



MAHATMA GANDHI UNIVERSITY, KERALA

Abstract

Bachelor of Science (Honours) Physics - Fifth Semester - Modifications to the Syllabus Index, Course Outcomes, Course Content, Mode of Assessment, Text Books & References - Approved - Orders Issued.

ACA 16

No. 6283/ACA 16/2026/MGU

Priyadarsini Hills, Dated: 20.06.2026

Read:- 1. U.O. No. 5797/ACA16/2024/MGU, dated. 27.06.2024

2. Recommendations of the Chairperson, Board of Studies, Physics (UG).
3. Orders of the Vice Chancellor under Section 10(17), Chapter III of the Mahatma Gandhi University Act 1985, dated. 19.06.2026.

ORDER

The syllabi of various Honours Under Graduate Programmes coming under the MGU-UGP (Honours) Regulations, 2024, have been approved vide paper read as (1) above and published on the website of the University.

The Board of Studies on Physics (U.G), discussed the need to modify the Course Level, Course Outcomes, Course Content, pattern for End Semester Evaluation, Text Books and References of DSC / DSE / SEC type courses, to modify the course name of MG5DSCPHY301: Introductory Quantum Mechanics, to MG5DSCPHY301: Introduction to Quantum Mechanics, in the syllabus index page, and to modify the Mode of Assessment of SEC type course in the Fifth Semester syllabus of Bachelor of Science (Honours) Physics programme and has submitted recommendations vide paper read as (2) above. (Recommendations are attached as Annexure.)

Considering the urgency of the matter, the Vice Chancellor, in exercise of the powers of the Academic Council vested upon him under Section 10(17), Chapter III of the Mahatma Gandhi University Act 1985, vide paper read as (3), has approved the above recommendations.

Hence, the Syllabus Index, Course Outcomes, Course Content, Mode of Assessment, Text Books & References of the said courses in the Fifth Semester syllabus of the Bachelor of Science (Honours) Physics, stands modified to this extent.

Orders are issued accordingly.

SIJI ANNA KURIEN

ASSISTANT REGISTRAR III
(ACADEMIC)
For REGISTRAR

Copy To

1. PS to VC
2. PA to Registrar/CE
3. Chairperson, Board of Studies, Physics (UG).
4. JR 2 (Admin)/ DR 2, AR 3 (Academic)
5. JR/DR/AR (Exam)
6. Tabulation/Academic Sections concerned
7. IT Cell 3 / OQPM - 1 Sections
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Section Officer

ANNEXURE

SEMESTER V

Syllabus Index (Modified)

| Course Code | Title of the Course | Type of the Course DSC, MDC, SEC etc. | Credit | Hours/ week | Hour Distribution / week | | | | Page No. |
|--------------|---|--|--------|----------------|--------------------------|---|---|---|----------|
| | | | | | L | T | P | O | |
| No Change | | No Change | | No Change | | | | | 11,12 |
| MG5DSCPHY301 | Introduction to Quantum Mechanics (Modified) | | | | | | | | |
| No Change | | | | | | | | | |
| MG5SECPHY301 | Physics using Computational Tools | | | | | | | | |

All Courses

| | |
|---------------------|---------------------------|
| Course Level | 300-399 (Modified) |
|---------------------|---------------------------|

Course Name : Classical Mechanics

Course Code : MG5DSCPHY300

COURSE OUTCOMES

| CO No. | Expected Course Outcome (Modified) | Learning Domains (Modified) | PO No | Page No |
|--------|---|-----------------------------|-----------|-----------------|
| 1 | To apply Lagrangian formalism to analyze and solve the dynamics of simple mechanical systems | U, A, An | No Change | 166, 167 |
| 2 | To make use of the central force problem in different dynamical systems | No change | | |
| 3 | To apply variational principles and Hamiltonian formalism and analyze the dynamics of mechanical systems | | | |
| 4 | To interpret the concepts of theory of relativity and explain physical phenomena using Special theory of relativity | | | |
| 5 | Removed | | | |
| 6 | | | | |
| 7 | | | | |

COURSE CONTENT

Content for Classroom Transaction (Units)

| Module | Units | Course Description (Modified) | Hrs (Modified) | CO No (Modified) | Page No. |
|--------|-----------|-------------------------------|----------------|------------------|----------|
| 1 | No Change | | | | |
| | 1.1 | No Change | No Change | 1 | |
| | 1.2 | | | | |
| | 1.3 | | | | |

| | | | | | |
|-------------------|--|--|-----------|---|--|
| | 1.4 | | | | |
| 2 | No Change | | | | |
| | 2.1 | No Change | No Change | 2 | |
| | 2.2 | | | | |
| | 2.3 | | | | |
| 2.4 | | | | | |
| 3 | No Change | | | | |
| | 3.1 | No Change | No Change | 3 | |
| | 3.2 | | | | |
| | 3.3 | | | | |
| 3.4 | | | | | |
| 4 | No Change | | | | |
| | 4.1 | Classical Relativity(Galilean Relativity) Galilean transformation, Electromagnetism and Galilean transformation | 3 | 4 | |
| | 4.2 | No Change | | | |
| | 4.3 | Velocity transformation, Length contraction, Time dilation, Simultaneity | 4 | | |
| | 4.4 | Mass in Relativity, Mass and energy- Reference to binding energy, Nuclear Fission and Fusion and pair production | 4 | | |
| 4.5 (Included) | The General Theory of Relativity – Principle of Equivalence, Bending of light in a gravitational field | 2 | | | |
| 5 | Teacher Specific Content | | | | |

