NATIONAL EDUCATION POLICY-2020

Syllabus for
Sri Dev Suman Uttarakhand University
and Affiliated Colleges

PROPOSED STRUCTURE OF
Under Graduate Physics
Course Syllabus

2022

Board Of Studies

Department of Physics, Sri Dev Suman Uttarakhand University

Pt. Lalit Mohan Sharma Campus Rishikesh

Syllabus Preparation Committee

A: Department of Physics, Sri Dev Suman Uttarakhand University, Pt. Lalit Mohan Sharma Campus, Rishikesh

S.N.	Name	Designation	Signature
1.	Dr. Yogesh Kumar Sharma	Professor & Head	10/8/22
2.	Dr. Manoj Yadav	Professor	
3.	Dr. Rajkumar Tyagi	Professor	
4.	Dr. Bimal Prakash Bahuguna	Professor	10-8-2022
5.	Dr. Hemant Singh	Associate Professor	

B: Director from Research Institute

1.	Professor Durgesh Pant	Director General UCOST, Dehradun	

C: Expert from Other Institutions

1.	Dr. A. A. Baurai	Professor & Director S. R. T Campus, Badshahithol Tehri (Garhwal) H. N. B. Garhwal Univeristy Srinagar (Garhwal)	
2.	Dr. D. P. Bhatt	Professor & Principal Govt. Degree College, Vedhikhal	

D: Invited Principals from Government Post Graduate Colleges

S. N.	Name	Designation and Address	Signature
1.	Dr. D. C. Nainwal	Professor & Principal Govt. P. G. College, Doiwala	10/8/22
2.	Dr. Renu Negi	Professor & Principal Govt. P. G. College, New Tehri	10/08/2022
3.	Dr. D. P. Bhatt	Professor & Principal Govt. Degree College, Vedhikhal	10/8/2022

List of Papers in Six Semesters (B.Sc. Degree) Semester-wise Titles of the Papers in Physics					
Year	**Sem.**	**Course Code**	**Paper Title**	**Theory/ Practical**	**Credits**
Certificate Course in Basic Physics					
FIRST YEAR	I		Mechanics	Theory	(04)
			Mechanical Properties of Matter	Practical	(02)
	II		Electricity and Magnetism	Theory	(04)
			Demonstrative Aspects of Electricity& Magnetism	Practical	(02)
Diploma in Applied Physics					
SECOND YEAR	III		Thermodynamics and Statistical Physics	Theory	(04)
			Demonstrative Aspects of Thermal Properties of Matter	Practical	(02)
	IV		Optics	Theory	(04)
			Demonstrative Aspects of Optics	Practical	(02)
Bachelor of Science					
THIRD YEAR	V		Solid State Physics	Theory	(04)
			Demonstrative Aspects of Solid State Physics & Circuit Designing	Practical	(02)
			Basic Electronics	Theory	(04)
			Demonstrative Aspects of Basic Electronics	Practical	(02)
	VI		Modern Physics & Elementary Quantum Mechanics	Theory	(04)
			Demonstrative Aspects of Modern Physics	Practical	(02)
			Analog and Digital Electronics	Theory	(04)
			Demonstrative Aspects of Analog & Digital Circuits	Practical	(02)

Subject prerequisites:

1. For Semester I: 12^{th} pass with subjects Physics, Chemistry & Mathematics
2. For Semester II: Passed Semester I with Physics
3. For Semester III: Passed Semester II with Certificate Course in Basic Physics
4. For Semester IV: Passed Semester III
5. For Semester V: Passed Semester IV with Diploma in Applied Physics
6. For Semester VI: Passed Semester V

Programme outcomes (POs):

Students having Degree in B.Sc. (with Physics) should have knowledge of different concepts and fundamentals of Physics and ability to apply this knowledge in various fields of academics and industry. They may pursue their future career in the field of academics, research and industry.

PO 1	1. Competence in the methods and techniques of calculations using Mechanics. 2. Students are expected to have hands-on experience to apply the theoretical knowledge to solve practical problems.
PO2	1. Students are expected to have deep understanding of electricity and magnetism. 2. Student should be able to make basic electrical circuits and handle electrical instruments.
PO 3	1. Competence in the concepts of Thermodynamics and Statistical Physics. 2. Students are expected to have hands on experience in Thermal Physics and Statisctical Physics Experiments.
PO 4	1 Knowledge of different concepts in Optics. 2 Students are expected to have hands on experience of Experiments of Optics
PO 5	1. Knowledge of basic concepts of Solid State Physics with their applications 2. Students are expected to have an insight in handling electronic instruments.
PO 6	1. Comprehensive knowledge of Analog & Digital Principles and Applications. 2. Learn the integrated approach to analog electronic circuitry and digital electronics for R&D.

