DIPLOMA IN APPLIED PHYSICS

Programme: *Diploma in Applied Physics*	**Year: II**	**Semester: III Paper-I**

Subject: Physics

Course Code:	**Course Title: Thermodynamics and Statistical Physics**

Course Outcomes:

1. Recognize the difference between reversible and irreversible processes.
2. Understand First and Second Law of Thermodynamics and concept of Entropy.
3. Understand the physical significance of thermo dynamical potentials.
4. Comprehend the kinetic model of gases w.r.t. various gas laws.
5. Study the implementations and limitations of fundamental radiation laws.

Credits: 04	**Core Compulsory**
Max. Marks: 100 **External Exam: 75** **Internal Assessment: 25**	**Min. Passing Marks: 33**

Total No. of Lectures-Tutorials-Practical (in hours per week): 4-0-0

Unit	Topic	No. of Lectures-60
Unit I	**Basic concepts and First law of thermodynamics** Thermodynamic Systems, Thermal equilibrium and Zeroth law of thermodynamics, Equation of state and First law of thermodynamics, Discussion of Heat and Work, Quasi-static Work; Reversible and Irreversible; Path Dependence; Heat Capacities Adiabatic Processes, Vander Wall equation, Distinction between Joule, Joule- Thompson and Adiabatic expansion of a gas.	**10**
Unit II	**Second law of Thermodynamics and Entropy** Insufficiency of first law of thermodynamics, Condition of Reversibility, Carnot"s Engine and Carnot"s Cycle, Second law of thermodynamics, Carnot"s Theorem, Thermodynamic scale of temperature and its identity to perfect gas, scale of temperature. Entropy, Mathematical formulation of Second law of thermodynamics, Entropy of an ideal gas, T-S diagram and its applications, Evaluation of Entropy changes in simple cases, Third law of thermodynamics.	**10**
Unit III	**Thermodynamic Relations** Thermodynamic potentials, Maxwell"s equation from thermodynamic potentials, Some useful manipulations with partial derivatives (cooling in adiabatic processes and Adiabatic stretching of a wire), The Clausius–Clapeyron"s equations, Triple point, Applications of Maxwell"sthermo	**10**

	dynamical relations.	
Unit IV	**Transport of Heat and Kinetic theory of Gases** Black body radiation, Thermodynamics of radiations inside a hollow enclosure, Kirchoff"s Laws, Derivation of Stefan Boltzmann Law, Wein"s displacement law, Black body spectrum formulaearly attempts, Raleigh Jean"s Law, Quantum theory of Radiation, Planck"s formula for black body spectrum, Wien"s law, Radiation as a photon gas. Degree of Freedom Law of Equipartition of Energy, Distributive law of velocities, Most Probable speed, Average and root mean square velocities.	**15**
Unit V	**Fundamentals of Statistical Mechanics:** Probability and thermodynamic probability, postulates of statistical mechanics, macrostates and microstates, equilibrium and fluctuation constraints, ensemble and average properties, phase space, μ-space and gamma space, division of phase space into cells, Micro canonical, canonical and grand canonical ensembles, Entropy and probability, interpretation of second law of thermodynamics, Boltzmann canonical distribution law. Classical and Quantum statistics, Comparison of three statistics.	**15**

Suggested Reading

1. S. Loknathan : Thermodynamics, Heat and Statistical Physics
2. Sharma and K.K. Sarkar : Thermodynamics, and Statistical Physics
3. Brijlal and Subrahmanyam : Heat and Thermodynamics
4. Garg, Bansal and Ghose: Thermal Physics, McGraw Hill,2012.
5. M.W. Zemansky, R. Dittman, "Heat and Thermodynamics", McGraw Hill,1997.
6. R. K Pathria, Statistical Mechanics, Elsevier
7. Meghnad Saha, B.N. Srivastava, "A Treatise on Heat", Indian Press,1973

Suggested Online Link:

1. MIT Open Learning - Massachusetts Institute of Technology, https://openlearning.mit.edu/
2. National Programme on Technology Enhanced Learning (NPTEL), https://www.youtube.com/user/nptelhrd
3. SwayamPrabha - DTH Channel, https://www.swayamprabha.gov.in/index.php/program/current_he/8

This course can be opted as an elective by the students of following subjects: The course can be opted as an elective, which is open to all students.

