KARNATAK UNIVERSITY, DHARWAD
ACADEMIC (S&T) SECTION
ಕರ್ನಾಟಕ ವಿಶ್ವವಿದ್ಯಾಲಯ, ಧಾರವಾಡ
ವಿದ್ಯಾಮಂಡಳ (ಎಸ್&ಟಿ) ವಿಭಾಗ

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NAAC Accredited
'A' Grade 2014

website: kud.ac.in

No.KU/Aca(S&T)/RPH-394A/2021-22/ 954

Date: 30 SEP 2021

ಅಧಿಸೂಚನೆ

ವಿಷಯ: 2021–22ನೇ ಶೈಕ್ಷಣಿಕ ಸಾಲಿನಿಂದ ಎಲ್ಲ ಸ್ನಾತಕ ಕೋರ್ಸಗಳಿಗೆ 1 ಮತ್ತು 2ನೇ ಸೆಮೆಸ್ಟರ್ NEP-2020 ಮಾದರಿಯ ಪಠ್ಯಕ್ರಮವನ್ನು ಅಳವಡಿಸಿರುವ ಕುರಿತು.

ಉಲ್ಲೇಖ: 1. ಸರ್ಕಾರದ ಅಧೀನ ಕಾರ್ಯದರ್ಶಿಗಳು(ವಿಶ್ವವಿದ್ಯಾಲಯ 1) ಉನ್ನತ ಶಿಕ್ಷಣ ಇಲಾಖೆ ಇವರ ಆದೇಶ ಸಂಖ್ಯೆ: ಇಡಿ 260 ಯುಎನ್ಇ 2019(ಭಾಗ–1), ದಿ:7.8.2021.
2. ವಿಶೇಷ ವಿದ್ಯಾವಿಷಯಕ ಪರಿಷತ್ ಸಭೆಯ ನಿರ್ಣಯ ದಿನಾಂಕ: 19.08.2021
3. ಈ ಕಚೇರಿ ಸುತ್ತೋಲೆ ಸಂ.No. KU/Aca(S&T)/RPH-394A/2021-22/18 ದಿ:21.08.2021.
4. ಸರ್ಕಾರಿ ಆದೇಶ ಸಂಖ್ಯೆ ಇಡಿ 260 ಯುಎನ್ಇ 2019(ಭಾಗ–1), ಬೆಂಗಳೂರು ದಿನಾಂಕ: 15.9.2021.
5. ಎಲ್ಲ ಅಭ್ಯಾಸಸೂಚಿ ಮಂಡಳಿ ಸಭೆಗಳ ನಡವಳಿಗಳು
6. ಎಲ್ಲ ನಿಖಾಯಗಳ ಸಭೆಗಳು ಜರುಗಿದ ದಿನಾಂಕ: 24,25–09–2021.
7. ವಿಶೇಷ ವಿದ್ಯಾವಿಷಯಕ ಪರಿಷತ್ ಸಭೆಯ ನಿರ್ಣಯ ಸಂಖ್ಯೆ: 01 ದಿನಾಂಕ: 28.9.2021.
8. ಮಾನ್ಯ ಕುಲಪತಿಗಳ ಆದೇಶ ದಿನಾಂಕ: 30.09.2021