Programme specific outcomes (PSOs):
UG I Year / Certificate course in Basic Physics

After completing this certificate course, the student should have

- Acquired the basic knowledge of Mechanics, Electricity and Magnetism.
- Hands-on experience to apply the theoretical knowledge to solve practical problems of basic physical phenomena. He should be able to carry out experiments to understand the laws and concepts of Physics.
- An insight in understanding electrical circuits and in handling electrical instruments.

Programme specific outcomes (PSOs):
UG II Year/ (Diploma in Applied Physics)

After completing this diploma course, the student should have

- Knowledge of different concepts in Thermodynamics, Statistical Physics and Optics.
- Knowledge of different aspects of Thermal Physics which serves as a basis for many physical systems used in industrial applications and deals with the physics and technology of Engines and Refrigerators.
- A deeper insight in Optics to understand the Physics of many optical instruments which are widely used in research and Industry, Optoelectronics, IT and communication devices, and in industrial instrumentation.
- Knowledge of basic concepts of optical instruments with their applications in technology.

Programme specific outcomes (PSOs): UG III Year / Bachelor of Science	
After completing this degree course, the student should have:	
PSO 1	*Knowledge of Mechanics and basic properties of matter. The course will empower him to apply his theoretical knowledge in various physical phenomena that occur in day to day life and he can use this scientific knowledge for the betterment of the society.*
PSO2	*Understanding of basic concepts related to Electricity and Magnetism. He should be proficienct in designing and handling different electrical circuits*
PSO3	*Expertise in different aspects of Thermal and Statistical Physics which serves as a basis for many physical systems used in industrial applications and deals with the physics and technology of Engines and Refrigerators.*
PSO4	*Proficient in the field of Optics which will increase his demand in research and industrial establishments engaged in activities involving optical instruments.*
PSO5	*Basic knowledge in the field of Modern physics, which have utmost importance at both undergraduate and graduate level.*
PSO6	• *Comprehensive knowledge of Analog & Digital Principles and Applications.* • *Learn the integrated approach to analog electronic circuitry and digital electronics for R&D.*

CERTIFICATE COURSE IN BASIC PHYSICS		
Programme: ***Certificate Course in Basic Physics***	**Year: I**	**Semester: I** **Paper-I**
Subject: Physics		
Course Code:	**Course Title: Mechanics**	

Course Outcomes

1. Understanding of Vector Algebra and Vector Calculus.

2. Understand the physical interpretation of gradient, divergence and curl.

3. Study of gravitational field and potential and understanding of Kepler's laws of Planetary motion.

4. Understanding of different frames of references and conservation laws.

5. Understand the dynamics of rigid body and concept of moment of inertia. Study of moment of inertia of different bodies and its applications.

6. Study the properties of matter, response of the classical systems to external forces and their elastic deformation and its applications.

7. Comprehend the dynamics of Fluid and concept of viscosity and surface tension along with its applications.

8. Understanding the basic idea of waves and oscillations through Simple harmonic motion.

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	**Vectors Algebra** Vector algebra. Scalar and vector products, scalar and vector triple products, Derivative of a vector with respect to a parameter, Del operator, gradient, divergence and curl, Gauss divergence theorem and applications, Stokes curl theorem and applications; and Green's theorem, Line, surface and volume integral of a vector function.	**10**

Unit II	**Gravitation field and potential** Gravitational field and potential, Gravitational potential energy, Gravitational field Intensity and potential due to a ring, a spherical shell, solid sphere and circular disc, gravitational self-energy, Inverse square law of forces, Kepler's laws of planetary motion.	**10**
Unit III	**Conservation Laws** Frames of reference, Concept of inertial and Non-inertial frames of references, Work energy theorem, Conservative and non-Conservative forces, Linear restoring force, Gradient of potential, Conservation of energy for the particle; Energy function, Concept of Centre of mass, Angular momentum and torque, Laws of conservation of total energy, total linear momentum and total angular momentum along with their examples.	**10**
Unit IV	**Dynamics of rigid body and Moment of Inertia** Translatory and Rotatory motion, Equation of motion for Rotating rigid body, angular momentum vector and moment of inertia, Theorem of parallel and perpendicular axes, Moment of inertia of a cylinder, rod, lamina, ring, disc, spherical shell, solid sphere, kinetic energy of rotation, rolling along a slope, Application to compound pendulum.	**10**
Unit V	**Properties of Matter** Basic concept, Elastic constants and their Interrelations, torsion of cylinder, bending of beam, bending moment, Cantilever, shape of Girders/ rail tracks. Viscosity, Stokes's law, Posieuille's formula, Equation of continuity, Bernoulli's theorem, Surface tension and its molecular interpretation.	**10**
Unit VI	**Waves and Oscillations** Characteristics, Differential equation of a wave motion, Periodic motion, SHM in mechanical systems, Energy of Simple harmonic oscillator, Superposition of SHM(s), Applications of Simple harmonic motion in compound pendulum, Torsional pendulum and LC circuit, Composition of two SHM(s) of different frequency ratio, Lissajous' figures for equal frequencies ratio and 2:1 frequencies ratio.	**10**

