GOVT. DIGVIJAY AUTO. PG COLLEGE

RAJNANDGAON (CHHATTISHGARH)

Approved syllabus for Semester and CBCS Curriculam of B.Sc. with PHYSICS , by the members of Board of Studies for Session 2025-26

Semester VII	No. of credits
DSC ELECTRONICS AND PHOTONICS DEVICES AND OPTICAL	3
DSC: LAB ELECTRONICS AND PHOTONICS DEVICES AND OPTICAL LAB	1
Choose four DSE from the below pool	
DSE-I MATHEMATICAL PHYSICS	3
DSE-I : LAB MATHEMATICAL PHYSICS LAB	1
DSE-II CLASSICAL MECHANICS (3Th+ 1T)	4
DSE-III ELECTRODYNAMICS & PLASMA PHYSICS (3Th + 1T)	4
GE -IV SOURCES OF POWER (3Th + 1T)	4

GOVT. DIGVIJAY AUTO. PG COLLEGE
RAJNANDGAON (CHHATTISHGARH)

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

- **THEORY PAPER :**

Class	Paper	Course title	Course code	Credit value	Theory marks	Internal marks	Passing marks
Sem.- VII	DSC	ELECTRONICS AND PHOTONICS DEVICES AND OPTICAL	UBSDCT702	3	80	20	40
	DSE-I	MATHEMATICAL PHYSICS	UBSDET702	4	80	20	40
	DSE-II	CLASSICAL MECHANICS	UBSDET703	4	80	20	40
	DSE-III	ELECTRODYNAMICS & PLASMA PHYSICS	UBSDET704	4	80	20	40
	GE	SOURCES OF POWER	UBSDGE702	4	80	20	40

- **PRACTICAL / PROJECT PAPER :**

Class	Paper	Course title	Course code	Credit value	Practical + viva marks+ Sessional	Internal assessment	Passing marks
Sem.- VII	DSC	ELECTRONICS AND PHOTONICS DEVICES AND OPTICAL LAB	UBSDCL702	1	40	10	20
Sem.- VII	DSE-I	MATHEMATICAL PHYSICS LAB	UBSDEL702	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 2025-26	**Programme- UG**
Semester - VII	**Subject- PHYSICS**
Course Type – DSC	**Course Code- UBSDCT702**
Course Title :	**ELECTRONICS AND PHOTONICS DEVICES AND OPTICAL**
Credit – 3(Theory) +1 (Lab) = 4	**Lecture - 45**
MM - Theory -80 + IA-20 = 100	**Min Marks- 40 %**

Course Title	**ELECTRONICS AND PHOTONICS DEVICES AND OPTICAL**
Course Learning Outcome:	• Understand the structure and working of unipolar devices, including JFET, MOSFET, UJT, SCR, and Diac, along with their I-V characteristics. • Describe the functioning of photonic devices, including LEDs, laser diodes, photodetectors, and solar cells (p-n junction, heterojunction, and thin-film types) • Analyze optical communication components, including optical fibers, numerical aperture, dispersion, and advanced modulation techniques. • Evaluate optoelectronic and nonlinear optical effects, including second harmonic generation, self-focusing, and acoustic/magneto-optic modulation.
Programe Specific Outcome:	**After completion of course the students will able to: -** • Apply principles of semiconductor physics to understand, analyze, and troubleshoot electronic and photonic devices. • Demonstrate knowledge of modern optoelectronic technologies used in communication, imaging, sensing, and renewable energy systems. • Utilize electronic device models and characteristics for circuit design, simulation, and performance evaluation in practical applications. • Engage in advanced interdisciplinary research involving electronics, photonics, materials science, and communication technologies.

Unit	**Lecture**	**Contents/Topic**	**Credits**
I	**10**	Unipolar device: JFET , MESFET and MOSFET basic structure, working and device I-V characteristics, small signal equivalent circuit related field effect device, Microwave performance, charged coupled device (CCDs), basics structure and working , principal, MOSFET- basic device characteristics, types of MOSFET, UJT , SCR , triac operation VI characteristics of Triac, Triac rating , Application of Diac, Diac- operation, Diac V-I characteristics curve.	**03**
II	**13**	Special Microwave Devices: Quantum effect device, Resonant Tunneling diode, unipolar resonant tunneling transistor. Tunnel diode and backward diode-basic device characteristics, IMPATT diode and their statics and dynamic characteristics, Transfer electron device-transferred electron effect, Gunn diode, Negative differential resistance, Hot electron devices, Hot electron HBT, Real space Transfer Transistor.	
III	**12**	Photonic Device: Radiative transitions and optical absorption optical cavity and feedback, LEDs: Visible LED and infrared, SC laser; Photo detectors ; Photo conductor, & Photodiode , SOLAR cell , Solar radiation and ideal conversion efficiency, p-n junction solar cells, Hetero junction, Interface thin film solar cells, Basic laser structure, Threshold current density, Quantum well laser, Silicon and compound –semiconductor solar cell, Optical concentration .	

IV	11	**Optical Modulation and Display devices** :- Optical fiber waveguides, Introduction: Optical fiber, Numerical aperture, Pulse dispersion in step index fibers, First and second generation fiber optic communication, Magneto-Optic and Acoustic-Optic effect , Materials exhibiting these properties , Non-linear Optics(self focusing, second harmonic generation) **Display devices**: Luminescence, Photo- luminescence, Electroluminescence, Liquid crystal display (LCD), Numeric display . **Fiber** - wave guides and optical communication system and networking.	
Total	**45**	**04 Unit**	

❖ TEXT AND REFERENCE BOOKS

1. Semiconductor Device: Physics and Technology, By SM Sze, Eiley (1985).
2. Introduction to semiconductor device. M.S. Tyagi , John Wiley and sons.
3. Measurement, Instrumentation and experimental design in physics and engineering By M. Sayer AND A. Mansingh, Prentice Hall India 2000.
4. Optical electronics By Ajay Ghatak and K.Thyagarajah, Cam. Univ. press.
5. Opto electronics – An Introduction : Jwilson and JFB Hawkes (Eastern Economy dition) .