167,
168

MODE OF ASSESSMENT

| B. End Semester Evaluation (ESE) (Modified) | | | |
|--|---------------------------------------|------------------------|------------|
| Theory | | | |
| MAX.MARKS: 70 Marks | | Duration: 2 Hrs | |
| Type of Questions | Number of Questions to be Answered | Marks | Page No. |
| Part A : Short Answer Questions | 10 out of 12 | 10x3=30 | 169 |
| Part B : Short Essay Questions | 5 out of 8 | 5 x 8 = 40 | |

Textbook

1. Aruldas G., Classical Mechanics, PHI, 2008.

References

1. Goldstein, Herbert; Poole, Charles P.; Safko, John. Classical Mechanics, 3rd Edition, 2011.
2. Beiser, Arthur; Mahajan, Shobhit; Choudhury, S. Rai. Concepts of Modern Physics. McGraw Hill Education, 2017.
3. J. C. Upadhyaya, Classical Mechanics, Himalaya Publishing House.
4. Florian Scheck, Mechanics: From Newton's Laws to Deterministic Chaos, 4th Edition, 2010.
5. David Morin, Introduction to Classical Mechanics, Cambridge University Press, 2009.
6. Kenneth S. Krane, Modern Physics, John Wiley & Sons, 2019.

Course Name : Introduction to Quantum Mechanics

Course Code : MG5DSCPHY301

COURSE OUTCOMES

| CO No. | Expected Course Outcome (Modified) | Learning Domains (Modified) | PO No. (Modified) | Page No. |
|--------|---|-----------------------------|-------------------|----------|
| 1 | Explain the counter-intuitive behaviour of quantum systems. | U | No Change | 170 |
| 2 | Solve the time-independent Schrödinger equation for standard one-dimensional systems | U, A, An | | |
| 3 | Represent quantum mechanical states and operators using the language of vector spaces | U, A | | |
| 4 | Formulate quantum mechanical problems within the Hilbert space framework | U, A | | |

COURSE CONTENT

Content for Classroom Transaction (Units)

| Module | Units | Course Description (Modified) | Hrs (Modified) | CO No. (Modified) | Page No. |
|--------|--|---|----------------|-------------------|----------|
| 1 | No Change | | | | |
| | 1.1 | Young's double slit experiment - with bullets, waves and electrons. (Textbook 1, Chapter 1) | 2 | 1 | |
| | 1.2 | Interference of electron waves and watching electrons. (Textbook 1, Chapter 1) | 2 | | |
| | 1.3 | First principles of quantum mechanics. (Textbook 1, Chapter 1) | 2 | | |
| | 1.4 | The Schrödinger Equation, The statistical interpretation | 3 | | |
| | 1.5 (Included) | Probability, Normalization | 3 | | |
| | 1.6 (Included) | Momentum, Uncertainty principle | 3 | | |
| 2 | No Change | | | | |
| | 2.1 | No Change | No Change | 2 | |
| | 2.2 | | | | |
| | 2.3 | | | | |
| | 2.4 | | | | |
| | 2.5 | | | | |
| 2.5 | | | | | |
| 3 | No Change | | | | |
| | 3.1 | Vectors | 2 | 3 | |
| | 3.2 | Inner Products | 2 | | |
| | 3.3 | Linear Transformations | 4 | | |
| | 3.4 | Eigenvectors and Eigenvalues | No Change | | |
| | 3.5 | Hermitian Transformations | 2 | | |
| | 3.6 (Included) | Functions as Vectors | 2 | | |
| 4 | No Change | | | | |
| | 4.1 | No Change | No Change | 4 | |
| | 4.2 | | | | |
| | 4.3 | Generalized Statistical Interpretation – State & Observables | 2 | | |
| | 4.4 | Generalized Statistical Interpretation | 2 | | |
| 4.4 | Generalized Statistical Interpretation | 2 | | | |

171,
172

| | | | | | |
|---|---------------------------------|---|---|---|--|
| | | – Measurement | | | |
| | 4.5 (Included) | Generalized uncertainty principle – Proof | 2 | 4 | |
| | 4.6 (Included) | Minimum uncertainty wave packet. | 1 | | |
| 5 | Teacher Specific Content | | | | |

MODE OF ASSESSMENT

| B. End Semester Evaluation (ESE) (Modified) | | | |
|--|------------------------------------|------------------------|------------|
| Theory | | | |
| MAX.MARKS: 70 Marks | | Duration: 2 Hrs | |
| Type of Questions | Number of Questions to be Answered | Marks | Page No. |
| Part A : Short Answer Questions | 10 out of 12 | 10x3=30 | 172 |
| Part B : Short Essay Questions | 5 out of 8 | 5 x 8 = 40 | |

References

1. Shankar R. Fundamentals of Physics II – Electromagnetism, Optics, and Quantum Mechanics: (The Open Yale Courses Series)Yale University Press 2019.
2. A. Ghatak & S. Lokanathan, Quantum Mechanics: Theory and Applications, 5th Ed., Macmillan (2004)