Suggested Reading

1. R. Resnick and D. Halliday: Physics Vol-I
2. Berkeley Physics Course: Mechanics Vol-I
3. R. P. Feynman, R. B. Leighton and M. Sands: The Feynman Lectures in Physics
4. D. S. Mathur: Mechanics
5. D. S. Mathur: Elements of Properties of Matter
6. Murray Spiegel, Seymour Lipschutz, Dennis Spellman: Schaum's Outline Series: Vector Analysis, McGraw Hill, 2017.
7. J. C. Upadhyaya: Mechanics

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

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- (25 marks)

Course Prerequisites: Physics and Mathematics in 12^{th}

CERTIFICATE COURSE IN BASIC PHYSICS			
Programme: ***Certificate Course in Basic Physics***		**Year: I**	**Semester: I Practical**
Subject: Physics (Practical)			
Course Code	**Course Title:** Mechanical Properties of Matter (Practical)		
Course Outcomes: 1. Experimental physics has the most striking impact on the industry wherever the instruments are used to study and determine the mechanical 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. To study the Motion of Spring and calculate (a) Spring constant, (b) g and (c) Modulus of rigidity. 2. To determine the Moment of Inertia of a Flywheel. 3. To determine the Moment of Inertia of a Inertia table 4. To determine g and velocity for a freely falling body using Digital Timing Technique. 5. To determine Coefficient of Viscosity of water by Capillary Flow Method (Poiseuille's method). 6. To determine the Young's Modulus of a Wire by Optical Lever Method. 7. To determine the Young's Modulus by bending of beam. 8. To determine the Modulus of Rigidity of a Wire by Maxwell'sneedle 9. To determine the elastic Constants of a wire by Searle's method. 10. To determine the value of g using Bar Pendulum. 11. To determine the value of g using Kater's Pendulum. 12. To determine Surface Tension. 13. To determine the modulus of rigidity by Barton's apparatus (Horizontal/Vertical)		**60**

Suggested Readings:

1. B. L. Worsnop, H. T. Flint, "Advanced Practical Physics for Students", Methuen & Co., Ltd.,London, 1962.
2. S. Panigrahi, B. Mallick, "Engineering Practical Physics", Cengage Learning India Pvt. Ltd., 2015.
3. Indu Prakash: Practical Physics
4. 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 list by individual Universities

Suggested Continuous Evaluation Methods:
Continuous internal evaluation shall be based on attendance of student in Lab and presentation of practical in the record file. The marks shall be as follows
Record File (15 marks)

PREREQUISITE: Opted / Passed Semester I, Theory Paper-1
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.

CERTIFICATE COURSE IN BASIC PHYSICS			
Programme: ***Certificate Course in Basic Physics***		**Year: I**	**Semester: I Vocational/ Minor**
Subject: Physics			
Course Code:	**Course Title: Basic Instrumentation Skills**		
Credits: 03		**Vocational/Minor (Experiments/hands on training)**	
Max. Marks: 100 **External Exam: 75** **Internal Assessment: 25**		**Min. Passing Marks: 33**	
Total No. of Lectures-Tutorials-Practical (in hours per week): 3-0-0			

Unit	Topic	No. of Lectures
Unit I	**Basics of Measurement** Instruments accuracy, precision, sensitivity, resolution, range, least count of different instruments etc. Errors in measurements and loading effects. Principle of Galvanometer, Voltmeter and Ammeter, Conversion of galvanometer into voltmeter and ammeter.	**15**
Unit II	**Multimeter** Principles of measurement of dc voltage and dc current, ac voltage, ac current and resistance. Specifications of a multimeter and their significance. Advantage over conventional multimeter for voltage measurement with respect to input impedance and sensitivity.	**10**
Unit III	**Digital Multimeter** Block diagram and working of a digital multimeter. Working principle of time interval, frequency and period measurement using universal counter/frequency counter, time-base stability, accuracy and resolution.	**10**
Unit IV	**Digital Instruments:** Comparison of analog and digital instruments. Characteristics of a digital meter. Working principle of digital voltmeter.	**10**