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)	

- **PHYSICS LAB: DSC – 01 Credits (UBSDCL702)**

LAB: ELECTRONICS AND PHOTONICS DEVICES AND OPTICAL

1. To Study the De-Morgans theorem and verify their truth table .
2. To Study the DC gate control characteristics of SCR.
3. To Study the Characteristics of LED.
4. To Study the Different types of logic gates and verify their truth table.
5. To Study the Characteristics of FET.
6. To Study the illumination characteristics of a Solar Cell.
7. To Study the Characteristics of Light Dependent Register (LDR).
8. To Perform Ex-OR gate using Universal gate .
9. To Perform Ex-NOR gate using Universal gate.
10. Energy band gap of Intrinsic semiconductor .

❖ Reference Books (Practical)

1. Digital Principles and Applications – Donald P. Leach & Albert Paul Malvino , McGraw Hill Education.
2. Electronic Devices and Circuit Theory – Robert L. Boylestad & Louis Nashelsky, Pearson Education.
3. Optoelectronics and Photonics: Principles and Practices – S.O. Kasap, Pearson India .
4. Experiments in Electronics – B.L. Theraja, S. Chand Publishing

Name & Signature of Members of Board of Studies	
V.C. Nominee	**DEPARTMENTAL MEMBER**
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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 - VII	**Subject- PHYSICS**
Course Type – DSE-I	**Course Code- UBSDET702**
Course Title :	**MATHEMATICAL PHYSICS**
Credit – 3(Theory) +1 (Lab) = 4	**Lecture - 45**
MM - Theory - 80 + IA-20 = 100	**Min Marks- 40 %**

Course Title	**MATHEMATICAL PHYSICS**
Course Learning Outcome:	• Understand and apply vector space concepts, including basis, dimension, and orthogonality, and compute eigenvalues and eigenvectors. • Analyze complex functions and use Cauchy-Riemann conditions, contour integration, and Laplace's equation in physical contexts. • Explain and apply special functions (Legendre, Bessel, Hermite, Laguerre) along with generating functions and orthogonality properties. • Use integral transforms (Laplace and Fourier) to solve boundary value problems and transform differential equations.
Programe Specific Outcome:	**After completion of course the students will able to:-** • Apply advanced mathematical tools to model and solve physical and engineering problems involving differential equations and transforms. • Connect mathematical theory with physical phenomena, especially through special functions and solutions to boundary value problems. • Utilize Laplace and Fourier analysis in signal processing, optics, and control systems. • Demonstrate analytical thinking by integrating methods from linear algebra, complex analysis, and mathematical physics.

Unit	**Lecture**	**Contents/Topic**	**Credits**
I	**10**	**Vector space and matrices**: - Linear independence , Bases, Dimensionality, Inner product , Linear, transformation matrices, Inverse matrix , Orthogonal and Unitary matrices, Eigen values and Eigen Vector, Diagonalization , complete orthogonal sets of functions, **complex variable :** Analytic function, Cauchy-Riemann condition, Cauchy integral formula, analytic function, necessary and sufficient conditions, Cauchy- Reimann equation in polar, Laplace equation; Laplace equation; Harmonic function line integral of a complex function, Derivations analytic function, singularities of an analytic function with examples.	**03**
II	**13**	**Differential equation**: - second order linear ODEs with variable coefficients, Solution by series expansion ,non -homogeneous differential equation and solution by the method of Green's function with application, Solution of second order differential equation with constant coefficient, power series solution ; Frobeniu's method .	
III	**12**	**Special function**: - Legendre , Bessel , Hermite and Laguerre function with their physical applications , Generating function, Orthogonality condition , Recursion relations .	

IV	11	**Integral Transforms**: - Laplace form integral transforms , Properties of Laplace transforms Laplace transforms , First and second shifting theorems with example , Inverse Laplace Transforms , LT of derivative and integral of a function . Fourier series , FS or arbitrary period , half wave expansions partial sums , Fourier integral and transforms, Laplace transform of periodic functions, inverse Laplace theorem: Fourier Mellin theorem: properties of inverse Laplace transform, Simple Applications of fourier transform; (i) Evaluation of integrals (ii) Solution of Boundary value problems.	
Total	**45**	**04 Unit**	

❖ TEXT AND REFERENCE BOOKS :

1. Mathematical Methods for Physics , By G. Arfken .
2. Matrices and Tensors for Physicist , By A. W. Joshi.
3. Advanced Engineering Mathematics , By E.Kroyazig
4. Special Functions , By E.B.Rainville.
5. Special Functions , By W.W.Bell.

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)	

- **PHYSICS LAB: DSE-I – 01 Credits (UBSDET702)**

  - **LAB: MATHEMATICAL PHYSICS LAB**

Construction

IC regulated power supply:

- Stable, Monostable Multivibrature
- R.C. coupled, schmitt trigger
- other equivalent Circuit Regulated power supply

❖ Reference Books (Practical)

1. Basic Electronics: Devices, Circuits and IT Fundamentals: S. K. Mandal, McGraw Hill Education.
2. Electronic Devices and Circuit Theory: Robert L. Boylestad & Louis Nashelsky, Pearson Education .
3. Integrated Electronics: Analog and Digital Circuits and Systems: Jacob Millman & Christos C. Halkias, McGraw-Hill.
4. Experiments in Electronic: B. S. Grewal, Khanna Publishers