ಮೇಲ್ಕಾಣಿಸಿದ ವಿಷಯ ಹಾಗೂ ಉಲ್ಲೇಖಗಳನ್ವಯ ಮಾನ್ಯ ಕುಲಪತಿಗಳ ಆದೇಶದ ಮೇರೆಗೆ, 2021–22ನೇ ಶೈಕ್ಷಣಿಕ ಸಾಲಿನಿಂದ ಅನ್ವಯವಾಗುವಂತೆ, ಎಲ್ಲ B.A./ BPA (Music)/BVA/ BTTM/ BSW/ B.Sc./B.Sc. Pulp & Paper Science/ B.Sc. (H.M)/ BCA/ B.A.S.L.P./ B.Com/ B.Com (CS)/ & BBA ಸ್ನಾತಕ ಕೋರ್ಸಗಳ 1 ಮತ್ತು 2ನೇ ಸೆಮೆಸ್ಟರ್‌ಗಳಿಗೆ NEP-2020 ರಂತೆ ವಿಶೇಷ ವಿದ್ಯಾವಿಷಯಕ ಪರಿಷತ್ ಸಭೆಯ ಅನುಮೋದಿತ ಕೋರ್ಸಿನ ಪಠ್ಯಕ್ರಮಗಳನ್ನು ಕ.ವಿ.ವಿ. ಅಂತರ್ಜಾಲ www.kud.ac.in ದಲ್ಲಿ ಭಿತ್ತರಿಸಲಾಗಿದೆ. ಸದರ ಪಠ್ಯಕ್ರಮಗಳನ್ನು ಕ.ವಿ.ವಿ. ಅಂತರ್ಜಾಲದಿಂದ ಡೌನಲೋಡ ಮಾಡಿಕೊಳ್ಳಲು ಸೂಚಿಸುತ್ತ ವಿದ್ಯಾರ್ಥಿಗಳ ಹಾಗೂ ಸಂಬಂಧಿಸಿದ ಎಲ್ಲ ಬೋಧಕರ ಗಮನಕ್ಕೆ ತಂದು ಅದರಂತೆ ಕಾರ್ಯಪ್ರವೃತ್ತರಾಗಲು ಕವಿವಿ ಅಧೀನದ/ಸಂಲಗ್ನ ಮಹಾವಿದ್ಯಾಲಯಗಳ ಪ್ರಾಚಾರ್ಯರುಗಳಿಗೆ ಸೂಚಿಸಲಾಗಿದೆ.

ಅಡಕ: ಮೇಲಿನಂತೆ

30/09/21

(ಡಾ. ಹನುಮಂತಪ್ಪ ಕೆ.ಟಿ.)
ಕುಲಸಚಿವರು.

ಗೆ,
ಕರ್ನಾಟಕ ವಿಶ್ವವಿದ್ಯಾಲಯದ ವ್ಯಾಪ್ತಿಯಲ್ಲಿ ಬರುವ ಎಲ್ಲ ಅಧೀನ ಹಾಗೂ ಸಂಲಗ್ನ ಮಹಾವಿದ್ಯಾಲಯಗಳ ಪ್ರಾಚಾರ್ಯರುಗಳಿಗೆ. (ಕ.ವಿ.ವಿ. ಅಂತರ್ಜಾಲ ಹಾಗೂ ಮಿಂಚಂಚೆ ಮೂಲಕ ಬಿತ್ತರಿಸಲಾಗುವುದು)

ಪ್ರತಿ:

1. ಕುಲಪತಿಗಳ ಆಪ್ತ ಕಾರ್ಯದರ್ಶಿಗಳು, ಕ.ವಿ.ವಿ. ಧಾರವಾಡ.
2. ಕುಲಸಚಿವರ ಆಪ್ತ ಕಾರ್ಯದರ್ಶಿಗಳು, ಕ.ವಿ.ವಿ. ಧಾರವಾಡ.
3. ಕುಲಸಚಿವರು (ಮೌಲ್ಯಮಾಪನ) ಆಪ್ತ ಕಾರ್ಯದರ್ಶಿಗಳು, ಕ.ವಿ.ವಿ. ಧಾರವಾಡ.
4. ಅಧೀಕ್ಷಕರು, ಪ್ರಶ್ನೆ ಪತ್ರಿಕೆ / ಗೌಪ್ಯ / ಜಿ.ಎ.ಡಿ. / ವಿದ್ಯಾಂಡಳ (ಪಿ.ಜಿ.ಪಿಎಚ್.ಡಿ) ವಿಭಾಗ, ಸಂಬಂಧಿಸಿದ ಕೋರ್ಸುಗಳ ವಿಭಾಗಗಳು ಪರೀಕ್ಷಾ ವಿಭಾಗ, ಕ.ವಿ.ವಿ. ಧಾರವಾಡ.
5. ನಿರ್ದೇಶಕರು, ಕಾಲೇಜು ಅಭಿವೃದ್ಧಿ / ವಿದ್ಯಾರ್ಥಿ ಕಲ್ಯಾಣ ವಿಭಾಗ, ಕ.ವಿ.ವಿ. ಧಾರವಾಡ.