Suggested Reading

1. B. L. Theraja: A text book in Electrical Technology
2. M. G. Say: Performance and design of AC machines
3. Venugopal: Digital Circuits and Systems
4. P. Vingron, Shimon: Logic Circuit Design
5. Subrata Ghoshal: Digital Electronics.
6. S. Salivahanan & N. S. Kumar: Electronic Devices and Circuits, 3rd Edn

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

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 (25 marks)

CERTIFICATE COURSE IN BASIC PHYSICS			
Programme: ***Certificate Course in Basic Physics***		**Year: I**	**Semester: II Paper-I**
Subject: Physics			
Course Code:	**Course Title: Electricity and Magnetism**		

Course Outcomes:

1. Understanding of Electric Field and Potential. Evaluation of Electric Field and Potential for different types of charge distributions.

2. Study of Electric and Magnetic Fields in matter. Understand the concept of polarizability, Magnetization and Electric Displacement Vector.

3. Study of Steady and Varying electric currents.

4. Understanding of different aspects of alternating currents and its applications.

5. Understand the Magnetostatics, Lorentz Force and Energy stored in magnetic Field.

6. Comprehend the different aspects of Electromagnetic induction and its applications.

7. Understanding the relation between electricity and magnetism.

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	**Electric field and potential** Coulomb law, Gauss' theory, its integral and differential forms, line integral of Electric field, Electric field and potential due to an arbitrary charge distribution. Electrostatic energy, energy stored in an Electric field. Electric field and potential due to long charged wire, Spherical shell, sphere, disc, dipole.	**10**
Unit II	**Electric and Magnetic fields in Matter** Moments of charge distributions, Polar and non-polar molecule, polarization vector, electric displacement vector, three electric vectors, dielectric susceptibility and permittivity, polarizability, Clausius-Mossotti relation Magnetization, magnetic susceptibility, diamagnetic, paramagnetic and ferromagnetic substances, Hysteresis and B-H curve, hysteresis loss.	**10**
Unit III	**Electric Currents (Steady and Varying)** Current density, Equation of Continuity, Ohm's law and electrical conductivity, Kirchhoff's Laws and their applications, Transient current, Growth and decay of D. C. in L - Rand R - C circuits, charging and discharging of a capacitor through a resistance.	**10**

Unit IV	**Magnetostatics** Lorentz force, Bio-Savert's law, Ampere's law and application, Application of Biot-Savert law, magnetic field due steady current in a long straight wire, coil, Interaction between two wires, field due a Helmholtz coil, solenoid and current loop, magnetic vector potential, Energy stored in Magnetic field.	**10**
Unit V	**Electromagnetic Induction and Alternating Current** Faraday's laws of induction, Lenz's law, Electromotive force, Measurement of magnetic field, Eddy current, Mutual inductance, Self-inductance. Impedance, admittance and reactance, R-C, R-L and L-C circuits with alternating e.m.f. source, series and parallel L-C-R circuits, resonance and sharpness, Quality factor, Power in A. C. circuits, Choke coil.	**10**
Unit VI	**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.	**10**

Suggested Reading

1. Edward M. Purcell: Electricity and Magnetism

2. J. H. Fewkes & J. Yarwood: Electricity & Magnetism, Vol. I

3. D C Tayal: Electricity and Magnetism, Himalaya Publishing House Pvt. Ltd., 2019.

4. D. J. Griffiths: Introduction to Electrodynamics.

5. Lal and Ahmed: Electricity and Magnetism

6. H. K. Malik and A. K. Singh: Engineering Physics, McGraw Hill Education (India) Private Limited, 2018.

7. Richard P. Feynman, Robert B. Leighton, Matthew Sands: The Feynman Lectures on Physics Vol. 2, Pearson Education Limited, 2012.

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 (25 marks)

Course Prerequisites: Passed semester I, theory paper-1

CERTIFICATE COURSE IN BASIC PHYSICS			
Programme: ***Certificate Course in Basic Physics***		**Year: I**	**Semester: II Practical**
Subject: Physics (Practical)			
Course Code:	**Course Title:** Demonstrative Aspects of Electricity & Magnetism (Practical)		

Course Outcomes:

1. Experimental physics has the most striking impact on the industry wherever the instruments are used to study and determine the electric and magnetic 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. Frequency of A.C. Mains. 2. Melde's Experiment. 3. Calibration of Voltmeter by potentiometer. 4. Calibration of ammeter by potentiometer. 5. Specific resistance determination by Carey Foster bridge. 6. Conversion of a Galvanometer into a Voltmeter. 7. Conversion of a Galvanometer into Ammeter. 8. Variation of magnetic field along the axis of a current carrying circular coil. 9. Electrochemical equivalent. 10. De Sauty's bridge- C_1/C_2 11. R_1/R_2 by potentiometer. 12. Study of R-C, L-C-R circuits. 13. Determination of self inductance, mutual inductance. 14. Magnetic field determination by search coil and ballistic galvanometer. 15. Sonometer.	**60**

Suggested Readings:

1. B. L. Worsnop, H.T. Flint, “Advanced Practical Physics for Students”, Methuen & Co., Ltd., London, 1962.
2. S. Panigrahi, B. Mallick, “Engineering Practical Physics”, Cengage Learning India Pvt. Ltd., 2015.
3. Indu Prakash: Practical Physics
4. 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 Semester I

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.