Suggested Continuous Evaluation (25 Marks):

Continuous internal evaluation shall be based on allotted assignment and class tests. The marks shall be as follows:

Class Test/Assignment/ attendance- (10+10+5)

Course Prerequisites: Passed Certificate course in Basic Physics.

DIPLOMA IN APPLIED PHYSICS

Programme: *Diploma in Applied Physics*	**Year: II**	**Semester: III Practical (Lab)**

Subject: Physics Practical (Lab)

Course Code:	**Course Title:** Demonstrative Aspects of Thermodynamics and Statistical Physics (Practical)

Course Outcomes:

1. Experimental physics has the most striking impact on the industry wherever the instruments are used to study and determine the thermal properties.
2. Measurement precision and perfection is achieved through Lab Experiments.

Credits: 02	**Core Compulsory**
Max. Marks: 50 **Internal (Record File): 15** **External Practical Exam: 20** **External Viva Voce : 15**	**Min. Passing Marks:17**

Total No. of Lectures-Tutorials-Practical (in hours per week): 0-0-4

Unit	**Topic**	**No. of Lectures**
	Lab Experiment List	
	1. Thermal conductivity of a bad conductor by Lee's method. 2. Mechanical equivalent of heat by Searle's method. 3. Stefan's law 4. Platinum resistance thermometer. 5. Thermal conductivity of a good conductor by Searle's method. 6. J by Callendar and Barnes method. 7. Random throw- statistical method. 8. Newton's law of cooling, sp. heat of Kerosene oil. 9. Variation of thermos emf across two junctions of a thermocouple with temperature 10. To show that deviation of probability of an event from theoretical values decreases with increase in the number of events (throuch coins and dices) 11. To verify the laws of probability distribution and to verify laws of probability of throwing one coin, two coin and ten coins 12. Study of statistical distribution from the given data and to find most probable value, averge value and rms value	**60**

Suggested Readings:

1. M. Yadav, Practical Physics, Vol 2, KedarNath Ramnath Pubaws of lication, 2023.
2. B.L. Worsnop, H.T. Flint, "Advanced Practical Physics for Students", Methuen & Co., Ltd., London, 1962.
3. S. Panigrahi, B. Mallick, "Engineering Practical Physics", Cengage Learning India Pvt. Ltd., 2015.
4. Indu Prakash: Practical Physics
5. S.L. Gupta, V. Kumar, "Practical Physics", Pragati Prakashan, Meerut, 2014.

Suggestive Digital Platforms / Web Links:

1. Virtual Labs at Amrita Vishwa Vidyapeetham, https://vlab.amrita.edu/?sub=1&brch=74
2. Digital Platforms /Web Links of other virtual labs may be suggested / added to this lists by individual Universities

Suggested Continuous Evaluation Methods:

Continuous internal evaluation shall be based on allotted assignment and class tests. The marks shall be as follows:

Record File (15 marks)

PREREQUISITE: Passed Certificate course in Basic Physics

Further Suggestions:

The institution may suggest a minimum number of experiments (say 6) to be performed by each student per semester from the Lab Experiment List.

DIPLOMAINAPPLIEDPHYSICS			
Programme:*Diploma in Applied Physics*		**Year:II**	**Semester: III Vocational/Minor**
Subject:Physics			
CourseCode:	**CourseTitle: Basic Instrumentation Skills -III**		
Credits:03		**Vocational/Minor**	
Max.Marks:100 **ExternalExam:75** **InternalAssessment:25**		**Min.PassingMarks:33**	
Total No.ofLectures-Tutorials-Practical (in hours per week):3-0-0			

Unit	Topic	No.of Lectures
UnitI	**Multimeter** Principles of measurement of dc voltage and dc current, ac voltage, ac curren and resistance. Specifications of a multimeter and their significance Advantage over conventional multimeter for voltage measurement with respeci to input impedance and sensitivity.	**20**
UnitII	**Digital Multimeter** Block diagram and working of a digital multimeter. Working principle of time interval, frequency and period measurement using universa counter/frequency counter, time-base stability, accuracy and resolution.	**10**
UnitIII	**Electronic Voltmeter** Principles of voltage, measurement (block diagram only). Specifications of an electronic Voltmeter, AC millivoltmeter: Type of AC millivoltmeters, Block diagram ac milli -voltmeter, specifications and their significance.	**15**

Suggested Reading

Books Recommended:

1. B L Theraja : A text book in Electrical Technology
2. M G Say : Performance and design of AC machines
3. S. Salivahanan& N. S.Kumar: Electronic Devices and Circuits, , 3rd Edn
4. Shashi Bhushan Sinha, Handbook of Repair and Maintenance of Domestic Electronics Appliances hand book.