Course Name : Atomic and Molecular Physics

Course Code : MG5DSCPHY302

MODE OF ASSESSMENT

| B. End Semester Evaluation (ESE) (Modified) | | | |
|--|---|------------------------|-----------------|
| Theory | | | |
| MAX.MARKS: 70 Marks | | Duration: 2 Hrs | |
| Type of Questions | Number of Questions to be Answered | Marks | Page No. |
| Part A : Short Answer Questions | 10 out of 12 | 10x3=30 | 177 |
| Part B : Short Essay Questions | 5 out of 8 | 5 x 8 = 40 | |

Course Name : Semiconductor Optoelectronic Devices

Course Code : MG5DSEPHY300

COURSE OUTCOMES

| CO No. | Expected Course Outcome (Modified) | Learning Domains | PO No | Page No. |
|---------------|--|-------------------------|--------------|-----------------|
| 1 | To explain the optical processes in semiconductors. (Rectification of typographical error) | No Change | No Change | 179 |
| 2 | No Change | | | |
| 3 | | | | |
| 4 | | | | |
| 5 | | | | |

COURSE CONTENT

Content for Classroom Transaction (Units)

| Module | Unit (Modified) | Course Description | Hrs (Modified) | CO No. | Page No. |
|--------|---------------------------------|--------------------|----------------|--------------|----------|
| 1 | No Change | | | | 180, 181 |
| | 1.1 | No Change | 4 | No Change | |
| | 1.2 | | 6 | | |
| | 1.3 | | 5 | | |
| | 1.4 | Deleted | | | |
| 2 | No Change | | | | |
| | 2.1 | No Change | 5 | No Change | |
| | 2.2 | | 7 | | |
| | 2.3 | | 4 | | |
| | 2.4 | Deleted | | | |
| | No Change | | | | |
| 3 | 3.1 | No Change | No Change | No Change | |
| | 3.2 | | | | |
| | 3.3 | | | | |
| | No Change | | | | |
| 4 | 4.1 | No Change | No Change | 5 | |
| | 4.2 | | | | |
| | 4.3 | | | | |
| | 4.4 | | | | |
| | 4.5 | | | | |
| | 4.6 | | | | |
| | 4.7 | | | | |
| | 4.8 | | | | |
| | 4.9 | | | | |
| | 4.10 | | | | |
| 5 | Teacher Specific Content | | | | |

MODE OF ASSESSMENT

| B. End Semester Evaluation (ESE) (Modified) | | | |
|--|---|--------------------------|-----------------|
| Theory | | | |
| MAX.MARKS: 50 Marks | | Duration: 1.5 Hrs | |
| Type of Questions | Number of Questions to be Answered | Marks | Page No. |
| Part A : Short Answer Questions | 10 out of 12 | 10x2 = 20 | 182 |
| Part B : Short Essay Questions | 5 out of 8 | 5 x 6 = 30 | |

Course Name : Computational Physics: Python

Course Code : MG5DSEPHY301

COURSE OUTCOMES

| CO No. (Modified) | Expected Course Outcome (Modified) | Learning Domains (Modified) | PO No. | Page No. |
|--------------------------|--|------------------------------------|---------------|---------------------|
| 1 | To understand Python basics, including data types, variables, operators, and data structures such as lists, tuples, sets, and dictionaries | K,U | No Change | 183, 184 |
| 2 | To apply control flow statements, user-defined functions, file handling, and OOP concepts to solve programming problems | A | | |
| 3 | To utilise the Python packages (Math, NumPy, Matplotlib), to perform numerical computations and data visualization | A, An | | |
| 4 | To develop Python programs to solve physical problems involving numerical methods, simulations, and graphical analysis | C,S | | |
| 5 | Removed | | | |
| 6 | | | | |
| 7 | | | | |
| 8 | | | | |

COURSE CONTENT

Content for Classroom Transaction (Units)

| Module | Units (Modified) | Course Description (Modified) | Hrs (Modified) | CO No. (Modified) | Page No. | |
|--------|---------------------------------|---|----------------|-------------------|----------|-----------|
| 1 | No Change | | | | | 184 - 187 |
| | 1.1 | Introduction to Algorithms and Flowcharts, Installation and familiarisation with Jupyter notebook | No Change | 1 | | |
| | 1.2 | No Change | | | | |
| | 1.3 | List operations (len, ppend,reverse, insert, del, remove, +, *, sort, max, min, count, sum, in, not in), set operations (set, add, remove, in, not in, union, intersection, symmetric difference) | | | | |
| | 1.4 | Tuples (all, any, Len, enumerate, max, min, sum, sorted,tuple), Dictionaries operations (clear, copy, fromkeys, items, keys, popitem,setdefault, values get,update,pop,keys) | | | | |
| 2 | No Change | | | | | |
| | 2.1 | Decision Making Statements: if..else, if..elif, if...elif...else | No Change | 2 | | |
| | 2.2 | Iteration Control Statements: while, for, List comprehension Jump Statements: break, continue | 3 | 2 | | |
| | 2.3 | User defined functions- File input and file output, (Package: -Pandas, file type:-csv), Pickling(Package: -pickle). | 3 | 2 | | |
| | 2.4 | No Change | No Change | 2 | | |
| 3 | Basic Packages in Python | | No Change | | | |
| | 3.1 | Math & CMath | No Change | 3 | | |
| | 3.1.1 | No Change | | | | |