Name & Signature of Members of Board of Studies	
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Subject Expert.....	• Dr. Suresh Kumar Patel.....
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Session 2025-26	**Programme- UG**
Semester - VII	**Subject- PHYSICS**
Course Type – DSE - II	**Course Code- UBSDET703**
Course Title :	**CLASSICAL MECHANICS**
Credit – 3 (Theory) +1 (Tutorial) =4	**Lecture - 45**
MM - Theory -80 + IA-20 = 100	**Min Marks- 40 %**

Course Title	**CLASSICAL MECHANICS**
Course Learning Outcome:	• Formulate equations of motion for single and multi-particle systems using Lagrangian and Hamiltonian mechanics. • Analyze motion in non-inertial frames, including Coriolis and centrifugal forces and their applications in astronomy and rotating systems. • Solve central force problems and orbital mechanics using advanced tools like canonical transformations and stability analysis. • Understand and utilize Poisson brackets, Euler's equations, and generalized coordinates in the study of rigid body dynamics and conserved quantities.
Programe Specific Outcome:	**After completion of course the students will able to:-** • Translate physical problems into mathematical models using the language of analytical mechanics. • Apply classical mechanics principles to real-world systems in celestial mechanics, atomic models, and rigid body motion. • Develop a foundation for modern physics including quantum mechanics and field theory through Hamiltonian formalism.

Unit	Lecture	Contents/Topic	Credits
I	10	Preliminaries - Newtonian mechanics of one and many Particle system , Conservation law , Constraints & their classifications , Work Energy theorem open system (with variable mass) , Generalized coordinates ,generalized notations, Principle of vertual work , D' Alembert's Principle and Lagrange's equations Lagrangian for a charges particle in an electromagnetic field, deduction of Hamilton's principle from D' Alembert's Principle, Deduction of Newton's second law of motion from Hamilton's principle .	03
II	13	Deduction of a Lagrange's equation using variational principle for non-conservative system , Application of Lagrangian formulation , Simple pendulum , Jacobi Integral: Generalized coordinates and Moment Integrals of motion , symmetries of space and time with conservation law , Principle of least action , invariance under Galilean transformations rotating frames integral forces , astronomical applications of Coriolis force.	
III	12	Hamilton's canonical equation of motion, physical significance of H, advantage of Hamiltonian approach, deduction of canonical equation from a Variational principle ,Central force definition and characteristics , two body problem , closure and stability of circular orbits , general analysis of orbits , Kepler's law and equation , principle of least action ,Hamilton's principle and characteristic function. Condition for a transformation to be canonical, Infinitesimal contact transformations, Canonical transformations , example of canonical transformation, Generating function .	

IV	**11**	Poisson bracket , Poisson theorem Angular momentum PBs, Small oscillations , Normal modes and coordinates. Rigid body dynamics- the Euler's angles , Euler's equation of motion ,rate of change of vector,invariance of Poisson bracket with respect to canonical transformation, Equation of motion in Poisson bracket form, Lagrange's brackets ,Relation between lagranges and Poisson bracket, Liouville's theorem.	
Total	**45**	**04 Unit**	

Tutorial Works / Topics for Create Projects - 15 LECTURE (01 Credits)	
Topics	1. Lagrangian Mechanics : Generalized coordinates, virtual work, constraints, D'Alembert's Principle, Euler-Lagrange equations. 2. Variational Principles: Hamilton's principle, least action, application to pendulum, non-conservative systems, Coriolis force effects. 3. Poisson Brackets & Rigid Body Dynamic: Angular momentum, Euler's equations, invariance, small oscillations, Lagrange brackets. 4. Central Force & Orbital Mechanics: Stability of circular orbits, two-body problem, Kepler's laws, closure analysis of orbits.

❖ TEXT AND REFERENCE BOOKS:

1. Classical Mechanics : By N. C. Rana and P.S. Joag (Tata Mcgraw- Hill, 1991).
2. Classical Mechanics : By H. Goldstein (Addison Wesley, 1980.).
3. Classical Mechanics : By H. Goldstein , C. Poole & J. Fafco (Pearson Education , Inc, 200
4. Introduction to Dynamics : By Perceival and D. Richaeds (Cambridge University, press, 1982.).

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**.....

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Department of Physics

Session 2025-26	**Programme- UG**
Semester - VII	**Subject- PHYSICS**
Course Type – DSE-III	**Course Code- UBSDET704**
Course Title :	**ELECTRODYNAMICS & PLASMA PHYSICS**
Credit – 3(Theory) +1 (Tutorial) =4	**Lecture - 45**
MM - Theory -80 + IA-20 = 100	**Min Marks- 40 %**

Course Title	**- ELECTRODYNAMICS & PLASMA PHYSICS**
Course Learning Outcome:	• Understand and apply Maxwell's equations in the context of wave equations, scalar/vector potentials, and gauge transformations. • Analyze radiation from accelerating charges using the Liénard-Wiechert potential and Larmor's formula (including relativistic cases). • Explain advanced radiation phenomena such as Bremsstrahlung, Synchrotron, and Cherenkov radiation with energy/angular distributions. • Interpret confinement mechanisms and electromagnetic field interactions in charged particle motion within plasmas
Programe Specific Outcome:	**After completion of course the students will able to:-** • Model dynamic electromagnetic fields using both classical and relativistic electrodynamics principles . • Utilize theoretical frameworks such as Lorentz transformations and gauge theory to understand electromagnetic phenomena. • Integrate plasma physics concepts with real-world applications in fusion, space physics, and MHD systems . • Develop analytical and computational skills to solve advanced problems involving wave propagation and plasma behavior .