Suggested equivalent online courses: This course can be opted as an elective by the students of following subjects: The course can be opted as an elective, which is open to all students.

Suggested Continuous Evaluation (25Marks):

Continuous internal evaluation shall be based on allotted assignment and class tests. The marks shall be as follows:

Class Test/Assignment/ attendance- (10+10+5)

Course Prerequisites: Passed Certificate course in Basic Physics and Passed Semester III.

DIPLOMA IN APPLIED PHYSICS

Programme: *Diploma in Applied Physics*	**Year: II**	**Semester: IV Paper-I**

Subject: Physics

Course Code:	**Course Title: Optics**

Course Outcomes:

1. Study of Fermat's Principle of Extremum Path and understand fundamental physics behind reflection and refraction of light.
2. Understand the theory of image formation by an optical system.
3. Study of different types of optical Aberration sand techniques for the irreduction.
4. Study of different types of optical instruments used in industry and research.

Credits:04	**Core Compulsory**
Max.Marks:100 **External Exam:75** **Internal Assessment:25**	**Min.Passing Marks:33**

Total No. of Lectures-Tutorials-Practical (in hours per week):4-0-0

Unit	Topic	No. of Lectures
Unit I	**Geometrical Optics:** Fermat's Principle: Principle of extremum path and its application to deduce laws of reflection and refraction, Gauss's general theory of image formation: Coaxial symmetrical system, Cardinal points of an optical system, general relationship, thick lens and lens combinations.	**10**
Unit II	**Optical Instruments:** Entrance and exit pupils, need for a multiple lens eyepiece, Ramsden's, Huygen's and Gaussian eyepieces, Astronomical refracting telescope, Spectrometer, Aberrations in images: Chromatic aberrations, achromatic combination of lenses in contact and separated lenses, Monochromatic aberrations and their reduction: aspherical mirrors and Schmidt corrector plates, aplantic points, oil immersion objectives meniscus lens.	**15**
Unit III	**Interference of Light:** The principle of superposition, Two slit interference, coherence, Division of wave front and amplitude, Optical path retardations lateral shift of fringes, Fresnel biprism, Interference with multiple reflection, Thin films, Application for precision measurements, Haidinger fringes, Fringes of equal thickness and equal inclination.	**15**
Unit IV	**Diffraction of Light:** Fresnel Diffraction: Half-period zones, Zone plate, Fresnel Diffraction pattern of a straight edge, a slit and a wire using half-period zone analysis. Fraunhofer diffraction: Diffraction of a Single slit; Double Slit, Multiple slits and Diffraction grating.	**10**
Unit V	**Polarization of Light:** Transverse nature of light waves, Concept of Plane polarized light – production and analysis, Malus law, Brewster's law, Nicol prism, Circular and elliptical polarization, Double refraction.	**10**

Suggested Reading

1. Fundamentals of Optics, F A Jenkins and H E White, 1976, McGraw-Hill
2. Principles of Optics, B. K. Mathur, 1995, Gopal Printing
3. Fundamentals of Optics, H. R. Gulati and D.R. Khanna, 1991, R. Chand Publication
4. A Textbook of Optics, N. Subramanyam and Brijlal.
5. Optics and Atomic Physics, D. P. Khandelwal.
6. Physical Optics, A. K. Ghatak.
7. Optics, Eugene Hecht, Pearson Publishers.
8. Optics, Satya Prakash.

Suggested OnlineLink:

1. MIT Open Learning Massachusetts Institute of Technology, https://openlearning.mit.edu/
2. National Programme on Technology Enhanced Learning (NPTEL), https://www.youtube.com/user/nptelhrd
3. Swayam Prabha - DTH Channel,

https://www.swayamprabha.gov.in/index.php/program/current_he/8

Suggested equivalent online courses:

This course can be opted as an elective by the students of following subjects: The course can be opted as an elective, which is open to all students.

Suggested Continuous Evaluation (25Marks):

Continuous internal evaluation shall be based on allotted assignment and class tests. The marks shall be as follows:

Class Test/Assignment/ attendance- (10+10+5)

Course Prerequisites: Passed Certificate course in Basic Physics and Passed Semester III.