| | | | | | |
|---|---|--|-----------|---|---------|
| | 3.1.2 | Exponents and logarithms, Trigonometric functions, Advanced Concepts: Complex numbers, Special functions (factorial, gamma function), Mathematical constants | No Change | 3 | |
| | 3.1.3 | No Change | | | |
| | 3.2 | No Change | | | |
| | 3.2.1 | | | | |
| | 3.2.2 | | | | |
| | 3.2.3 | Advanced NumPy Techniques: Random number generation, Universal functions (ufuncs), Data manipulation and filtering with NumPy | | | |
| | 3.3 | No Change | | | |
| | 3.3.1 | | | | |
| | 3.3.2 | | | | |
| | 3.3.3 | | | | |
| 4 | Practicals (Do not use any in built functions for doing the problem) | | | | |
| | 4.1 | No Change | | 4 | 184-187 |
| | 4.2 | | | | |
| | 4.3 | | | | |
| | 4.4 | | | | |
| | 4.5 | | | | |
| | 4.6 | | | | |
| | 4.7 | | | | |
| | 4.8 | | | | |
| | 4.9 | | | | |
| | 4.10 | | | | |
| | 4.11 | | | | |
| | 4.12 | | | | |

| | | | | | |
|--|---|--|--|---|---------|
| | | <p style="text-align: center;">Freely Falling Body</p> <p>Write a Python program to simulate the motion of a freely falling body dropped from a height $h = 100$ m. Plot (i) Position Vs Time, (ii) Kinetic Energy Vs height, (iii) Potential Energy Vs height, and (iv) KE, PE, and Total Mechanical Energy Vs height on the same graph. Take mass $m = 1$ kg and $g = 9.8$ m/s². Verify the conservation of mechanical energy from the plot.</p> | | | |
| | <p style="text-align: center;">4.13 (Included)</p> | | | | |
| | <p style="text-align: center;">4.14 (Included)</p> | <p style="text-align: center;">Variation of Acceleration due to Gravity with Altitude</p> <p>Write a Python program to calculate and plot the variation of acceleration due to gravity g with altitude (h) ranging from 0 to 1000 km above the Earth's surface. Use the values: $g_0 = 9.8$ m/s², radius of Earth $R = 6371$ km. From the plot, find the altitude at which g reduces to half its surface value.</p> | | | |
| | <p style="text-align: center;">4.15 (Included)</p> | <p style="text-align: center;">Simple Harmonic Motion</p> <p>Write a Python program to simulate simple harmonic motion of a particle of mass $m = 1$ kg, spring constant $K = 4$ N/m, and amplitude $A = 1$ m. Plot (i) the displacement-time trajectory, (ii) the phase space trajectory (velocity Vs displacement), and (iii) variation of KE, PE, and total energy with position. Verify energy conservation from the plots.</p> | | | |
| | <p style="text-align: center;">4.16 (Included)</p> | <p style="text-align: center;">Projectile Motion</p> <p>Write a Python program to simulate projectile motion for initial velocity</p> | | | |
| | | | | 4 | 184-187 |

| | | | | |
|---|-----------------------------------|---|---|---------|
| | | <p>$u = 20 \text{ m/s}$ and projection angle $\theta = 45^\circ$. Plot (i) the trajectory (y Vs x), (ii) the phase space plot (v_y Vs v_x), and (iii) KE, PE, and total mechanical energy as a function of time. Find the maximum height, range, and time of flight from the simulation and compare with analytical values.</p> | | |
| | <p>4.17 (Included)</p> | <p>Damped Harmonic Motion</p> <p>Write a Python program to numerically solve the equation of motion of a damped harmonic oscillator with mass $m = 1 \text{ kg}$, spring constant $K = 4 \text{ N/m}$, for three damping coefficients $b = 0.5$ (underdamped), $b = 4$ (critically damped), and $b = 8$ (overdamped). Plot (i) displacement Vs time for all three cases, (ii) the phase space trajectory (velocity Vs displacement), and (iii) variation of KE, PE, and total energy with position for the underdamped case. Compare the nature of oscillations in each case.</p> | 4 | 184-187 |
| 5 | Teacher Specific Content | | | |

MODE OF ASSESSMENT

| B. End Semester Evaluation (ESE) (Modified) | | | |
|--|------------------------------------|--------------------------|------------|
| Theory | | | |
| MAX.MARKS: 50 Marks | | Duration: 1.5 Hrs | |
| Type of Questions | Number of Questions to be Answered | Marks | Page No. |
| Part A : Short Answer Questions | 10 out of 12 | $10 \times 2 = 20$ | 188 |
| Part B : Short Essay Questions | 5 out of 8 | $5 \times 6 = 30$ | |

Text Books

1. Downey, Allen B. How to think like a computer scientist. O'Reilly, Third Edition, 2024

References

1. Mahendra Verma, Practical Numerical Computing Using Python: Scientific & Engineering Applications, Amazon Digital Services LLC.
2. Programming for Computations - Python, Svein Linge, Hans Petter Langtangen, SpringerOpen 2016. [free ebook].
3. Lambert, Kenneth A. Fundamentals of Python: first programs. Cengage Learning, 2018.
4. https://www.w3schools.com/python/numpy_intro.asp
5. <https://www.tutorialspoint.com/matplotlib/index.htm>
6. https://www.tutorialspoint.com/python_pandas/index.htm