Unit	Lecture	Contents/Topic	Credits
I	10	Maxwell's equations, vector and scalar potentials and the wave equation, Gauge transformations, Lorenz gauge, Coulomb gauge, Green function for the wave equation, four-vectors, mathematical properties of the space-time in special relativity, matrix representation of Lorentz transformation, covariance of electrodynamics, transformation of electromagnetic fields.	03
II	13	Radiation by moving charges, Lienard-Wiechert potential and fields for a point charge, total power radiated by an accelerated charge-Larmor's formula and its relativistic generalization, angular distribution of radiation emitted by an accelerated charge, radiation emitted by a charge in arbitrary extremely relativistic motion, distribution in frequency and angle of energy radiated by accelerated charge.	
III	12	Bremsstralung: emission from single-speed electrons, thermal Bremsstralung emission and absorption, Synchrotron radiation: spectrum of synchrotron radiation, spectral index for power law electron distribution, transition from Cyclotron to Synchrotron emission, Cherenkov radiation.	

IV	11	Plasma: definition, Debye shielding phenomenon and criteria for plasma, motion of charged particles in electromagnetic field ,Fundamental equations of magneto- hydrodynamics (MHD), Hydrodynamics Waves; Magneto sonic and Alfven waves, Magnetic viscosity and magnetic pressure, plasma confinement schemes.	
Total	**45**	**04 Unit**	

Tutorial Works / Topics for Create Projects - 15 LECTURE (01 Credits)	
Topics	1. Maxwell's Equations and Gauge Theory :Wave equation, scalar/vector potentials, Coulomb and Lorenz gauges, Green's function applications. 2. Special Radiation Mechanisms : Bremsstrahlung, Synchrotron radiation, Cyclotron-Synchrotron transition, Cherenkov radiation. 3. Magneto-Hydrodynamics and Plasma Waves :MHD equations, Alfven and magnetosonic waves, plasma confinement, magnetic pressure. 4. Radiation by Accelerated Charges : Liénard-Wiechert potentials, angular distributions, Larmor's formula (classical and relativistic).

❖ 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

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 - VII	**Subject- PHYSICS**
Course Type - GE	**Course Code- UBSDGET704**
Course Title :	**SOURCES OF POWER**
Credit – 3(Theory) +1 (Tutorial) =4	**Lecture - 60**
MM - Theory -80 + IA-20 = 100	**Min Marks- 40 %**

Course Title	**SOURCES OF POWER**
Course Learning Outcome:	• To observe standard practices based on energy conservation act. • Able to understand the renewable energy sources available at present • Able to understand the biomass energy generation . • Able to understand the solar energy operation and its characteristics.
Program Specific Outcome:	**After completion of course the students will able to:-** • Understand the global and national energy scenario with a focus on sustainable development. • Analyze technological advancements in both conventional and non-conventional energy systems. • Promote energy efficiency and conservation in daily life and industry • Contribute to renewable energy research and practical implementation, especially in rural and urban settings.

Unit	**Lecture**	**Contents/Topic**	**Credits**
I	**13**	**Non-Renewable Energy Source** :Energy concept- sources in general, its significance & necessity. Classification of energy sources: Primary and Secondary energy, Commercial and Non-commercial energy, Renewable and Non-renewable energy, Conventional and Non-conventional energy, Importance of Non-commercial energy resources.	**03**
II	**10**	**Conventional energy Source**: Fossil fuels & Nuclear energy-production & extraction, usage rate and limitations. Impact on environment and their issues& challenges Need of eco-friendly & green energy & their related technology.	
III	**10**	**Renewable energy:** Need of renewable energy, non-conventional energy sources ,Tidal Energy, Wave energy systems, Ocean Thermal Energy Conversion, solar energy, biomass, biochemical conversion, biogas generation, geothermal energy tidal energy, Hydroelectricity.	
IV	**12**	**Solar Energy**- Key features, its importance, Merits & demerits of solar energy, Applications of solar energy. Solar water heater, flat plate collector, solar distillation, solar cooker, solar green houses, solar cell -brief discussion of each. Need and characteristics of photovoltaic (PV) systems,	
Total	**45**	**04 unit**	

Tutorial Works / Topics for Create Projects - 15 LECTURE (01 Credits)	
Topics	1. Classification of Energy Sources: Primary vs secondary, commercial vs non-commercial, renewable vs non-renewable. 2. Impact of Conventional Energy : Fossil fuel use, nuclear energy generation, environmental degradation, need for alternatives. 3. Sustainable Energy Solutions: Eco-friendly technologies, smart energy policies, and practical renewable integration in communities. 4. Solar Energy Devices : Construction and function of solar water heaters, cookers, greenhouses, and PV cells.

❖ TEXT AND REFRENCE BOOKS

1. Non Conventional energy sources –G.D Rai –khanna Publisers, New Delhi
2. Solar Energy –M.P. Agrawal – S Chand and Co. Ltd
3. Solar Energy- Resource Assesment Handbook 2009 by Dr. P Jayakumar
4. God frey Boyel Renewable Energy , Power for a sustainable future 2004.
5. Solar Energy-Suhas P Sukhative Tata McGraw- Hill Publising Company Ltd.

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 AUTO. PG COLLEGE

RAJNANDGAON (CHHATTISHGARH)

Approved syllabus for Semester and CBCS Curriculam of B.Sc. with PHYSICS , by the members of Board of Studies for Session 2025-26

Semester VIII For Students opting B.Sc. Honous (With Physics) CGPA (completion of VI Sem) < 7.5	No. of credits	Semester VIII For Students opting B.Sc. Honous (With Research) CGPA (completion of VI Sem) < 7.5	No. of credits
DSC: ELECTRONICS	3	DSC: ELECTRONICS	3
DSC: ELECTRONICS LAB	1	DSC: ELECTRONICS LAB	1
Choose four DSE from the below pool		Research Project / Dissertation Supervised by Teacher	12
DSE-I QUANTUM MECHANICS-I (3 Th + 1 T)	4	Choose one DSE from the below pool	
DSE-II STATISTICAL MECHANICS (3Th+ 1T)	4	DSE-I QUANTUM MECHANICS-I (3 Th + 1 T)	4
DSE-III COMPUTATIONAL PHYSICS AND COMPUTER PROGRAMMING	3	DSE-II STATISTICAL MECHANICS (3Th+ 1T)	4
DSE-III :LAB COMPUTATIONAL PHYSICS AND COMPUTER PROGRAMMING LAB	1	DSE-III COMPUTATIONAL PHYSICS AND COMPUTER PROGRAMMING	3
DSE -IV NANOMATERIAL (3Th + 1T)	4	DSE-III:LAB COMPUTATIONAL PHYSICS AND COMPUTER PROGRAMMING LAB	1
		DSE -IV NANOMATERIAL (3Th + 1T)	4