KARNATAK UNIVERSITY, DHARWAD

B.Sc. (Hons.) Program

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SYLLABUS

PHYSICS

[Effective from 2021-22]

DISCIPLINE SPECIFIC CORE COURSE (DSCC) FOR SEM I & II,

OPEN ELECTIVE COURSE (OEC) FOR SEM I & II and

SKILL ENHANCEMENT COURSE (SEC) FOR SEM I

AS PER N E P - 2020

Karnatak University, Dharwad

Four Years Under Graduate Program in Physics for B.Sc. (Hons.)

Effective from 2021-22

Sem	Type of Course	Theory/ Practical	Instruction hour per week	Total hours of Syllabus / Sem	Duration of Exam	Internal Assessment Marks	Sem End Exam. Marks	Total Marks	Credits
I	DSCC-1T	Theory	04 hrs	56	03 hrs	30	70	100	04
	DSCC-1P	Practical	04 hrs	52	03 hrs	15	35	50	02
	OEC-1	Theory	03 hrs	42	03 hrs	30	70	100	03
	SEC-1	Practical	02 hrs	22-30	03 hrs	15	35	50	02
II	DSCC-2T	Theory	04 hrs	56	03 hrs	30	70	100	04
	DSCC-2P	Practical	04 hrs	52	03 hrs	15	35	50	02
	OEC-2	Theory	03 hrs	42	03 hrs	30	70	100	03
	Details of the other Semesters will be given later								

***Student can opt digital fluency as SEC or the SEC of his/ her any one DSCC selected it will be evaluated as pr the guidelines issued by the University time to time.**

Program Outcomes:

By the end of the program the students will be able to:

1. culminate in depth knowledge of almost all basic branches of physics such as mechanics, properties of matter, relativity, electricity and magnetism, wave motion, optics, thermal physics, electronics, classical mechanics, quantum mechanics, spectroscopy, nuclear physics, condensed matter physics and also advanced areas like Nanoscience, energy science, astrophysics, instrumentation.
2. communicate effectively physics concepts with examples related to day to day life. Acquire ability of recognizing and distinguishing various aspects of physics found in real life.
3. learn, perform and design experiments in the laboratory to demonstrate the concepts principles, laws of physics, theories learnt in the class rooms.
4. acquire ability of critical thinking and logical reasoning in physics problems and their solutions. Develop ability to analyze physics problem including simple to thought provoking problems and apply the acquired knowledge to solve.
5. appreciate the importance of physics subjects and its application for pursuing interdisciplinary and multidisciplinary higher education and research in these areas.
6. understand the vast scope of physics as theoretical and experimental science with application in finding solution of problems in nature spanning from smallest dimension 10^{-15} m to highest dimension 10^{26} m in space, covering energy ranges from 10^{-10} eV to 10^{25} eV.
7. think independently and develop algorithm and program using programming techniques for solving real world physics problems.
8. develop ability of working independently and to make in-depth study of various notions of physics.
9. develop ability to apply the knowledge and skill acquired through experiments of physics in laboratories to solve real life problems.
10. Pursue advanced studies and research in varied areas of physical science.

Course Outcomes (COs):

At the end of the course the student should be able to:

1. Analyze data, (graphical and analytical), through estimation of errors and their sources in experimental determination of physical quantities. Also able to fit experimental data to straight line graph and calculate standard deviation, standard error and probable error.
2. Distinguish inertial, non-inertial and rotational frames of reference. Also able understand and distinguish real, fictitious and Coriolis force and its importance in real life.
3. Distinguish Galilean, Lorentz transformation and their applications .Understand special theory of relativity by studying variation of length, mass and time with relativistic velocity.
4. Analyze collision problems through laboratory and center of mass frame of reference, also able to relate these two frames.
5. Understand concept of moment of inertia of regular/irregular bodies and its variation with axes through distribution of mass.
6. Find Young's modulus, rigidity modulus and their importance in understanding materials and applications.
7. Understand concept of surface tension and viscosity of liquids and their experimental determination.