Course Name : Physics of Atmosphere

Course Code : MG5DSEPHY302

COURSE OUTCOMES

| Co No (Modified) | Expected Course Outcome (Modified) | Learning Domains (Modified) | PO No | Page No |
|------------------|---|-----------------------------|-----------|---------|
| 1 | Students will develop a comprehensive understanding of atmospheric structure, thermodynamics, weather and climate. | K, U, A | No Change | 190 |
| 2 | Students will gain understanding of atmospheric radiative transfer and Earth's radiation balance. | K, U, A | | |
| 3 | Students will develop a comprehensive understanding of atmospheric dynamics and general circulation. | K, U, A | | |
| 4 | Students will critically apply and analyse atmospheric and climate processes using observational and model data, including climate variability and air-quality indices. | An, E | | |
| 5 | Removed | | | |
| 6 | | | | |

COURSE CONTENT

Content for Classroom Transaction (Units)

| Module | Units (Modified) | Course Description | Hrs. | CO No. (Modified) | Page No. |
|--------|------------------|--------------------|-----------|-------------------|----------|
| 1 | No Change | | | | 191-194 |
| | 1.1 | No Change | No Change | 1 | |
| | 1.2 | | | | |
| | 1.3 | | | | |
| | 1.4 | | | | |
| | 1.5 | | | | |

| | | | | | | |
|---|---------------------------------|-----------|-----------|---|---------|-----------------|
| 2 | No Change | | | | 191-194 | |
| | 2.1 | No Change | No Change | 2 | | |
| | 2.2 | | | | | |
| | 2.3 | | | | | |
| 3 | No Change | | | | | |
| | 3.1 | No Change | No Change | 3 | | |
| | 3.2 | | | | | |
| | 3.3 | | | | | |
| | 3.4 | | | | | |
| 4 | No Change | | | | | |
| | 4.1 | No Change | No Change | 4 | | |
| | 4.2 | | | | | |
| | 4.3 | | | | | |
| | 4.4 | | | | | |
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| | 4.8 | | | | | |
| | 4.9 | | | | | |
| | 4.10 | | | | | |
| | 4.11 | | | | | |
| | Existing | | | | | Modified |
| | 4.13 | | | | | 4.12 |
| | 4.14 | | | | | 4.13 |
| | 4.15 | | | | | 4.14 |
| | 4.16 | | | | | 4.15 |
| | 4.17 | | | | 4.16 | |
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| | 4.20 | | | | 4.19 | |
| | 4.21 | | | | 4.20 | |
| | 4.22 | | | | 4.21 | |
| | 4.23 | | | | 4.22 | |
| | 4.24 | | | | 4.23 | |
| | 4.25 | | | | 4.24 | |
| | 4.26 | | | | 4.25 | |
| 5 | Teacher Specific Content | | | | | |

MODE OF ASSESSMENT

| B. End Semester Evaluation (ESE) (Modified) | | | |
|--|---|--------------------------|-----------------|
| Theory | | | |
| MAX.MARKS: 50 Marks | | Duration: 1.5 Hrs | |
| Type of Questions | Number of Questions to be Answered | Marks | Page No. |
| Part A : Short Answer Questions | 10 out of 12 | 10x2=20 | 194 |
| Part B : Short Essay Questions | 5 out of 8 | 5 x 6 = 30 | |

References

1. Ahrens, Donald C. 2009. Meteorology Today. 9th edn. Brooks/Cole, Cengage Learning.
2. Holton, James R. 2004. An Introduction to Dynamic Meteorology. 4th ed. USA: Elsevier Academic Press.
3. Mcilveen, Robin. 1992. Fundamentals of Weather and Climate. 2nd ed. Spinger-Science+Business Media
4. Introduction to Atmospheric Science, IIT Madras, Prof. C. Balaji
<https://nptel.ac.in/courses/119106008>

Course Name : Laser, Non-linear Optics and Fiber Optics
Course Code : MG5DSEPHY303

COURSE OUTCOMES

| CO No. (Modified) | Expected Course Outcomes (Modified) | Learning Domains (Modified) | PO No. (Modified) | Page No. |
|-------------------|---|-----------------------------|-------------------|----------|
| 1 | No Change | | | 196, 197 |
| 2 | | | | |
| 3 | | No Change | No Change | |
| 4 | To analyse the propagation of light through fibres and waveguides based on the nonlinear optical effects | U, An | 1, 2 | |
| 5 | To study the laser propagation through different dielectric media and to understand laser modulation mechanisms and nonlinear frequency conversion through numerical simulations. | U, A, S | 1, 2, 3 | |
| 6 | Removed | | | |
| 7 | | | | |