DIPLOMA IN APPLIED PHYSICS		
Programme: *Diploma in Applied Physics*	**Year: II**	**Semester: IV Practical (Lab)**
Subject: Physics Practical (Lab)		
CourseCode:	**Course Title:** Demonstrative Aspects of Optics(Practical)	

Course Outcomes:

1. Experimental physics has the most striking impact on the industry wherever the instruments are used to study and determine the optical properties.
2. Measurement precision and perfection is achieved through Lab Experiments.

Credits: 02	**Core Compulsory**
Max. Marks: 50 **Internal (Record File): 15** **External Practical Exam: 20** **External Viva Voce : 15**	**Min. Passing Marks:17**

Total No. of Lectures-Tutorials-Practical (in hours per week): 0-0-4

Unit	Topic	No. of Lectures
	Lab Experiment List	
	1. Nodal slide assembly, Location of cardinal points of lens system. 2. Newton's formula. 3. Dispersive power of prism. 4. Resolving power of a telescope. 5. To determine the Resolving Power of a Prism. 6. To verify the Cauchy's dispersion formula. 7. To find the thickness of the wire using optical bench. 8. To determine the thickness of mica-sheet by using Biprism 9. Newtons ring experiment 10. To determine specific rotation of cane sugar using polarimeter 11. Diffraction grating 12. Malus Law 13. Sextant	**60**

Suggested Readings:

1. M. Yadav, Practical Physics, Vol 2, KedarNath Ramnath Publication, 2023.
2. B.L. Worsnop, H.T. Flint, "Advanced Practical Physics for Students", Methuen & Co., Ltd., London, 1962.

3. S. Panigrahi, B. Mallick, "Engineering Practical Physics", Cengage Learning India Pvt. Ltd., 2015.
4. Indu Prakash, Practical Physics
5. S.L. Gupta, V. Kumar, "Practical Physics", PragatiPrakashan, Meerut, 2014.

Suggestive Digital Platforms / Web Links:

1. Virtual Labs at Amrita Vishwa Vidyapeetham, https://vlab.amrita.edu/?sub=1&brch=74
2. Digital Platforms /Web Links of other virtual labs may be suggested / added to this lists by individual Universities

Suggested Continuous Evaluation Methods:

Continuous internal evaluation shall be based on allotted assignment and class tests. The marks shall be as follows:

Record File (15 marks)

PREREQUISITE: Passed Certificate course in Basic Physics and Semester III.

Further Suggestions:

The institution may suggest a minimum number of experiments (say 6) to be performed by each student per semester from the Lab Experiment List.

DIPLOMAINAPPLIEDPHYSICS		
Programme:*Diploma in Applied Physics*	**Year:II**	**Semester: IV Vocational/Minor**
Subject:Physics		
CourseCode:	**CourseTitle: Basic Instrumentation Skills -IV**	
Credits:03	**Vocational (Experiments/hands on training)**	
Max.Marks:100 **External Exam:75** **Internal Assessment:25**	**Min. Passing Marks:33**	
TotalNo.ofLectures-Tutorials-Practical (in hours per week):3-0-0		

Unit	Topic	No. of Lectures
UnitI	**Cathode Ray Oscilloscope**: Block diagram of basic CRO. Construction of CRT, Electron gun, electrostatic focusing and acceleration (Explanation only— no mathematical treatment), brief discussion on screen phosphor, visual persistence & chemical composition. Time base operation, synchronization. Front panel controls. Specifications of a CRO and their significance. Use of CRO for the measurement of voltage (dc and ac frequency, time period. Special features of dual trace, introduction to digital oscilloscope, probes. Digital storage Oscilloscope: Block diagram and principle of working.	**20**
UnitII	**Signal and pulse Generators** Block diagram, explanation and specifications of low frequency signal generator and pulse generator. Brief idea for testing, specifications. Distortion factor meter,wave analysis.	**10**
UnitIII	**Impedance Bridges** Block diagram of bridge. Working principles of basic (balancing) RLC bridge, Specifications of RLC bridge, Block diagram and working principle as of a Q-meter, Digital LCR bridges.	**15**

Suggested Reading

Books Recommended:

1. B L Theraja: A text book in Electrical Technology
2. M G Say: Performance and design of AC machines
3. S. Sa1ivahanan& N. S. Kumar: Electronic Devices and Circuits, 3rd Edn
4. Shashi Bhushan Sinha, Handbook of Repair and Maintenance of Domestic Electronics Appliances hand book.

