

IV	10	**Dirac Delta function and its properties:** Definition of Dirac delta function. Representation as limit of a Gaussian function and rectangular function. Properties of Dirac delta function. Problems based on dirac-delta function and its application.	
Total	**45**	**04 Unit**	

❖ TEXT AND REFRENCE BOOKS :-

1. Advanced Engineering Mathematics, D.G. Zill and W.S. Wright, 5 Ed, 2012, Jones and Bartlett Leaming.
2. Mathematical Physics, Goswami, Ist edition, Cengage Learning .
3. Engineering Mathematics, S. Pal and S.C. Bhunia, 2015, Oxford University Press
4. Advanced Engineering Mathematics, Erwin Kreyszig, 2008, Wiley India.
5. Essential Mathematical Methods, K. F. Riley & M.P Hobson, 2011, Cambridge Univ. Press.
6. Mathematical Physics, H.K. Dass and R. Verma, S. Chand & Company.

Tutorial Works / Topics: For Create Projects -15 LECTURE (1 Credits)	
Topics-	1. Exploring the Contributions of Bhaskaracharya to Calculus. 2. Visualization and Applications of Multivariable Calculus. 3. Dirac Delta Function and Its Role in Physics and Engineering. 4. Probability Distributions and Their Applications in Data Science.

Name & Signature of Members of Board of Studies

V.C. Nominee .....

Subject Expert .....

Subject Expert.....

Specialist from Industry .....

Alumni (Member) .....

DEPARTMENTAL MEMBER

- **HOD/ Dr. Priti Bala Taunk**.....
- **Dr. Suresh Kumar Patel**.....
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Govt. Digvijay Autonomous PG College Rajnandgaon (CG)
FYUGP (CBCS/LOCF Course)
Department of Physics

Session 2025-26	**Programme- UG**
Semester - VI	**Subject- PHYSICS**
Course Type – DSE-II	**Course Code- UBSDET603**
Course Title :	**Nuclear Physics**
Credit – 3(Theory) +1 (Tutorial) =4	**Lecture - 45**
MM - Theory -80 + IA-20 = 100	**Min Marks- 40 %**

Course Title	**Nuclear Physics**
Course Learning Outcome:	➢ Describe nuclear constituents and their intrinsic properties. Analyze binding energy variations with mass number and understand the N/Z plot. ➢ Explain and apply nuclear models for clear understanding of stability of nuclei and nuclear processes. Differentiate alpha, beta, and gamma decay and interpret energy spectra. ➢ Apply conservation laws to compute Q-values, and analyze reaction mechanism. Explain significance of scattering and reaction cross section. ➢ Calculate and compare nuclear fission and fusion energy. Describe nuclear detectors and particle accelerators.
Programme Specific Outcome:	**After completion of course the students will able to:-** ➢Understand the fundamental properties of nuclei, including mass, charge, binding energy, and nuclear structure. ➢Analyze various nuclear models, including the liquid drop model, shell model, and nuclear stability conditions. ➢Explain nuclear decay processes, reaction mechanisms, energy calculations, and the role of nuclear energy in power generation. ➢Describe the working principles of nuclear detectors and particle accelerators, along with their applications in nuclear physics.

Unit	**Lecture**	**Contents/Topic**	**Credits**
I	**10**	**General Properties of Nuclei:** Constituents of nucleus and their Intrinsic properties, quantitative facts about mass, radii, charge density (matter density). binding energy, average binding energy and its variation with mass number, main features of binding energy versus mass number curve, N/A plot, angular momentum, parity, magnetic moment, electric moments.	**03**
II	**10**	**Nuclear Models:** Liquid drop model approach, semi empirical mass formula and, significance of its various terms, condition of nuclear stability, two nucleon separation energies, Fermi gas model, evidence for nuclear shell structure, nuclear magic numbers, basic assumption of shell model, concept of mean field.	
III	**14**	**Nuclear decay and Reactions:** Alpha, beta, gamma decay, energy spectrum, Geiger-Nuttel law, disintegration energy, quantum theory of alpha decay, types of beta decay and energy spectrum, Pauli's prediction of neutrino. Types of Reactions, Conservation Laws, kinematics of reactions. **Nuclear Energy Reactions**: Nuclear Fission, Calculation of energy released, Nuclear fusion, Energy released in Fusion, Comparison of Fission and fusion energy, Fusion as source of stellar Energy, Nuclear reactors in India, Contribution of nuclear energy in total energy requirement.	