8. Understand importance of surface tension and viscosity of liquids/fluids in real life situation (everyday life).

Physics as Discipline Specific Core Course (DSCC)

B.Sc. Semester – I

PHYSICS: PHY -1

Type of Course	Theory / Practical	Credits	No. of Classes/Week	Total No. of Lectures/Hours	Duration of Exam in hrs	Internal Assessment Marks	Semester End Exam Marks	Total Marks
DSCC-1T	Theory	04	04	56	3	30	70	100
DSCC-1P	Practical	02	04	52	3	15	35	50

Title of the Course: PHYDSCCT 1.1: Mechanics and Properties of Matter

Unit- 1 **(14 hours)**

Frames of Reference and Special Theory of Relativity:

Frames of Reference: Inertial frames, Galilean transformation equations (derivation), invariance of Newton's laws under Galilean transformations, invariance of the laws of conservation of momentum and energy under Galilean transformations. Non-inertial frames and fictitious force, rotating frame of reference, concept of the Coriolis force and its importance with derivation.

Special Theory of Relativity: The Michelson-Morley experiment, significance of negative result. Postulates of special theory of relativity. The Lorentz transformation equations (derivation), length contraction (derivation), time dilation (derivation), simultaneity, twin paradox, addition of velocities (derivation), variation of mass with velocity, mass-energy equivalence (derivation). Four vectors in relativity: space-time and energy-momentum vectors and their Lorentz transformation.

Suggested Activities: please refer to foot note

Unit-2 **(14 hours)**

Collisions and Rotational Dynamics:

Collisions: Two-dimensional elastic and inelastic collisions in center of mass and laboratory frames of reference: i) relation between velocities in center of mass system and laboratory system ii) relation between angle of recoil in laboratory system and angle of scattering in center of mass system. Conservation of linear momentum in case of variable mass. Double stage rocket (derivation for final velocity).

Rotational Dynamics: Angular momentum of a particle and system of particles. Torque, principle of conservation of angular momentum. Rotation about a fixed axis, moment of

inertia, theorem of parallel and perpendicular axes (derivation). M.I. of rectangular lamina, and circular disc, (derivations), hallow and solid cylinders (mention of expressions). Theory of flywheel and experimental determination of radius of gyration. Theory of gyroscope: effect of external torque on gyroscope.

Suggested Activities: please refer to foot note

Unit-3 **(14 hours)**

Gravitation and Elasticity: Theory of compound pendulum, interchangeability of centers of suspension and oscillation, four points collinear with the C.G. about which the time period is same, conditions for maximum and minimum time periods. Bar pendulum, experimental determination of 'g' using bar pendulum. Bifilar suspension with parallel threads. Satellite in circular orbit and geosynchronous orbits. Global Positioning System (GPS): basic principle, working and its applications in various fields. Qualitative discussions on applications of artificial satellites.

Elasticity: Review of basic concepts of elasticity: Relation between elastic constants (derivation), Poisson's ratio in terms of elastic constants (derivation). Twisting couple on a solid cylinder (wire), work done in twisting solid cylinder (wire). Determination of coefficient of rigidity by torsional pendulum and Maxwell needle method. Bending of beams-neutral surface, neutral axis, plane of bending, bending moment. Expression for bending moment (derivation), uniform bending (mention formula). Theory of light cantilever (derivation).

Suggested Activities: please refer to foot note

UNIT-4 **(14 hours)**

Fluid Mechanics:

Surface Tension: Review of basics of surface tension. Pressure difference across a liquid surface: excess pressure inside a spherical liquid drop and excess pressure inside a soap bubble. Derivation of relation between radius of curvature, pressure and surface tension. Angle of contact: case of two liquids in contact with each other and with air, case of solid, liquid and air in contact. Experimental determination of surface tension by Jaeger's method with relevant theory. Determination of surface tension and angle of contact of mercury by Quincke's method.