Suggested OnlineLink:

1. MITOpenLearning-MassachusettsInstituteofTechnology,https://openlearning.mit.edu/
2. NationalProgrammeonTechnologyEnhancedLearning(NPTEL),htt ps://www.youtube.com/user/nptelhrd
3. SwayamPrabha - DTH

Minor/Elective (04 Credit, One from the list E12)

Students having major in Physics will have to choose the elective/minor from sl. no. 1-6. Other faculty students (Arts/Commerce) have to choice sl. no. 1.

1. **Elementary Physics-II**
2. **Elements of Modern Physics**
3. **Electromagnetic Theory**
4. **Optoelectronic Devices**
5. **Opto-Electronics and Laser Instrumentation**
6. **Classical Dynamics**

DIPLOMA IN APPLIED PHYSICS		
Programme: ***Diploma in Applied Physics***	**Year: II**	**Semester: III/IV**
Subject: Physics		
Course Code:	**Course Title: Elementary Physics-II**	

Credits: 04	**Minor/Elective**
Max. Marks: 100 **External Exam: 75** **Internal Assessment: 25**	**Min. Passing Marks: 33**
Total No. of Lectures-Tutorials-Practical (in hours per week): 4-0-0	

Unit	**Topic**	**No. of Lectures**
Unit I	Semiconductors- P- type, n-type, Semiconductor materials, pn diode, Depletion region, Working of pn diode, characteristics, Diode as a rectifier, Transistors PNP and NPN and their working.	**15**
Unit II	OPTICS- Mirrors and lenses, image formation, lens formula, Ramsden and Huygens eyepieces.	**10**
Unit III	Newton's first and Second Law, Concept of force and mass, Some particular forces, Newton's third law, Friction, Properties of friction.	**10**
Unit IV	Rectilinear motion, laws of motion, Work and energy, conservation of energy, law of gravitation and Kepler's law (not derivation).	**10**
Unit V	Thermodynamics systems, Thermal equilibrium, Zeroth law, work done, first law of thermodynamics, Internal energy, enthalpy.	**15**

Suggested Reading:

1- Physics: Resnick and Halliday, John Wiley, New York.
2- Mechanics: D S Mathur, S Chand & company.
3- Semiconductor materials and devices, M S Tyagi, John Wiley, New York.
4- Basic Electronics: B L Theraja, S Chand & company.

Suggested Online Link:

1. MIT Open Learning - Massachusetts Institute of Technology, https://openlearning.mit.edu/
2. National Programme on Technology Enhanced Learning (NPTEL),
https://www.youtube.com/user/nptelhrd
3. Swayam Prabha - DTH Channel,
https://www.swayamprabha.gov.in/index.php/program/current_he/8

Suggested Continuous Evaluation (25 Marks):

Continuous internal evaluation shall be based on allotted assignment and class tests. The marks shall be as follows:

Class Test/Assignment/ attendance- (10+10+5)

DIPLOMA IN APPLIED PHYSICS		
Programme: *Diploma in Applied Physics*	**Year: II**	**Semester: III/IV**
Subject: Physics		
Course Code:	**Course Title: Elements of Modern Physics**	

Credits: 04	**Minor/Elective**
Max. Marks: 100 **External Exam: 75** **Internal Assessment: 25**	**Min. Passing Marks: 33**
Total No. of Lectures-Tutorials-Practical (in hours per week): 4-0-0	

Unit	Topic	No. of Lectures
Unit I	**Quantum Mechanics and Bohr Atom Model** Planck's quantum, Planck's constant and light as a collection of photons; Photoelectric effect and Compton scattering. De Broglie wavelength and matter waves; Davisson-Germer experiment. Rutherford model, Bohr's model, quantization rule and atomic stability; calculation of energy levels for hydrogen like atoms and their spectra.	**15**
Unit II	**Quantum Systems and Heisenberg Uncertainty Principle** Position measurement; Wave-particle duality, Heisenberg uncertainty principle- impossibility of a particle following a trajectory; Estimating minimum energy of a confined particle using uncertainty principle; Energy-time uncertainty principle.	**15**
Unit III	**Matter Waves and Schrödinger Equation** Two slit interference experiment with photons, atoms & particles; linear superposition principle as a consequence; Matter waves and wave amplitude; Schrodinger equation for non-relativistic particles; Momentum and Energy operators; stationary states; physical interpretation of wavefunction, probabilities and normalization; Probability and probability current densities in one dimension.	**15**
Unit IV	**Motion in a Potential Well** One dimensional infinitely rigid box- energy eigenvalues and eigenfunctions, normalization; Quantum dot as an example; Quantum mechanical tunnelling in one dimension - across a step potential and across a rectangular potential barrier.	**15**