CERTIFICATE COURSE IN BASIC PHYSICS			
Programme : ***Certificate Course in Basic Physics***		**Year: I**	**Semester: II Vocational/Minor**
Subject: Physics			
Course Code:	**Course Title: Electronics Instrumentation skills**		
Credits: 03		**Vocational/Minor**	
Max. Marks: 100 **External Exam: 75** **Internal Assessment: 25**		**Min. Passing Marks: 33**	
Total No. of Lectures-Tutorials-Practical (in hours per week): 3-0-0			

Unit	Topic	No. of Lectures
Unit I	**Electronic Voltmeter** Principles of voltage, measurement (block diagram only). Specifications of an electronic Voltmeter, Multimeter and their significance. AC millivoltmeter: Type of AC millivoltmeters: Amplifier- rectifier, and rectifier- amplifier. Block diagram ac milli -voltmeter, specifications and their significance.	**10**
Unit II	**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.	**15**
Unit III	**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**
Unit IV	**Impedance Bridges** Block diagram of bridge. Working principles of basic (balancing) RLC bridge. Specifications of RLC bridge. Block diagram and working principleas of a Q-meter. Digital LCR bridges.	**10**

Suggested Reading

1. B. L. Theraja: Basic Electronics
2. M. G. Say: Performance and design of AC machines
3. Venugopal: Digital Circuits and Systems
4. P. Vingron, Shimon: Logic Circuit Design
5. Subrata Ghoshal: Digital Electronics
6. S. Salivahanan & N. S..Kumar: Electronic Devices and Circuits
7. V. K. Mehta: Basic Electronics

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

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 (25 Marks)

Minor/Elective (04 Credit, One from the list El 1)

Students having major in Physics will have to choose the elective/minor from sl. no. 1-4 only. Other students may have choice from sl. no. 1-6.

1. Statistical Physics
2. Numerical Methods
3. Computer Programming
4. Waves and Oscillations
5. Fundamental Mechanics
6. Basic Electricity and Magnetism

CERTIFICATE COURSE IN BASIC PHYSICS		
Programme: ***Certificate Course in Basic Physics***	**Year: I**	**Semester: I/II**
Subject: Physics		
Course Code:	**Course Title: Statistical 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	**Basic Concepts in Statistical Physics** Basic postulates of Statistical Physics, Macro and Micro States, Phase Space, Density distribution in phase space, μ space representation and its division, Statistical average values, Condition of equilibrium, Stirling's Approximation, Entropy and Thermodynamic probability, Boltzmann entropy relation.	**15**
Unit II	**Ensembles and Thermodynamic connections** Ensembles, Micro -canonical, Canonical and Grand Canonical ensembles, Statistical definition of temperature and interpretation of second law of thermodynamic, Pressure, Entropy and Chemical potential. Entropy of mixing and Gibb's paradox, Partition function and Physical significances of various statistical quantities.	**15**
Unit III	**Classical Statistics** Maxwell-Boltzmann statistics and Distribution law, Energy distribution function, Maxwell Boltzmann law of velocity distribution (most probable velocity, average velocity, RMS velocity), Limitations of M-B statistics, Elementary idea of quantum statistics.	**15**

Unit IV	**Bose-Einstein and Fermi-Dirac Statistics** B-E distribution law, Thermodynamic functions of a strongly Degenerate Bose Gas, Bose Einstein condensation, properties of liquid He (qualitative description), Radiation as a photon gas and Thermodynamic functions of photon gas, Bose derivation of Planck's law. Fermi-Dirac Distribution Law, Thermodynamic functions of a Completely and strongly Degenerate Fermi Gas, Fermi Energy, Electron gas in a Metal, Specific Heat of Metals, Relativistic Fermi gas, White Dwarf Stars, Chandrasekhar Mass Limit.	**15**

Suggested Reading

1. B. B. Laud: Introductions to Statistical Mechanics
2. J. K. Bhattarjee: Statistical Physics (Allied Publishers)
3. F. Reif : Statistical Physics (Mc.Graw Hill)
4. Kamal Singh: Elements of Statistical Mechanics
5. K. Hung: Statistical Physics (Chapman and Hall/CRC)
6. K. E. Atkinson: Elementary Numerical Analysis
7. R. K. Pathria, B. Heinemann: Statistical Mechanics