COURSE CONTENT

Content for Classroom Transaction (Units)

| Module | Units | Course Description | Hours | CO No. | Page No. |
|--------|-----------|--------------------|-----------|-----------|----------|
| 1 | No Change | | | | 197-199 |
| | 1.1 | No Change | No Change | No Change | |
| | 1.2 | | | | |
| 2 | No Change | | | | |

| | | | | | |
|---|---------------------------------|--|-----------|-----------|---------|
| | 2.1 | No Change | No Change | No Change | 197-199 |
| | 2.2 | | | | |
| 3 | No Change | | | | |
| | 3.1 | No Change | No Change | 4 | |
| | 3.2 | | | | |
| | 3.3 | | | | |
| | 3.4 | | | | |
| 4 | Practicals | | | | |
| | 4.1 | Design and construct a laser beam expander and study its performance. | No Change | 5 | |
| | 4.2 | Study the refraction of a laser beam in a glass slab and measure its refractive index using total internal reflection. | | | |
| | 4.3 | Determination of wavelength of a laser using diffraction grating. | | | |
| | 4.4 | Determine the diameter of a thin wire using laser. | | | |
| | 4.5 | Fraunhofer Diffraction: Determination of wavelength of a laser using a double slit. | | | |
| | 4.6 | Determine the numerical aperture and acceptance angle of an optical fibre. | | | |
| | 4.7 | Determine the refractive index of glass by measuring the Brewster angle using a laser beam. | | | |
| | 4.8 | Measure the divergence of an edge emitting diode laser beam by measuring the dimensions of the beam projected on to a screen at different distances. | | | |
| | 4.9 | To measure the diameter (Beam Spot Size) of a laser beam. | | | |
| | 4.10 | Simulate mode locking in a laser using python/ excel. | | | |
| | 4.11 (Included) | Model Q-Switched Laser Dynamics using Rate Equations | | | |
| | 4.12 (Included) | Simulation of Second Harmonic Generation and Phase Matching in Nonlinear Crystals | | | |
| 5 | Teacher Specific Content | | | | |

MODE OF ASSESSMENT

| B. End Semester Evaluation (ESE) (Modified) | | | |
|--|---|--------------------------|-----------------|
| Theory | | | |
| MAX.MARKS: 50 Marks | | Duration: 1.5 Hrs | |
| Type of Questions | Number of Questions to be Answered | Marks | Page No. |
| Part A : Short Answer Questions | 10 out of 12 | 10x2=20 | 200 |
| Part B : Short Essay Questions | 5 out of 8 | 5 x 6 = 30 | |

Course Name : Physics of Advanced Materials

Course Code : MG5DSEPHY304

| | | |
|----------------------------------|---|-----------------|
| Course Summary (Modified) | This course introduces the fundamentals of polymers, ceramics and composite materials, emphasizing their structure, types and applications. It covers important mechanical, thermal, electrical, optic and magnetic properties and their role in material performance. The practical component focuses on measurement and analysis of these properties using standard testing techniques. | Page No. 201 |
|----------------------------------|---|-----------------|

COURSE OUTCOMES

| CO No. (Modified) | Expected Course Outcome (Modified) | Learning Domains (Modified) | PO No. (Modified) | Page No. |
|-------------------|--|-----------------------------|-------------------|----------|
| 1 | Understanding different types of materials and their mechanical properties | U | 1,2 | 201 |
| 2 | Analysing the electrical properties of materials | An | | |
| 3 | Analysing the magnetic properties of materials | | | |
| 4 | Analysing the thermal properties of materials | | | |
| 5 | Analysing the optical properties of materials | | | |
| 6 | Application of the various properties of materials. | A | | |
| 7 | Removed | | | |

COURSE CONTENT

Content for Classroom Transaction (Units)

| Module | Units | Course Description | Hrs | CO NO (Modified) | Page No. |
|--------|-----------|---|-----------|------------------|----------|
| 1 | No Change | | | | |
| | 1.1 | Ceramics: Types and Applications of Ceramics(Glass, Glass Ceramics, Clayproducts, Refractories, Abrasives, Cements and Advanced Ceramics), Mechanical Properties: Brittle Fracture of Ceramics, Stress Strain Behaviour. | No Change | 1 | 202, 203 |
| | 1.2 | No Change | | | |
| | 1.3 | Composites: Introduction, Particle Reinforced composites: Large particle composite, Dispersion strengthened composites. | | | |
| 2 | No Change | | | | |

| | | | | | |
|----------|-------------------------------|--|-----------|--|-------------|
| | 2.1 | No Change | No Change | 2 | 202. 203 |
| | 2.2 | | | | |
| | 2.3 | | | | |
| | 2.4 | | | | |
| 3 | No Change | | | | |
| | 3.1 | No Change | No Change | 3 | |
| | 3.2 | | | 4 | |
| | 3.3 | | | Optical: Optical properties in Metals, Optical Properties of nonmetals (Refraction, Reflection, Absorption, Transmission, Color, Opacity and Translucency in insulators). | |
| 4 | Practicals | | | | |
| | 4.1 | No Change | No Change | 6 | |
| | 4.2 | | | | |
| | 4.3 | | | | |
| | 4.4 | | | | |
| | 4.5 | | | | |
| | 4.6 | Frequency dependence of dielectric constant from given data. | | | |
| | 4.7 | Temperature dependence of dielectric constant from given data. | | | |
| | (Newly included Units) | | | | |
| | 4.8 | Thermal conductivity of a bad conductor-Lee's disc | | | |
| | 4.9 | Determination of dielectric constant of a thin sheet | | | |
| | 4.10 | Refractive Index of glass using Liquid lens/ Spectrometer | | | |
| | 4.11 | Determination of Young's Modulus of a polymer composite(Wood) | | | |

| | | | | | |
|---|---------------------------------|--|-----------|---|--|
| | 4.12 | Draw the hysteresis curve (B-H Curve) of a ferromagnetic material and determination of retentivity and coercivity. | No Change | 6 | |
| | 4.13 | Hall Effect in semiconductor- Determination of Hall Coefficient, carrier concentration and mobility | | | |
| | 4.14 | Measurement of resistivity of a semiconductor using Four Probe Method and determination of energy band gap | | | |
| 5 | Teacher Specific Content | | | | |