Suggested Reading:

1. Arthur Beiser: Concepts of Modern Physics

2. J. R. Taylor, C.D. Zafiratos: Modern Physics

3. Thomas A. Moore: Six Ideas that Shaped Physics: Particle Behave like Waves

4. Berkeley Physics Course: Vol.4 (Quantum Physics)

5. Serway, Moses, and Moyer: Modern Physics

6. G. Kaur and G.R. Pickrell: Modern Physics

7. B.L. Flint and H.T. Worsnop: Advanced Practical Physics for Students

8. Michael Nelson and Jon M. Ogbor: Advanced level Physics Practicals, , 4th Edition

Suggested Online Link:

1. MIT Open Learning - Massachusetts Institute of Technology, https://openlearning.mit.edu/
2. National Programme on Technology Enhanced Learning (NPTEL), https://www.youtube.com/user/nptelhrd
3. Swayam Prabha - DTH Channel, https://www.swayamprabha.gov.in/index.php/program/current_he/8

Suggested Continuous Evaluation (25 Marks):

Continuous internal evaluation shall be based on allotted assignment and class tests. The marks shall be as follows:

Class Test/Assignment/ attendance- (10+10+5)

DIPLOMA IN APPLIED PHYSICS		
Programme: *Diploma in Applied Physics*	**Year: II**	**Semester: III/IV**
Subject: Physics		
Course Code:	**Course Title: Electromagnetic Theory**	

Credits: 04	**Minor/Elective**
Max. Marks: 100 **External Exam: 75** **Internal Assessment: 25**	**Min. Passing Marks: 25**
Total No. of Lectures-Tutorials-Practical (in hours per week): 4-0-0	

Unit	Topic	No. of Lectures
Unit I	**Maxwell's Equations** Review of electrostatic and electromagnetic equations, their differential and integral forms, Maxwell's equations. Displacement Current. Wave Equations. Plane Waves in Dielectric Media. Poynting Theorem and Poynting Vector. Electromagnetic (EM) Energy Density. Physical Concept of Electromagnetic Field Energy Density.	**15**
Unit II	**EM Wave Propagation in Unbounded Media** Plane EM waves through vacuum and isotropic dielectric medium transverse nature of plane EM waves, refractive index and dielectric constant, wave impedance. Propagation through conducting media, relaxation time, skin depth.	**15**
Unit III	**EM Wave in Bounded Media** Boundary conditions at a plane interface between two media. Reflection & Refraction of plane waves at plane interface between two dielectric media- Laws of Reflection and Refraction, Fresnel's Formulae, Brewster's law. Total internal reflection,	**15**
Unit IV	**Polarization of Electromagnetic Waves** Description of Linear, Circular and Elliptical Polarization. Uniaxial and Biaxial Crystals. Light Propagation in Uniaxial Crystal. Double Refraction. Polarization by Double Refraction. Nicol Prism. Ordinary & extraordinary refractive indices.	**15**

Suggested Reading

1. D.J. Griffiths: Introduction to Electrodynamics

2. M.N.O. Sadiku: Elements of Electromagnetics

3. T.L. Chow: Introduction to Electromagnetic Theory

4. M.A.W. Miah: Fundamentals of Electromagnetics

5. R.S. Kshetrimayun: Electromagnetic field Theory

6. Willian H. Hayt: Engineering Electromagnetic

7. J.A. Edminster: Electromagnetics, Schaum Series, 2006

8. B.L. Flint and H.T. Worsnop: Advanced Practical Physics for Students

9. Michael Nelson and J. M. Ogborn: Advanced level Physics Practicals

Suggested Online Link:

1. MIT Open Learning - Massachusetts Institute of Technology, https://openlearning.mit.edu/
2. National Programme on Technology Enhanced Learning (NPTEL),
https://www.youtube.com/user/nptelhrd
3. Swayam Prabha - DTH Channel,
https://www.swayamprabha.gov.in/index.php/program/current_he/8