GOVT. DIGVIJAY AUTO. PG COLLEGE
RAJNANDGAON (CHHATTISHGARH)

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

- **THEORY PAPER :**

Class	Paper	Course title	Course code	Credit value	Theory marks	Internal marks	Passing marks
Sem.- VIII	DSC	ELECTRONICS	UBSDCT802	3	80	20	40
	DSE-I	QUANTUM MECHANICS-I	UBSDET802	4	80	20	40
	DSE-II	STATISTICAL MECHANICS	UBSDET803	4	80	20	40
	DSE -III	COMPUTATIONAL PHYSICS AND COMPUTER PROGRAMMING	UBSDET804	3	80	20	40
	DSE-IV	NANOMATERIAL	UBSDET805	4	80	20	40

- **PRACTICAL / PROJECT PAPER :**

Class	Paper	Course title	Course code	Credit value	Practical + viva marks+ Sessional	Internal assessment	Passing marks
Sem.- VIII	DSC	ELECTRONICS LAB	UBSDCL802	1	20+10+10	10	20
Sem - VIII	DSE - III	COMPUTATIONAL PHYSICS AND COMPUTER PROGRAMMING LAB	UBSDEL804	1	20+10+10	10	20
Research Project / Dissertation				12	300		120

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 2025-26	**Programme- UG**
Semester - VIII	**Subject- PHYSICS**
Course Type – DSC	**Course Code- UBSDCT802**
Course Title :	**ELECTRONICS**
Credit – 3 (Theory) +1 (Lab) =4	**Lecture - 45**
MM - Theory -80 + IA-20 = 100	**Min Marks- 40 %**

Course Title	**ELECTRONICS**
Course Learning Outcome:	• Understand and Analyze Operational Amplifiers • Apply Knowledge of Combinational and Sequential Digital Logic Circuits • Explain the Architecture and Operation of the Intel 8085 Microprocessor • Integrate Analog and Digital Systems for Practical Applications. • Write and Execute Simple Assembly Language Programs.
Programe Specific Outcome:	**After completion of course the students will able to:-** • Demonstrate Practical Skills in Analog and Digital Electronics • Understand the Functioning of Microprocessors. • Design and Analyze Electronic Circuits . • Develop and Execute Assembly Language Programs . • Bridge Physics Concepts with Embedded System Applications .

Unit	**Lecture**	**Contents/Topic**	**Credits**
I	**10**	**Operational amplifier:** Basic Op-amp. Ideal operational Amplifier Differential amplifier, Practical inverting Op-amp , the emitter coupled . difference amplifier , transfer characteristics of a diff. Amplifier , An example of an AC Op-amp , offset error voltage and currents, measurement of Op-Amp . Parameters, frequency response of an Op-Amp, Dominant-pole compilation. **Linear Analog system :** basic Op-Amp Application , Analog integration and differentiation ,Electronic Analog computation . Non-linear analogsystem , comparators ,wave form generator Schmitt Trigger.	**03**
II	**13**	**Combinational Logic–** Basic Logic gate : OR ,AND , NOT gates, NOR and NAND gates Boolean algebra , De-Morgan's theorem , exclusive OR gate , Decoder / Demultiplexer , Date Selector/multiplexer –.encoder , TTL circuit. Arithmetic-Logic units , adder , **Sequential Logic :** flip-flop : R-S Flip-Flop, J-K Flip-Flop level clocking, Edge triggered Flip flop D Flip flop JK , Flip flop J.K master slave Resisters buffer shift and control shift resisters , ripple synchronous & ring counter , tri-resisters Memories: RAM , ROM , PROM , EPROM	

III	12	**Microprocessors :-** Evolution of microprocessor , organization of a microcomputer , programming of microprocessor , Basic concept ,data representation , binary number system , Floating point notation , organization of Intel 8085 , instruction set of 8085. Programming with 8085 , Assembly language programming , the stack , subroutines CPU of a microprocessor ,timing and control , system timing and interrupt timing of 8085 ,resistor in 8085 , interfacing memory and I/O device a preliminary ideas.	
IV	11	Instruction set of 8085 type of instructions- Data transfer group, Arithmetic Logic, branch group, stack I/O machine control group, addressing mode of Intel 8085 , example of Assembly language programs in 8085 , summing of two 8-bit number to result a 16-bit number , summing two 16-bit number. 8085 interrupt. 8085 recorded interrupts, microprocessor application designing scanned display, interfering a matrix keyboard, Memory design.	
Total	**45**	**04 Unit**	

❖ TEXT AND REFERENCE BOOKS

1. Intgrated Electronics: J.Milliman R.C.C. Halkias
2. Electronics devices and circuit theory, by Robert Boylested and Nash PHI, New Delhi-110001, 1991
3. Operational Amplifier linear integrated circuits, by Romakanth A. Gayakwad PHI, second edition 1991.
4. Digital computer electronics by A.P. Malvino and Donald P. Lenach, Tata McGraw Hill company, New Delhi 1987.
5. Microprocessor architecture, programming applications with 8085/8086 by Ramesh S. Gaonkar, Willey-Eastem.limited 1987.
6. Introduction to microprocessors-A.P. Mathur (Tata Mcgraw).