MODE OF ASSESSMENT

| B. End Semester Evaluation (ESE) (Modified) | | | |
|--|------------------------------------|--------------------------|------------|
| Theory | | | |
| MAX.MARKS: 50 Marks | | Duration: 1.5 Hrs | |
| Type of Questions | Number of Questions to be Answered | Marks | Page No. |
| Part A : Short Answer Questions | 10 out of 12 | 10x2=20 | 204 |
| Part B : Short Essay Questions | 5 out of 8 | 5 x 6 = 30 | |

Course Name : Introduction to Group theory

Course Code : MG5DSEPHY305

COURSE CONTENT

Content for Classroom Transaction (Units)

| Module | Units | Course Description | Hrs | CO NO | Page No. |
|---------------|--|---------------------------|------------|--------------|-----------------|
| 1 | No Change | No Change | No Change | No Change | 206,207 |
| 2 | | | | | |
| 3 | | | | | |
| 4 | | | | | |
| 5 | Teacher Specific Content (Included) | | | | |

MODE OF ASSESSMENT

| B. End Semester Evaluation (ESE) (Modified) | | | |
|--|---|------------------------|-----------------|
| Theory | | | |
| MAX.MARKS: 70 Marks | | Duration: 2 Hrs | |
| Type of Questions | Number of Questions to be Answered | Marks | Page No. |
| Short Answer Questions | 10 out of 12 | 10 x 2 = 20 | 208 |
| Short Essay Questions | 5 out of 8 | 5 x 6 = 30 | |
| Problem type Questions | 4 out of 7 | 4 x 5 = 20 | |

Course Name : Robotics and Industrial Automation
Course Code : MG5DSEECT310

MODE OF ASSESSMENT

| B. End Semester Evaluation (ESE) (Modified) | | | |
|--|---|-------------------------|-----------------|
| Theory | | | |
| MAX.MARKS: 50 Marks | | Duration:1.5 Hrs | |
| Type of Questions | Number of Questions to be Answered | Marks | Page No. |
| MCQ | 10 out of 10 | 10 x 1=10 | 211 |
| Short Answer Questions | 5 out of 7 | 5 x 2=10 | |
| Short Essay Questions | 5 out of 8 | 5 x 6= 30 | |

Course Name : Op amp and Linear Integrated Circuits
Course Code : MG5DSEPHY307

COURSE OUTCOMES

| CO No. (Modified) | Expected Course Outcome (Modified) | Learning Domains (Modified) | PO No | Page No. |
|--------------------------|--|------------------------------------|--------------|-----------------|
| 1 | No Change | No Change | No Change | 213, 214 |
| 2 | | | | |
| 3 | | | | |
| 4 | | | | |
| 5 | To design various circuits for different applications regarding Op Amp | A,An,S,C | | |
| 6 | Removed | | | |
| 7 | | | | |

COURSE CONTENT

Content for Classroom Transaction (Units)

| Module | Units | Course Description (Modified) | Hrs (Modified) | CO No. (Modified) | Page No. | |
|--------|---------------------------------|-------------------------------|---------------------------------------|-------------------|------------|---|
| 1 | No Change | | | 1 | 214 215 | |
| | 1.1 | No change | 2 | | | |
| | 1.2 | | 2 | | | |
| | Existing 1.2 | Modified 1.3 | Ideal operational amplifier | | | 2 |
| | 1.3 | 1.4 | Inverting and non inverting amplifier | | | 2 |
| | 1.4 | 1.5 | Voltage buffer | | | 3 |
| | 1.5 | 1.6 | Summing amplifier | | | 2 |
| 2 | No Change | | | 2 | | |
| | 2.1 | No Change | No Change | | | |
| | 2.2 | | | | | |
| | 2.3 | | | | | |
| | 2.4 | | | | | |
| | 2.5 | | | | | |
| | 2.6 | | | | | |
| | 2.7 | | | | | |
| 3 | No Change | No Change | No change | 3,4 | | |
| | 3.1 | No Change | No Change | | | |
| | 3.2 | | | | | |
| | 3.3 | | | | | |
| 4 | No Change | | | 5 | | |
| | 4.1 | No Change | No Change | | | |
| | 4.2 | | | | | |
| | 4.3 | | | | | |
| | 4.4 | | | | | |
| | 4.5 | | | | | |
| | 4.6 | | | | | |
| | 4.7 | | | | | |
| | 4.8 | | | | | |
| | 4.9 | | | | | |
| | 4.10 | | | | | |
| | 4.11 | | | | | |
| | 4.12 | | | | | |
| 5 | Teacher Specific Content | | | | | |

MODE OF ASSESSMENT

| B. End Semester Evaluation (ESE) (Modified) | | | |
|--|---|--------------------------|-----------------|
| Theory | | | |
| MAX.MARKS: 50 Marks | | Duration: 1.5 Hrs | |
| Type of Questions | Number of Questions to be Answered | Marks | Page No. |
| Part A : Short Answer Questions | 10 out of 12 | 10x2=20 | 216 |
| Part B : Short Essay Questions | 5 out of 8 | 5 x 6 = 30 | |