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 (25 marks)

CERTIFICATE COURSE IN BASIC PHYSICS		
Programme: ***Certificate Course in Basic Physics***	**Year: I**	**Semester: I/II**
Subject: Physics		
Course Code:	**Course Title: Numerical Methods**	

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	**Ordinary Differential Equations** Brief review of ordinary differential equations, Exact equations, Equations reducible to exact equations, Equations of the first order and higher degrees, Clairaut's equation. Applications of ODEs in concerned engineering branch. Linear differential equations with constant co-efficient, Complimentary functions and particular integral, Method of variation of parameters, Equations reducible to linear equations with constant co-efficient (Cauchy's and Legendre's linear equations), Initial and Boundary value problems Simultaneous linear equations with constant co-efficient, Applications of differential equations in concerned engineering branch.	**15**
Unit II	**Partial Differential Equations** Formulation of Partial Differential Equations (PDE), Solution of PDE, Linear PDE of First Order (Lagrange's Linear Equation), Non-linear Equation of First Order (Standard Forms), Charpit's Method, Homogeneous Linear Equations with Constant Coefficients, Non-homogeneous Linear Equations. Applications of PDE: Method of separation of variables, Solution of one dimensional wave and heat equation and two dimensional Laplace's equation.	**15**
Unit III	**Transforms Theory** Laplace Transform: Laplace Transforms of standard functions and their properties, Inverse Laplace Transforms, General Properties of inverse Laplace transforms and Convolution Theorem, Laplace Transforms of periodic functions, Dirac-delta Function, Heaviside's Unit Function, Solution of ODE	**15**

	and linear simultaneous differential equations using Laplace transforms. Fourier Transform: Fourier integral representation, Fourier sine, cosine and complex transform, Finite Fourier Transforms and their applications. Z – Transforms: Z–Transforms & its properties, inversion of Z – transform and applications of Z – transform	
Unit IV	**Probability and Statistics** Review of probability, Conditional probability and sampling theorems, Discrete and Continuous Probability Distribution, Probability Mass & Probability Density Functions, Distribution function, Discrete and Continuous probability distributions, Binomial, Poisson and Normal distributions.	**15**

Suggested Reading

1. Advanced Engineering Mathematics by E. Kreyszig, John Wiley and Sons, NC, New York.
2. Differential Equations by S. L. Ross, John Wiley & Sons, New York.
3. An Introduction to Probability Theory & its Applications by W. Feller, Wiley.
4. Probability and Statistics for Engineers and Scientists by R.E. Walpole, S. L. Myers and K. Ye, Pearson.
5. Integral Transforms and Their Applications by Lokenath Dennath and Dambaru Bhatta, Chapman and Hall/CRC Press.

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 (25 marks)

CERTIFICATE COURSE IN BASIC PHYSICS		
Programme: ***Certificate Course in Basic Physics***	**Year: I**	**Semester: I/II**
Subject: Physics		
Course Code:	**Course Title: Computer Programming**	

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	**Programming Fundamentals** Introduction to computer, block diagram and organization of computer, number system and binary arithmetic, processing data, hardware, software, firmware, types of programming language -Machine language, Assembly level language, higher level language, source file, object file, translator-assembler, compiler, interpreter. Evolution and classification of programming languages.	**15**
Unit II	**Programming Techniques** Steps in program development, algorithm, flowchart, pseudo code. **C Language**: 'C' character set, literals, keywords, identifiers, data types and size, variable declaration, expression, labels, statements, formatted input output statements, types of operators, data type conversion, mixed mode arithmetics, control structures.	**15**
Unit III	**Data Structures** Storage classes, scope rules and visibility, arrays, pointers, dynamic storage allocation, structures and unions, self-referential structures. Relationship between pointers and arrays, dynamic arrays: Introduction to dynamic data structures linked lists, stack, and binary trees.	**15**
Unit IV	**Functions and File Handling** 'C' functions, library functions, parameter passing, recursion, 'C' files function for file handling, 'C' pre-processors and command line arguments, macros and conditional compiler directives.	**15**

Suggested Reading

1. C Programming Language by Briain W. Kenigham and Dennis Ritchie, Prentice Hall of India.
2. Programming with C by Byron Gottfried, Tata McGraw Hill.
3. The Complete Reference C by Herbert Schildt, Tata McGraw Hill.
4. Let us C by Yashwant Kanetkar, BPB Publication.
5. A Structured Programming Approach in C by B.A. Forouzan and R.F. Gilberg, Cengage Learning.