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)	

- **PHYSICS LAB: DSC – 01 Credits (UBSDCL802)**

LAB: ELECTRONICS

1. To Study the Half Adder using NAND and NOR gates .
2. To Study the Full Adder using NAND and NOR gates.
3. To Study the operation of Digital Multiplexer (MUX).
4. To Study the operation of Digital De- Multiplexer (DE- MUX).
5. To Study the operation of J-K Flip-Flop and verify it using a Truth Table.
6. To Study the R-S Flip-Flop.
7. To Write and execute a program for the addition of two 8-bit numbers using 8085 MPI.
8. To Write and execute a program for the subtraction of two 8-bit numbers using 8085 MPI.
9. To Study the Op-Amp in inverting amplifier mode.
10. To Study the Op-Amp in non- inverting amplifier mode.

❖ Reference Books (Practical)

1. Digital Principles and Applications- Donald P. Leach & Albert Paul Malvino, McGraw-Hill .
2. Microprocessor Architecture, Programming and Applications with the 8085- Ramesh S. Gaonkar, Penram International Publishing .
3. Op-Amps and Linear Integrated Circuits- Ramakant A. Gayakwad, Pearson Education .
4. Modern Digital Electronics- R.S. Sedha, S. Chand Publishing .

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 - VIII	**Subject- PHYSICS**
Course Type – DSE-I	**Course Code- UBSDET802**
Course Title :	**QUANTUM MECHANICS-I**
Credit – 3(Theory) +1 (Tutorial) =4	**Lecture - 45**
MM - Theory -80 + IA-20 = 100	**Min Marks- 40 %**

Course Title	**Quantum Mechanics-I**
Course Learning Outcome:	• Understand the Foundations of Quantum Mechanics. • Solve Schrödinger's Equation for Standard Potentials. • Apply Linear Algebra to Quantum Systems . • Analyze Angular Momentum in Quantum Systems • Apply Perturbation Theory to Atomic Systems .
Programe Specific Outcome:	**After completion of course the students will able to:-** • Develop Conceptual and Mathematical Proficiency in Quantum Mechanics . • Solve Realistic Quantum Models . • Understand and Predict Quantum Behavior in Atomic and Subatomic Systems. • Interpret Physical Observables from Quantum Formalism. • Bridge Quantum Theory with Experimental Observables.

Unit	Lecture	Contents/Topic	Credits
I	10	Inadequacy of classical mechanics. Equation of motion of matter waves, physical interpretation of the wave function, Expectation value of dynamic quantities, probability current density: particle flux, Ehrenfest theorem, physical Applications of Schrodinger's equation the free particles, particle in a Box, potential step, Rectangular potential barrier, Application of barrier penetration (α- decay).Schrodinger equation , one-dimensional Infinitely deep potential well , Schrodinger equation for Linear Harmonic oscillator and its solution,Eigen values, Zero point energy, Uncertainty relations.	03
II	13	Super position principle , general formalism of wave function , commutation relationship, representation of states and dynamical variable , Completeness of Eigen functions , Dirac-Delta function , Bra & Ket notation , Matrix representation of an operator ,Harmonic oscillator and its solution by matrix method , Heisenberg equation of motion .	
III	12	Angular Momentum in quantum mechanics , commutation relationship, Eigen value addition of angular momentum , Clebsch-Gordon coefficient , spherically symmetric potential in three dimensional , separation of wave equation , three dimensional square well potential and energy level the Hydrogen atom , solution of the radial equation energy level and stationary state wave function .	

IV	11	Time-independent perturbation theory , non-degeneracy case, first order and second perturbation with the example of perturbation of an oscillation , degeneracy case ,removal of degeneracy of second order , first order stark effect in hydrogen perturbed energy level , Zeeman effect without electron.	
Total	**45**	**04 Unit**	

Tutorial Works / Topics: For Create Projects -15 LECTURE (1 Credits)	
Topics-	1. Numerical Simulation of Schrodinger Equation in 1D Potential wells. 2. Visualization and Analysis of Quantum Tunneling. 3. Matrix Mechanics Approach to the Quantum Harmonic Oscillator. 4. Stark and Zeeman Effects in Hydrogen Atom. 5. Clebsch- Gorden Coefficients and Angular Momentum Coupling .

❖ TEXT AND REFERENCE BOOKS:

1. H. Schiff quantum mechanics By McGraw-hill.
2. S.Gasiorowicz Quantum Physics .
3. Landauand Lifshitz Non-relative quantum mechanics.
4. B.Crasemen and Z.D.Powell Quantum mechanics addition westey.
5. A.P.Massiah Quantum mechanics.
6. J.J. Sakurah Moderrn Quantum Mechanics.
7. Mathews and Venketesan quantum mechanics.

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 - VIII	**Subject- PHYSICS**
Course Type – DSE- II	**Course Code- UBSDET803**
Course Title :	**STATISTICAL MECHANICS**
Credit – 3(Theory) +1 (Tutorial) = 4	**Lecture - 45**
MM - Theory -80 + IA-20 = 100	**Min Marks- 40 %**

Course Title	**STATISTICAL MECHANICS**
Course Learning Outcome:	• Explain the foundations of statistical mechanics including phase space, ensembles, Liouville's theorem, and partition functions. • Analyze thermodynamic behavior of ideal Bose and Fermi gases, including Bose-Einstein condensation and black body radiation. • Understand the statistical mechanics of interacting systems including fluctuation theory, Onsager relations, and Brownian motion.
Programe Specific Outcome:	**After completion of course the students will able to:-** • Demonstrate deep knowledge of classical and quantum statistical mechanics and apply it to thermodynamic systems. • Bridge microscopic particle behavior and macroscopic thermodynamic laws using ensemble theory. • Model systems of indistinguishable particles using advanced distribution functions and interpret physical properties like entropy, energy, and heat capacity. • Apply mathematical tools such as partition functions and fluctuation theory to solve physical problems involving statistical ensembles.