Suggested Continuous Evaluation (25 Marks):

Continuous internal evaluation shall be based on allotted assignment and class tests. The marks shall be as follows:

Class Test/Assignment/ attendance- (10+10+5)

DIPLOMA IN APPLIED PHYSICS		
Programme: *Diploma in Applied Physics*	**Year: II**	**Semester: III/IV**
Subject: Physics		
Course Code:	**Course Title: Optoelectronic Devices**	

Credits: 04	**Minor/Elective**
Max. Marks: 100 **External Exam: 75** **Internal Assessment: 25**	**Min. Passing Marks: 33**
Total No. of Lectures-Tutorials-Practical (in hours per week): 4-0-0	

Unit	Topic	No. of Lectures
Unit I	**Properties of semiconductors** Electron and photon distribution: density of states, effective mass and band structure, effect of temperature and pressure on band gap, recombination processes. Basics of semiconductor optics: Dual nature of light, band structure of various semiconductors, light absorption and emission, photoluminescence electroluminescence, radioactive and non-radiative recombination, wave trains.	**15**
Unit II	**Semiconductor light-emitting diodes and Semiconductor lasers** Structure and types of LEDs and their characteristics, guided waves and optical modes, optical gain, confinement factor, internal and external efficiency semiconductor heterojunctions, double hetero structure LEDs. Semiconductor lasers: Spontaneous and stimulated emission, principles of a laser diode, threshold current, effect of temperature, design of an edge-emitting diode, emission spectrum of a laser diode, quantum wells, quantum-well laser diodes.	**15**
Unit III	**Semiconductor light modulators** Modulating light (direct modulation of laser diodes, electro-optic modulation acousto-optic modulation), isolating light (magneto-optic isolators), inducing optical nonlinearity (frequency conversion, switching)	**15**

Unit IV	**Semiconductor light detectors** I-V characteristics of a p-n diode under illumination, photovoltaic and photoconductive modes, load line, photocells and photodiodes, pi-n photodiodes, responsivity, noise and sensitivity, photodiode materials, electric circuits with photodiodes, solar cells.	**15**

Suggested Reading:

1. Semiconductor Optoelectronics: Physics and Technology, Jasprit Singh, McGraw HillCompanies, ISBN 0070576378
2. Optoelectronics, E. Rosencher and B. Vinter, Cambridge Univ. Press, ISBN 052177813.
3. Photonic Devices, J. Liu, Cambridge Univ. Press, ISBN 0521551951.
4. Semiconductor Optoelectronic Devices 2nd Edition", P. Bhattacharya, Prentice Hall, ISBN 0134956567.
5. Physics of Semiconductor Devices, by S. M. Size (2nd Edition, Wiley, New York, 1981)

Suggested Online Link:

1. MIT Open Learning - Massachusetts Institute of Technology, https://openlearning.mit.edu/
2. National Programme on Technology Enhanced Learning (NPTEL),

https://www.youtube.com/user/nptelhrd

3. Swayam Prabha - DTH Channel,

https://www.swayamprabha.gov.in/index.php/program/current_he/8

Suggested Continuous Evaluation (25 Marks):

Continuous internal evaluation shall be based on allotted assignment and class tests. The marks shall be as follows:

Class Test/Assignment/ attendance- (10+10+5)

DIPLOMA IN APPLIED PHYSICS		
Programme: *Diploma in Applied Physics*	**Year: II**	**Semester: III/IV**
Subject: Physics		
Course Code:	**Course Title: Opto-Electronics and Laser Instrumentation**	

Credits: 04	**Minor/Elective**
Max. Marks: 100 **External Exam: 75** **Internal Assessment: 25**	**Min. Passing Marks: 33**
Total No. of Lectures-Tutorials-Practical (in hours per week): 4-0-0	

Unit	Topic	No. of Lectures
Unit I	**Introduction** Characteristics of optical radiation, luminescence, irradiance – Optical Sources – Photo Detectors – Opto-couplers and their application in analog and digita devices. Optical Fiber Fundamentals – modes, types of optical fibers – fibe coupling – Fiber optic sensors for common industrial parameters – V, I pressure, temperature – IR sources and detectors – fiber optic gyroscope.	**15**
Unit II	**Characteristics of LASERS** Einstein's equations – population inversion two, three and four level system Laser rate equation, properties – modes – Resonator configurations – Q switching and mode locking, cavity dumping, single frequency operation – Types of Lasers. Applications – Lasers for measurement of distance and length velocity, acceleration, atmospheric effects, pollutants.	**15**
Unit III	**Applications** Lasers for measurement of distance and length, velocity, acceleration atmospheric effects, pollutants. Material processing applications – Laser heating melting, scribing, splicing, welding and trimming of materials, removal and vaporization.	**15**
Unit IV	**Holographic Interferometry and Applications** Holography for non-destructive testing – medical applications – lasers and tissue interaction -surgery – dermatology.	**15**