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 (25 marks)

CERTIFICATE COURSE IN BASIC PHYSICS		
Programme: ***Certificate Course in Basic Physics***	**Year: I**	**Semester: I/II**
Subject: Physics		
Course Code:	**Course Title: Fundamental Mechanics**	

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	**Vectors Algebra and Ordinary Differential Equations** Vector algebra. Scalar and vector products. Derivatives of a vector with respect to a parameter. 1st order homogeneous differential equations. 2nd order homogeneous differential equations with constant coefficients.	**15**
Unit II	**Translatory and Rotatary Motion and Conservation Laws** Frames of reference. Newton's Laws of motion. Dynamics of a system of particles. Centre of Mass, Conservation of momentum. Work and energy. Conservation of energy. Motion of rockets, Angular velocity and angular momentum. Torque. Conservation of angular momentum.	**15**
Unit III	**Gravitation** Newton's Law of Gravitation. Motion of a particle in a central force field (motion in a plane, angular momentum conservation). Kepler's Laws (statement only). Satellite in circular orbit and applications. Geosynchronous orbits. Basic idea of global positioning system (GPS). Weightlessness. Physiological effects on astronauts.	**15**
Unit IV	**Elasticity** Hooke's law - Stress-strain diagram - Elastic moduli-Relation between elastic constants - Poisson's Ratio-Expression for Poisson's ratio in terms of elastic constants - Work done in stretching and work done in twisting a wire – Twisting couple on a cylinder - Determination of Rigidity modulus by static torsion – Torsional pendulum-Determination of Rigidity modulus and moment of inertia - q, η and σ by Searles method.	**15**

Suggested Reading

1. Sears, Zemansky and Young: University Physics
2. Berkeley Physics Course: Volume-1 Mechanics
3. Resnick, Halliday & Walker Fundamentals of Physics
4. Basudeb Bhattacharya: Engineering Mechanics 2nd Edn
5. Ronald Lane Reese: University Physics
6. B.L. Flint and H.T. Worsnop: Advanced Practical Physics for Students

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 (25 marks)

CERTIFICATE COURSE IN BASIC PHYSICS		
Programme: *Certificate Course in Basic Physics*	**Year: I**	**Semester: I/II**
Subject: Physics		
Course Code:	**Course Title: Waves and Oscillations**	

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	**Analysis of wave motion** Characteristics, Differential equation of a wave motion, principle of superposition, Interference, Beats, stationary waves, Energy of stationary waves, Wave velocity and group velocity, Fourier theorem, Fourier analysis of square, triangular and saw-tooth waves. Energy density of plane acoustic waves, Acoustic intensity, Measurement of acoustic intensity – the dB scale, Characteristics and loudness of Musical sound, Acoustic impedance, Reflection and transmission of acoustic waves. Acoustics of buildings, reverberation time, Sabine's formula, Principle of sonar system.	**15**
Unit II	**Ultrasonics** Classification of Sound waves, Ultrasonics, Quartz crystal and Piezo electric effect, Magnetostriction effect, Properties of Ultrasonic, Detection of ultrasonic waves, Determination of velocity of ultrasonic waves in liquid (Acoustic grating method) . Application of Ultrasonics.	**15**
Unit III	**Simple Harmonic Oscillations** Periodic motion, SHM in mechanical systems, Energy of Simple harmonic oscillator, Superposition of SHM(s), Oscillations of two masses connected by a spring, Non-linear (An-harmonic) oscillator and its applications to simple pendulum. Applications of Simple harmonic motion in compound pendulum, Torsional pendulum and LC circuit, Composition of two SHM(s) of different frequency ratio, Lissajous' figures for equal frequencies ratio and 2:1 frequencies ratio	**15**
Unit IV	**Damped and Forced Harmonic Oscillations** Damping force, Different cases for over, critical and under damping, Mechanical damped harmonic oscillators, Logarithmic decrement, Power Dissipation, Relaxation time & Quality Factor.	**15**

	Forced oscillations, Mechanical driven harmonic oscillators, Transient and steady state behavior, Power absorption, phenomenon of resonance, amplitude resonance, velocity resonance, sharpness of resonance/Fidelity, Bandwidth and quality factor.	