Viscosity: Review of basics of viscosity. Expression for critical velocity, significance of Reynolds's number. Derivation of Poiseuille's equation. Experimental determination of co-efficient of viscosity for a liquid by Poiseuille's method. Motion of a spherical body in a viscous medium: expression for co-efficient of viscosity from Stokes law.

Suggested Activities I:

1. Considering the edges of a room as three axes of a RH/LH coordinates system, specify the position of objects in the room (say tip of the head of students seated there) describe their motion.

2. Perform an experiment with a freely falling body in the class room and explain equations of motion. Arrive at the fictitious force expression.

Suggested Activities II:

1. Students can try and understand conservation of energy in every day examples. For example: What happens in solar conservation panels, Pushing an object on the table it moves, Moving car hits a parked car causes parked car to move. In these cases, energy is conserved. How? Understand and verify if possible.
   Reference : Weblink/Youtube/Book
2. Moment of inertia is an abstract concept. It simply gives a measure of rotational inertia of a rigid body and it is proportional to the product of the square of radius, r of the body and its mass, m. Students by referring to websites, can construct and perform simple experiments to verify that MI α mr^2

   Reference: www.khanacademy.org, www.pinterest.com, www.serc.cerleton.edn

Suggested Activities III:

1. Arrange a steel spring with its top fixed with a rigid support on a wall and a meter scale along side. Add 100 g load at a time on the bottom of the hanger in steps. This means that while putting each 100g load, we are increasing the stretching force by 1N. Measure the extension for loads up to 500g. Plot a graph of extension versus load. Shape of the graph should be a straight line indicating that the ratio of load to extension is constant. Go for higher loads and find out elastic limit of the material.

2. Repeat the above experiment with rubber and other materials and find out what happens after exceeding elastic limit. Plot and interpret.
   Reference: Weblink/Youtube/Book

Suggested Activities IV:

1. Measure surface tension of water and other common liquids and compare and learn Why water has high ST? Think of reasons, check whether ST is a function of temperature? You can do it by heating the water to different temperatures and measure ST. Plot ST versus T and learn how it behaves. Mix some quantity of kerosene or any oil to water and measure ST. Check whether ST for the mixture is more or less than pure water. Think of reasons.
2. Collect a set of different liquids and measure their viscosity. Find out whether sticky or non- sticky liquids are most viscous. Think of reasons. Mix non sticky liquid to the sticky liquid in defined quantities and measure viscosity. Find out viscosity is increasing or decreasing with increase of non-sticky liquid concentration. Find out change in viscosity with increase of concentration of sticky liquid. Think why this is so

Note:

1. Total teaching hours are inclusive of solving numerical problems on all the topics.

2. Preference may be given to solve maximum number of numerical problems and thought-provoking problems are to be solved wherever necessary.
3. Questions should not be framed on review of basic aspects in the semester end examination as it is revision of topics in the lower class.
4. Guide/Students are permitted to do any relevant and thought provoking activity, which gives in depth understanding of physics concepts and their application in a specific chapter.
5. Guide/students are also permitted to take up any innovative project work/field work/ problem solving activity, so that students get clear understanding of underlying principles of physics/concepts of physics in a particular topic/area of physics.
6. Teacher should encourage students to think out of the box and take up activity beyond the syllabus.

Reference books:

1. Mechanics (VI-Edition) - J. C. Upadhyay –Ramprasad & Sons, Agra, 2005.
2. Mechanics (XX-Edition) – D. S. Mathur- S. Chand & Company Ltd., New-Delhi, 2007.
3. Mechanics & Electrodynamics (XVII-Edition, Course- 1 & 2) – Brijlal, Subramanyam & Jivan Seshan, S. Chand & Company Ltd., New-Delhi, 2008.
4. Properties of Matter (XIII-Edition) – Brijlal & Subramanyam, Eurasia Publishing House Pvt. Ltd., New-Delhi, 2001.
5. Elements of Properties of Matter (XXVIII-Edition), D. S. Mathur - S. Chand & Company Ltd., New-Delhi, 2005.
6. Physics, Vol. No. I (V-Edition)– Resnick, Halliday & Krane – John Wiley & Sons Inc., New-York, Singapore, 2005.
7. Berkeley Physics, Vol. No. I – ABC Publications, Bangalore & New-Delhi.
8. University Physics (XI-Edition)- Young & Freedman – Pearson Education, 2004.
9. Introduction to Relativity- R. Resnik.
10. Relativistic Mechanics- Gupta and Kumar.
11. Physics For Degree Students B. Sc. First Year, S. Chand & Company.
12. Electronics Instrumentation by H. S. Kalasi.
13. B.Sc. practical Physics – C.L. Arora.
14. Advanced practical Physics – Samir Kumar Ghosh.
15. Advanced practical Physics – Worsnop and Flint.

Pedagogy: Problem solving, seminar, presentation, activities, group discussion, field visit etc.,

Course Title: **PHYDSCCP 1.1: Practical: Mechanics and Properties of Matter**

FIRST SEMESTER PHYSICS (PHYDSCCP-1.1) PRACTICALS

1. Estimation of errors (Average deviation, Standard deviation, standard error and Probable error) in the experimental determination of physical quantities like length, diameter, thickness, time, mass, temperature and resistance from the given data. And also fit the given data to a straight-line graph and calculate from the given observation's Standard deviation, standard error and Probable error.
2. Y by bending/cantilever.
3. Parallel/perpendicular axes theorem.
4. Bar Pendulum /Kater's pendulum.
5. Fly-Wheel
6. Bifilar Suspension.
7. Koenig's method.
8. Co-efficient of viscosity of liquid by Poiseuille's method.
9. Surface Tension by Jaeger's Method / Quincke's method.
10. Modulus of Rigidity of a wire using disc/ Maxwell's needle.
11. To find Youngs modulus, modulus of rigidity and Poisson's ratio for the material of a wire by Searle's method.
12. Problem based learning in physics: Problems on, gravitation (especially on satellite communication), special theory of relativity, rigid body dynamics and center of mass of different bodies.

Note:

1. ***Experiments are of four hours duration.***
2. ***Minimum of eight experiments to be performed.***
3. ***Any new experiment may be added to the list with the prior approval from the BOS.***

Reference books:

1. Physics For Degree Students B. Sc. First Year, S. Chand & Company.
2. Electronics Instrumentation by H. S. Kalasi.
3. B.Sc. practical Physics – C.L. Arora.
4. Advanced practical Physics – Samir Kumar Ghosh.
5. Advanced practical Physics – Worsnop and Flint.

Pedagogy: Problem solving, seminar, presentation, activities, group discussion, field visit etc.,

B.Sc. Semester – I
Open Elective Course (OEC)-1
Course Title: PHYOET 1.1: Energy Sources

Type of Course	Theory / Practical	Credits	No. of Classes/Week	Total No. of Lectures/Hours	Duration of Exam in hrs	Internal Assessment Marks	Semester End Exam Marks	Total Marks
OEC-I	Theory	03	03	42	3	30	70	100

Unit -1 **(14 Hours)**

Introduction to Energy Sources: Energy concepts, sources in general, its significance and necessity. Classification of energy sources: primary and secondary sources. Energy consumption as a measure of prosperity. Need of renewable energy sources. Conventional (commercial) energy sources, Non- Conventional energy sources (Renewable energy). Advantages of renewable energy. Obstacles to the implementation of renewable energy systems. Prospects of renewable energy sources. Fossil fuels & Nuclear energy- production & extraction, usage rate and limitations. Impact on environment and their issues& challenges.

Unit -2 **(14 Hours)**

Solar-Energy and its Applications: Potential of solar energy, solar radiation and measurements, different types of solar energy collectors, advantages and disadvantages of different collectors, solar energy storage. Solar hot water supply systems. Solar air heating and cooling systems. Solar thermal electric power generation. Solar pumping, distillation, furnace and green houses. Need andcharacteristics of photovoltaic (PV) systems, PV models and equivalent circuits, and sun tracking systems.