Unit	**Lecture**	**Contents/Topic**	**Credits**
I	**10**	**Foundation of statistical mechanics** , contact between statistical and thermodynamics , the classical ideal gas , entropy of mixing and Gibb's paradox , phase space of classical system , Liouville's theorem and its consequence quantum state and phase space .Elements of ensemble theory: micro canonical and grand canonical ensemble , partition functions , physical significance of statistical quantities , example of classical system energy and energy density , fluctuation and mutual correspondence of various ensembles.	**03**
II	**13**	**Formulation of quantum statistics** : Quantum mechanical ensemble theory , Density matrix , statistics of various quantum mechanical ensemble , Ex: An electronic magnetic field, System compose of indistinguishable particles. Density matrix and the partition of a system of a free particles. theory of simple gases-ideal gas in various quantum mechanical, ensembles, Maxwell-Boltzmann , Bose- Einstein , Fermi-Dirac distributions ,statistical of occupation number.	
III	**12**	**Ideal Bose and Fermi gases**: Thermodynamics of black body radiation, the field of sound waves, Inertial density of sound field. Thermodynamics behavior of an ideal Bose and Fermi gas of elementary particle , degenerate Bose gas , Bose-Einstein	

		condensation and elementary excitations in liquid helium II ,Thermodynamic behavior of an ideal Fermi gas , Magnetic behaviors of an ideal Fermi gas, the electron gas , theory of Whit Dwarf Stars.	
IV	**11**	Statistical mechanics of interaction system the method of cluster expansion classical gas . viral expansion of the equation of the state. Evaluation of viral coefficient, Landan theory of phase transition-general remark on the problem of condensation Fluctuation , thermodynamic fluctuation . Brownian motion, Einstein and Langevin theory of Brownian motion , fluctuation dissipative theory. The Onsager relations., Unreal remark on cluster expansion Exact treatment of second viral coefficient .	
Total	**45**	**04 Unit**	

Tutorial Works / Topics: For Create Projects -15 LECTURE (1 Credits)	
Topics-	1. Ensemble Theory and Partition Functions. 2. Quantum Statistics and Indistinguishability. 3. Bose-Einstein Condensation & White Dwarf Theory. 4. Fluctuation Theorems and Interacting Systems . 5. Thermodynamics of Quantum Gases .

❖ **TEXT AND REFERENCE BOOKS:**

1. R.K.Patharia- Statistical Mechanics.
2. L.D.Landau&E.M.Lifshitz .
3. Fedrick Rief - Fundamental of statistical and thermal physics.

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)
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Department of Physics

Session 2025-26	**Programme- UG**
Semester - VIII	**Subject- PHYSICS**
Course Type – DSE- III	**Course Code- UBSDET804**
Course Title :	**COMPUTATIONAL PHYSICS AND COMPUTER PROGRAMMING**
Credit – 3(Theory) +1 (Lab) =4	**Lecture - 45**
MM - Theory -80 + IA-20 = 100	**Min Marks- 40 %**

Course Title	**COMPUTATIONAL PHYSICS AND COMPUTER PROGRAMMING**
Course Learning Outcome:	• Perform interpolation and curve fitting using techniques like Gauss interpolation, least squares, and spline fitting. • Implement numerical differentiation and integration methods, including Newton-Cotes formulas and Gauss quadrature. • Write and interpret computer programs in C to apply numerical methods for matrix operations, equation solving, and interpolation, enhancing computational problem-solving skills.
Programe Specific Outcome:	**After completion of course the students will able to:-** • Apply mathematical and computational concepts to model and solve real-world physics and engineering problems using numerical techniques. • Use algorithmic thinking and programming skills (especially in C language) to develop efficient solutions for mathematical and physical problems • Interpret numerical errors and stability issues in the context of algorithm design and numerical approximation. • Bridge theoretical knowledge and practical application by integrating numerical methods with computational tools for simulations and modeling.

Unit	**Lecture**	**Contents/Topic**	**Credits**
I	**10**	Method of determination of zeroes of linear and non linear algebraic equation and transcendental equation , convergence of solution , Solution of simultaneous linear equations , Gaussian elimination , pivoting , iterative method matrix inversion , Eigen value and Eigen vector of matrices , power and Jacobi method. factorization method, givens method, house holders methods partition method.	**03**
II	**13**	Finite differences , interpolation with equally spaced and unevenly spaced point , Gauss Interpolation, curve fitting , polynomial least squares and cubic spline fitting , Numerical differentiation and integration , Newton-cotes formulae , Gauss method, Sterling formula, Law containing three constant. Error-error estimate.	
III	**12**	Numerical solution of ordinary differential equation , Run's method , Modified Euler method, Euler and Runga-Kutta methods , predictor-corrector method, Milne's and Adam's predictor and Picard's method ,corrector method, taylor series method , stability analysis.	

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Hemchand Yadav Vishwavidyalaya, Durg)

IV	**11**	Elementary information about digital computer principle , compilers , interpreters ,subroutine ,Computer Representations of number, Floating points presentations of number ,computer calculations ,Numerical method using C language , An overview of C features ,Example ;-Multiplications of matrices ,Gauss- Eliminations method ,Gauss –Jordan method ,Factorizations method ,Gauss –Seidal iterations method ,Power method ,Method of Least squares, Method of averages ,Method of moments Newton forward interpolations method , Langranges interpolations formula ,Derivatives using forward differences formula .	
Total	**45**	**04 Unit**	

❖ **TEXT AND REFERENCE BOOKS:**

1- Sastry : Introduction method of Numerical Analysis
2- Rajaraman: Numerical Analysis
3- B.S.Garewal : Numerical Analysis

Note- scientific calculator allowed.

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**.....