Suggested Reading

1. R. Resnick and D. Hilliday: Physics Vol-I
2. D. S. Mathur: Mechanics
3. Brijlal and Subrahmanyam: Waves and Oscillations
4. B. S. Semwal and M. S. Panwar: Wave Phenomena and MaterialScience
5. Berkeley Physics Course: Mechanics Vol-I
6. R. K. Ghose: The mathematics of waves an Vibrations
7. D. P. Khandelwal: Oscillations and Waves
8. I. I. Pain: Physics of Vibration
9. A. P. French: Vibrations and Waves

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 (25 marks)

CERTIFICATE COURSE IN BASIC PHYSICS		
Programme: *Certificate Course in Basic Physics*	**Year: I**	**Semester: I/II**
Subject: Physics		
Course Code:	**Course Title: Basic Electricity and Magnetism**	

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	**Electrostatics:** Electrostatic Field, electric flux, Gauss's theorem of electrostatics. Applications of Gauss theorem- Electric field due to point charge, infinite line of charge, uniformly charged spherical shell and solid sphere, plane charged sheet, charged conductor. Electric potential as line integral of electricfield, potential due to a point charge, electric dipole, uniformly charged spherical shell and solid sphere.	**15**
Unit II	**Magnetism** Magnetostatics: Biot-Savart's law and its applications- straight conductor circular coil, solenoid carrying current. Divergence and curl of magnetic field. Magnetic vector potential. Ampere's circuital law. Magnetic properties of materials: Magnetic intensity, magnetic induction, permeability, magnetic susceptibility. Brief introduction of dia-, para-and ferromagnetic materials.	**15**
Unit III	**Electromagnetic Induction and Alternating Current** Faraday's laws of electromagnetic induction, Lenz's law, self and mutualinductance, L of single coil, M of two coils. Energy stored in magnetic field. Basic concepts of alternating currents.	**15**
Unit IV	**Maxwell`s equations and Electromagnetic wave propagation** Equation of continuity, Displacement current, Maxwell's equations, Poynting vector, energy density in electromagnetic field, electromagnetic wave and its transverse nature.	**15**

Suggested Reading

1. Edward M. Purcell: Electricity and Magnetism

2. J. H. Fewkes & J. Yarwood: Electricity & Magnetism, Vol. I

3. D. C. Tayal: Electricity and Magnetism

4. Ronald Lane Reese: University Physics
5. D. J. Griffiths: Introduction to Electrodynamics, 3rd Edn.
6. B. L. Flint & H. T. Worsnop: Advanced Practical Physics for Students
7. M. Nelson and J. M. Ogborn: Advanced level Physics Practicals, 4th Ed
8. I. Prakash & Ramakrishna: A Text Book of Practical Physics, 11th Ed
9. S. Panigrahi & B. Mallick: Engineering Practical Physics

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 marksshall be as follows:

Class Test/Assignment (25 marks)

Theory and Practical Examination Pattern

Theory (External) each theory paper carrying **maximum marks 75** and shall consist of two sections A and B. Examination duration shall be 02 hours.

a. Section A: Multiple choice questions (MCQ)/true and false/very very short answer type questions.
   Section A will consist of 10 questions, each of one mark)
   Total: 10X1= 10 Marks
b. Section B: (Short answers type , 200 words)
   Section B will consist of 08 questions, each of 7 marks in which 5 has to be answered.
   Total: 7X5= 35 Marks
c. Section C: (Long answers type, 500 words)
   Section C will consist of 3 long answered questions, in which has to be answered, each of 15 marks.
   Total: 2X15= 30 marks

For each theory paper internal assessment shall be conducted periodically (in the form of class tests and/or assignments/ group discussion/ oral presentation/ overall performance) during the semester period. Total marks allotted to internal assessment shall be 25 (Assignments 10 marks, written test/viva 10 marks and regularity 5 marks). The evaluated answer sheets/assignments have to be retained by the Professor In-Charge for the period of six months and can be shown to the students if students want to see the evaluated answer sheets. The marks obtained by the students shall be submitted to the Head of concerned department/ the Principal of the College for uploading onto the University examination portal.

Practical The laboratory work of the students has to be evaluated periodically.

The internal assessment (in the form of lab test, lab record, internal evaluation, assignment/home assignment and attendance) of total 10 marks for each semester shall be conducted during the semester. All kinds of exercises have to be conducted during a semester. Maximum 5 marks of attendance can be given to the students.

In each semester practical examination of 40 marks has to be conducted by two examiners (External and internal) having duration of 4 hours. The total number of students to be examined per batch should not be more than sixty. Marks obtained in the practical examination have to be submitted to the Head of the department/ Principal of the College. The Head of the Department/Principal of the College will make necessary arrangement for uploading the marks onto the University exam portal. The hard copy of the award list from portal has to be submitted to the Controller of Examination, Sri Dev Suman Uttarakhand University, Badshahithaul, New Tehri.

The breakup of marks for practical examination for each semester would be as follows:

Practical exam:	30 Marks (exercises)
Viva voce:	05 Marks
Lab Record and collection:	05 Marks
Sessional (Internal):	10 Marks
Total:	**50 marks (each semester)**