Unit -3 **(14 Hours)**

Wind energy harvesting and Ocean Energy and energy from Biomass:

Fundamental of wind energy, wind turbines and different electrical machines in wind turbines, power electronic interfaces and grid interconnection topologies.

Ocean Energy: Ocean energy potential against wind and solar, wave characteristics and statics wave energy devices. Tide characteristics and statistics, tide energy technologies ocean thermal energy, osmotic power, ocean bio-mass.

Energy from Biomass: Biomass conversion technologies: wet process, dry process, photosynthesis. Biogas generation: Factors affecting bio-digestion. Classification of biogas plants: Floating drum plant, fixed dome plant, advantages and disadvantages of these plants.

Suggested Activities:

1. Demonstration of on Solar energy, wind energy, etc, using training modules atLabs.
2. Conversion of vibration to voltage using piezoelectric materials.
3. Conversion of thermal energy into voltage using thermoelectric (using thermocouples or heat sensors) modules.
4. Project report on Solar energy scenario in India
5. Project report on Hydro energy scenario in India
6. Project report on wind energy scenario in India
7. Field trip to nearby Hydroelectric stations.
8. Field trip to wind energy stations like Chitradurga, Hospet, Gadag, etc.
9. Field trip to solar energy parks like Yeramaras near Raichur.
10. Videos on solar energy, hydro energy and wind energy.

Note:

1. Total teaching hours are inclusive of solving numerical problems on all the topics.
2. Preference may be given to solve maximum number of numerical problems and thought-provoking problems are to be solved wherever necessary.
3. Questions should not be framed on review of basic aspects in the semester end examination as it is revision of topics in the lower class.
4. Guide/Students are permitted to do any relevant and thought provoking activity, which gives in depth understanding of physics concepts and their application in a specific chapter.
5. Guide/students are also permitted to take up any innovative project work/field work/ problem solving activity, so that students get clear understanding of underlying principles of physics/concepts of physics in a particular topic/area of physics.
6. Teacher should encourage students to think out of the box and take up activity beyond the syllabus.

Reference Books:

1. Non-conventional energy sources by G. D. Rai Khanna Publishers New Delhi.
2. Solar energy by M. P. Agarwal S. Chand and Co. Ltd.
3. Solar energy by Suhas P. Sukhative Tata McGraw-Hill publishing Company Ltd.
4. Dr. P. Jayakumar, solar Energy: Resources Assesment Handbook, 2009

Pedagogy: Seminar, presentation, activities, group discussion, field visit etc.,

B.Sc. Semester - I
SKILL ENHANCEMENT COURSE (SEC)-I
Course Title: PHYSEC 1.1: BASIC INSTRUMENTATION

Type of Course	Theory / Practical	Credits	No. of Classes/Week	Total No. of Lectures/Hours	Duration of Exam in hrs	Internal Assessment Marks	Semester End Exam Marks	Total Marks
SEC-I	Practical	02	03	22-30	3	15	35	50

BASIC INSTRUMENTATION: (30 Hours)

Basics of Measurement (02Hours): Instrument accuracy, precision, sensitivity, resolution range etc. Errors in measurements and loading effects.

Analog Multimeter (02 Hours): Principle of measurement of dc voltage and dc current, ac voltage, ac current and resistance. Specifications of a multimeter and its significance.

Digital Multimeter (02 Hours): Block diagram, principle and working of a digital multimeter.

Cathode Ray Oscilloscope (04 Hours): Introduction to CRO, Basic diagram of CRT: Brief introduction to Electron Beam,Operating voltage, Deflecting plates, Deflecting voltages, Phosphor Screen. Block diagram of CRO: Brief mention of functions of Vertical and Horizontal Amplifier, Delay Line, Time Base, Trigger Circuit, Power supply and brief explanation of waveform display. Mention of uses of CRO.