- **PHYSICS LAB: DSE-III – 01 Credits (UBSDEL804)**

➢ **LAB: COMPUTATIONAL PHYSICS AND COMPUTER PROGRAMMING**

1. C Program to Implement Matrix Multiplication and Inversion.
2. C Program to Solve Quadratic Equation Using Numerical Roots.
3. C Program to Evaluate a Polynomial Using Horner's Method.
4. C Program to Simulate Simple Calculator Using Switch Case.
5. C Program to Convert Octal to Binary Using Encoder Logic.
6. C Program for Binary to Decimal Conversion.
7. C Program to Implement Euler's Method for Solving First Order Differential Equations.
8. C Program to Implement Runge-Kutta Method (4th Order).
9. C Program to Implement Newton-Raphson Method for Finding Roots of Equations.
10. C Program to Implement Modified Euler's Method.
11. C Program to Implement Bisection Method for Root Finding.
12. C Program to Implement Secant Method for Solving Equations.

❖ Reference Books (Practical)

1. Numerical Methods in C and C++ – B.S. Grewal, Khanna Publishers .
2. Let Us C – Yashavant Kanetkar, BPB Publications .
3. Numerical Methods: Problems and Solutions – M.K. Jain, S.R.K. Iyengar, R.K. Jain, New Age International Publishers.
4. Programming in C – E. Balagurusamy, McGraw Hill India.
5. Computational Physics – R. C. Verma, P.K. Ahluwalia, K.C. Sharma

Name & Signature of Members of Board of Studies	
V.C. Nominee	**DEPARTMENTAL MEMBER**
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Subject Expert.....	• **Dr. Suresh Kumar Patel**.....
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Alumni (Member)	

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Session 2025-26	**Programme- UG**
Semester - VIII	**Subject- PHYSICS**
Course Type – DSE- IV	**Course Code- UBSDET805**
Course Title :	**NANOMATERIALS**
Credit – 3(Theory) +1 (Tutorial) =4	**Lecture - 45**
MM - Theory -80 + IA-20 = 100	**Min Marks- 40 %**

Course Title	**NANOMATERIALS**
Course Learning Outcome:	• Understand size-dependent phenomena at the nanoscale and Describe the basic concepts and types of nanomaterials. • Critically discuss hazards related to usage of nanomaterials • Compare different synthesis routes, • Interpret results obtained from characterization of nanomaterials to discover the associated properties. • Evaluate and discuss optical, electrical and magnetic properties materials at nanoscale.
Programe Specific Outcome:	**After completion of course the students will able to:-** • Understand Nanoscale Concepts and Theories. • Acquire Competency in Synthesis Methods . • Analyze Properties and Applications of Nanomaterials . • Prepare for careers in nanotechnology, materials science, and advanced manufacturing.

Unit	**Lecture**	**Contents/Topic**	**Credits**
I	**13**	**Fundamentals of Nanoscience:** Introduction to nanoscale systems, Classification of nanomaterials- 0D, 1D, 2D, and 3D; Surface to volume ratio and quantum confinement; Differences between nanomaterials and bulk materials Nanotechnology	**03**
II	**10**	**Synthesis of Nanomaterials Top-down approaches:** Ball milling, lithography; Bottom-up approaches: Sol Gel, hydrothermal, CVD, green synthesis; Advantages and limitations of different synthesis methods.	
III	**12**	**Characterization Techniques Structural:** XRD, SEM, TEM; Surface: AFM, BET; Spectroscopic: UV-Vis, FTIR, Raman , Particle size analysis, zeta potential, and DLS	
IV	**10**	**Properties and Applications:** Optical, magnetic, electrical, thermal, and mechanical properties; Applications in electronics, medicine, energy, and environment.	
Total	**45**	**04 Unit**	

Tutorial Works / Topics for Create Projects - 15 LECTURE (01 Credits)	
Topics	1. Understanding the Nanoscale: Dimensions and Properties. 2. Synthesis of Nanomaterials: Top-down vs Bottom-up. 3. Characterization Techniques in Nanoscience . 4. Nanomaterial Properties: Key Features at the Nanoscale . 5. Applications of Nanotechnology in Real-world Fields

❖ TEXT AND REFERENCE BOOKS

1. Introduction to Nanoscience and Nanotechnology – K.K. Chattopadhyay & A.N. Banerjee.
2. Nanotechnology: Principles and Practices – Sulabha K. Kulkarni .
3. Nanostructures and Nanomaterials – Guozhong Cao .

❖ Online Resources: (e- Resources/ e- Books/ e- Learning Portals)

1. e-Books (Free & Open Access)

- https://web.pdx.edu/~pmoeck/phy381/intro-nanotech.pdf
- https://epgp.inflibnet.ac.in/epgpdata/uploads/epgp_content/S000831ME/P001852/M030097/ET/1525781634Module-6_Unit-1_NSNT.pdf
- http://cdn.intechopen.com/pdfs-wm/37900.pdf
- http://myukk.xsrv.jp/free_journal/download.php?fn=NDFCT511_full.pdf
- http://www.researchgate.net/profile/Yoshinori_Ando/publication/42804843_Chemical_Vapor _Deposition_of_Carbon_Nanotubes_A_Review_on_Growth_Mechanism_and_Mass_Pro duction/links/0fcfd50809726e590a000000.pdf
- http://www.understandingnano.com/electrical-properties-carbon-nanotubes.html
- http://education.mrsec.wisc.edu/documents/usingVectors- answers.pdf
- http://www.understandingnano.com/nanotubes-carbon-properties.html

2. e-Learning Portals / MOOCs

- NPTEL: Introduction to Nanotechnology and Applications – https://nptel.ac.in/courses/118104008
- MIT OCW: Nanomaterials course – https://ocw.mit.edu.

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Specialist from Industry	• **Mr. Lekha Prasad Urvasha**.....
Alumni (Member)	