IV	11	**Nuclear Detector and Particle Accelerators:** Interaction of charge particle through matter, Gas detectors: estimation of electric field, mobility of particle, for ionization chamber and GM Counter. Basic principle of Scintillation, Detectors and construction of photo-multiplier tube (PMT), Semiconductor Detectors. Accelerator facility available in India: Van-de Graaff generator, Pelletron accelerator, Linear accelerator, Cyclotron accelerator.	
Total	**45**	**04 Unit**	

❖ TEXT AND REFRENCE BOOKS :-

1. Introduction to Nuclear and Particle Physics V.K. Mittal, R. C. Verma, S. C. Gupta, Eastern Economy Edition.
2. Basic ideas and concepts in Nuclear Physics - An Introductory Approach by K. Heyde (IOP-Institute of Physics Publishing, 2004) .
3. Nuclear Physics by S.N. Ghoshal, S. Chand Publishing, 2019.
4. Unified Physics-III by R P Goyal, Shivlal Agrawal & Sons Publication
5. Nuclear Physics -6Ed by D. C. Tayal, Himalaya Publishing House.

Tutorial Works / Topics: For Create Projects -15 LECTURE (1 Credits)	
Topics-	1. Binding Energy and Nuclear Stability. 2. Nuclear Reactions and Energy Generation 3. Detection of Nuclear Radiation 4. Particle Accelerators and Their Applications.

Name & Signature of Members of Board of Studies

V.C. Nominee .....

Subject Expert .....

Subject Expert.....

Specialist from Industry .....

Alumni (Member) .....

DEPARTMENTAL MEMBER

- **HOD/ Dr. Priti Bala Taunk**.....
- **Dr. Suresh Kumar Patel**.....
- **Mr. Lekha Prasad Urvasha**.....

Govt. Digvijay Autonomous PG College Rajnandgaon(CG)
FYUGP (CBCS/LOCF Course)
Department of Physics

Session 2025-26	**Programme - UG**
Semester - VI	**Subject- PHYSICS**
Course Type - SEC	**Course Code- UBSEC613**
Course Title:	**PHYSICS INTERNSHIP**
Credit – 2	**Lecture - 30**
MM - 50 = (Project 40+Int. 10)	**Min Marks- 40%**

Course Title	**PHYSICS INTERNSHIP**
Course Learning Outcome:	• Apply Theoretical Knowledge in Practical Settings . • Develop Laboratory and Instrumentation skills . • Analyze and interpret Experimental data . • Enhance Scientific Communications . • Foster Teamwork and Professionalism and promote Ethical Conduct in Scientific practice .
Programe Specific Outcome:	**After completion of course the students will able to:-** • Gain Exposure to Career Pathways in Physics . • Develop the ability to apply principles of classical , quantum , thermodynamics in practical and industrial settings . • Gain proficiency in operating scientific instruments , collecting data , and troubleshooting experimental setups. • Demonstrate understanding of experimental design , data analysis , hypothesis testing , and scientific reporting in real research environments .

ASSESSMENT

PROJECT	30
VIVA	10
INTERNAL	10
TOTAL	**50**

GOVT. DIGVIJAY COLLEGE
RAJNANDGAON (C.G.)
(An Autonomous College Affiliatted With
Hemchand Yadav Vishwavidyalaya, Durg)

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