Suggested Reading

1. Wilson and Hawkes, "Opto Electronics-An Introduction", Third Edition, Pearson Education, 1998.
2. John Ready, "Industrial Applications of Lasers", Second Edition, Academic Press, 1997.
3. Bhattacharya P, "Semiconductor Optoelectronics", Second Edition, Pearson Education, 1998.
4. Djafar K. Mynbaev, Lowell L. Scheiner, "Fiber-Optic Communications Technology", First Edition, Prentice Hall of India Pvt. Limited, 2000.
5. R. P. Khare, "Fiber Optics and Optoelectronics", Oxford Press, 2004.

Suggested Online Link:

1. MIT Open Learning - Massachusetts Institute of Technology, https://openlearning.mit.edu/
2. National Programme on Technology Enhanced Learning (NPTEL), https://www.youtube.com/user/nptelhrd
3. Swayam Prabha - DTH Channel, https://www.swayamprabha.gov.in/index.php/program/current_he/8

Suggested Continuous Evaluation (25 Marks):

Continuous internal evaluation shall be based on allotted assignment and class tests. The marks shall be as follows:

Class Test/Assignment/ attendance- (10+10+5)

DIPLOMA IN APPLIED PHYSICS		
Programme: *Diploma in Applied Physics*	**Year: II**	**Semester: III/IV**
Subject: Physics		
Course Code:	**Course Title: Classical Dynamics**	

Credits: 04	**Minor/Elective**
Max. Marks: 100 **External Exam: 75** **Internal Assessment:25**	**Min. Passing Marks: 25**
Total No. of Lectures-Tutorials-Practical (in hours per week): 4-0-0	

Unit	Topic	No. of Lectures
Unit I	**Classical Mechanics of Point Particles** Review of Newtonian Mechanics; Generalized coordinates and velocities Hamilton's principle, Lagrangian and the Euler-Lagrange equations, one-dimensional Simple Harmonic Oscillations and falling body in uniform gravity; applications to simple systems such as coupled oscillators Canonical momenta & Hamiltonian. Hamilton's equations of motion. Applications: Hamiltonian for a harmonic oscillator, particle in a central force field	**15**
Unit II	**Small Amplitude Oscillations** Minima of potential energy and points of stable equilibrium, expansion of the potential energy around a minimum, small amplitude oscillations about the minimum, normal modes of oscillations example of N identical masses connected in a linear fashion to (N -1) - identical springs.	**15**
Unit III	**Special Theory of Relativity** Postulates of Special Theory of Relativity. Lorentz Transformations Minkowski space. The invariant interval, light cone and world lines. Space-time diagrams. Time-dilation, length contraction and twin paradox. Four-vectors: space-like, time-like and light-like. Four-velocity and acceleration Metric and alternating tensors. Four-momentum and energy-momentum relation. Doppler effect from a four-vector perspective. Concept of four-force. Conservation of four-momentum. Relativistic kinematics. Application to two-body decay of an unstable particle.	**15**
Unit IV	**Fluid Dynamics** Density and pressure in a fluid, an element of fluid and its velocity continuity equation and mass conservation, stream-lined motion, laminar flow, Poiseuille's equation for flow of a liquid through a pipe, Navier-Stokes	**15**

	equation, qualitative description of turbulence, Reynolds number, Basic physics of fluids: Definition of a fluid- shear stress; Fluid, properties- viscosity, thermal conductivity, mass diffusivity, other fluid properties and equation of state; Flow visualization - streamlines, pathlines, Streaklines	

Suggested Reading

1. H. Goldstein: Classical Mechanics
2. N.C. Rana & P. S. Jog: Classical Mechanics
3. Landau and Lifshitz: Mechanics
4. Sommerfeld: Mechanics
5. Whittaker: Analytical Dynamics of Particles and Rigid Bodies
6. Raychaudhuri: Classical Mechanics

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