Course Name : Solar Cell Technology: From Fundamentals to Applications

Course Code : MG5SECPHY300

COURSE OUTCOMES

| CO No. (Modified) | Expected Course Outcome (Modified) | Learning Domains (Modified) | PO No | Page No. |
|--------------------------|--|------------------------------------|--------------|---------------------|
| 1 | No Change | No Change | No Change | 217, 218 |
| 2 | | | | |
| 3 | | | | |
| 4 | To apply theoretical concepts to analyze and evaluate different types of solar cell technologies, including crystalline silicon, thin film and emerging technologies | A,An,S | | |
| 5 | Removed | | | |
| 6 | Removed | | | |

COURSE CONTENT

Content for Classroom Transaction (Units)

| Module | Units | Course Description | Hrs | CO No. (Modified) | Page No. |
|--------|--------------------------|--------------------|-----------|-------------------|-------------|
| 1 | No Change | | | | 218, 219 |
| | 1.1 | No Change | No Change | No Change | |
| | 1.2 | | | | |
| | 1.3 | | | | |
| | 1.4 | | | | |
| 2 | No Change | | | | |
| | 2.1 | No Change | No Change | No Change | |
| | 2.2 | | | | |
| | 2.3 | | | 3 | |
| | 2.4 | | | | |
| 3 | No Change | | | | |
| | 3.1 | No Change | No Change | 4 | |
| | 3.2 | | | | |
| | 3.2 | | | | |
| 4 | Teacher Specific Content | | | | |

| Teaching and Learning Approach | Classroom Procedure (Mode of transaction) (Modified) | Page No. |
|--------------------------------|--|----------|
| | | 219 |

MODE OF ASSESSMENT (Modified)

| A. Continuous Comprehensive Assessment (CCA) - 25 marks | Page No. |
|---|-----------------|
| Formative Assessment <ul style="list-style-type: none"> • Quiz • Assignments /Seminar Summative Assessment <ul style="list-style-type: none"> • Skill assessment test (MCQ/Viva/mini project) | 220 |
| <p style="text-align: center;">B. End Semester Evaluation (ESE)</p> Practical Evaluation : 50 marks <p>1.Evaluate theoretical and conceptual knowledge: 30marks (Viva only) (Question pattern set externally)</p> <p>2.Skill assessment test: 20 marks</p> <p>Industrial Visit/Minor Project -5marks Industrial Visit/Minor Project Report 15marks</p> | |

Text Books

1. Solar Photovoltaics: Fundamental, Technologies and Applications; C.S. Solanki; 2011; Prentice Hall of India.

References

1. Chenming, H. and White, R.M., Solar Cells from B to Advanced Systems, McGraw Hill Book Co, 1983
2. Chetan Singh Solanki, Solar Photovoltaics : Fundamentals Technologies And Applications, PHI Learning, 2015
3. D.P. Kothari, RENEWABLE ENERGY SOURCES AND EMERGING TECHNOLOGIES, PHI Learning; 3rd edition, 2022
4. Jay Warmke, Designing and Installing Solar PV Systems: Commercial and Large Residential Systems, Blue Rock Station LLC, 2022
5. Solar Energy: Fundamentals and Applications; H. P. Garg & J. Prakash; 2000; Tata McGraw-Hill.

Course Name : Physics using Computational Tools

Course Code : MG5SECPHY301

COURSE CONTENT

Content for Classroom Transaction (Units)

| Module | Units | Course Description (Modified) | Hrs (Modified) | CO No. (Modified) | Page No. | |
|--------|---------------------------------|--|----------------|-------------------|----------|-----|
| 1 | No Change | | | | | 222 |
| | 1.1 | Newton Raphson method. Regula-Falsi Method | 6 | No Change | | |
| | 1.2 | Solution of a system of linear algebraic equations - Gauss elimination method with pivoting -Gauss-Jordan method for matrix inversion- Gauss-Seidel iterative method | 8 | | | |
| | 1.3 | Removed | | | | |
| 2 | No Change | | | | | |
| | 2.1 | Least squares Regression- fitting a straight line, parabola | No Change | No Change | | |
| | 2.2 | No Change | | | | |
| | 2.3 | Newton's divided difference interpolation polynomial | | | | |
| 3 | No Change | | | | | |
| | 3.1 | No Change | No Change | 3,4 | | |
| | 3.2 | Trapezoidal, Simpson's 1/3 rule | | | | |
| | 3.3 | Taylor Series Method | 3 | | | |
| | 3.4 | Euler's and modified Euler's method. 4 th Order Runge Kutta method(Derivation Not needed) | 6 | | | |
| 4 | Teacher Specific Content | | | | | |

MODE OF ASSESSMENT

| B. End Semester Evaluation (ESE) (Modified) | | | |
|--|---|--------------------------|-----------------|
| Theory | | | |
| MAX.MARKS: 50 Marks | | Duration: 1.5 Hrs | |
| Type of Questions | Number of Questions to be Answered | Marks | Page No. |
| Part A : Short Answer Questions | 10 out of 12 | 10x2=20 | 223 |
| Part B : Short Essay Questions | 5 out of 8 | 5 x 6 = 30 | |