Laboratory Skill Experiments:

1. To observe the loading effect of i) Analog ii) Digital multimeters while measuring across a low resistance and high resistance and to observe the limitations of a multimeter for measuring high frequency voltage and currents.
2. Soldering and de-soldering technique (Solder given electronic circuit and check its working).
3. Use of CRO – Measurement of AC voltage and frequency for sine and square waves.
4. Use of CRO – Determination of phase shift using RC network and study of Lissajous figures.
5. Converting the range of a given measuring instrument (voltmeter, ammeter)
6. Basics of transformers. Winding a coil / transformer.
7. Using Resistive network study of star to delta network conversion or vice-versa. Show that they are equivalent.
8. Experimental study of KVL and KCL using DC source and resistive network.
9. Calibration of analog voltmeter and ammeter.
10. Conversion of galvanometer to ohm-meter for at least two ranges.
11. Basics of Relays, Fuses and disconnect switches, Circuit breakers and Overload devices.
12. Study of inductor: To check the health of the inductor using DMM and find self-inductance using AC and DC source.
13. Study of Capacitor: To check the health of the capacitor using DMM, find capacitor using RC network using step down transformer/ AFG and verify laws of combination of capacitor.
14. Basics and working of Battery Eliminators/ battery charger.

Note:

1. **Minimum of Eight experiments to be performed.**
2. **Any new experiment may be added to the list with the prior approval from the BOS.**

B.Sc. Semester – II

PHYSICS: PHY -2

Type of Course	Theory / Practical	Credits	No. of Classes/Week	Total No. of Lectures/Hours	Duration of Exam in hrs	Internal Assessment Marks	Semester End Exam Marks	Total Marks
DSCC-1T	Theory	04	04	56	3	30	70	100
DSCC-1P	Practical	02	04	52	3	15	35	50

Course Outcomes (COs): *At the end of the course the student should be able to:*

1. understand and distinguish application of Gauss law in vacuum and dielectric medium.
2. determine dielectric constant of solid/liquid materials by experiments in laboratory.
3. apply the resonant circuits in the field of communication and signal oscillator building
2. apply concepts of AC and DC bridges to determine values of resistance, capacitance of capacitor and self- inductance of coil.
3. understand how to produce magnetic field from electric current. Understand magnetic field produced by current in toroid and solenoid.
4. distinguish Seeback and Peltier effect and their applications to real life. Also able to distinguish different type of thermocouples as temperature sensors.
5. explain Maxwell's equations to articulate the relationship between varying electric and magnetic field. Also able to explain electromagnetic waves and their characteristics.

Title of the Course: PHYDSCCT 2.1: ELECTRICITY and MAGNETISM

UNIT-1 **(14 hours)**

Theory of Dielectrics and Electric Instruments, Measurements:

Theory of Dielectrics: Introduction to dielectric materials. Polar and nonpolar molecules with examples. Gauss law in a dielectric medium. Dielectric in an electric field, electric polarization (**P**), electric displacement (**D**), electric susceptibility (χ) and atomic polarizability (α), relation between **D**, **E** and **P**. Mechanism of polarization. Boundary condition at a dielectric surface (derivation). Derivation of Clausius–Mosotti equation and its limitations. Langevin-Debye theory of polarization in polar dielectrics. Dielectric constant and its determination for liquids and solids by Hopkinson's method.

Electrical Instruments, Measurements: Theory of moving coil galvanometer to be ballistic & dead beat. Charge and current sensitivity and their relationship, correction for damping.

Measurement of capacitance of a capacitor by absolute method using B.G. Measurement of high resistance by leakage method using B.G.

Suggested Activities: please refer to foot note

UNIT-2 **(14hours)**

Resonance Circuits, D. C. & AC Bridges:

Resonance Circuits: Overview of AC circuits: Operator j, Argand diagram. LCR series circuit- Expression for current, impedance and phase (using j–operator method). Condition for resonance, resonant frequency, bandwidth, quality factor & their relation. LCR parallel circuit (Series L-R in parallel with C) - Expression for admittance & condition for resonance (using j-operator method). Comparison between series & parallel resonant circuits.

D. C. & A.C. Bridges: D.C. Wheatstone Bridge and its demerits (qualitative discussion without derivation). Theory of low resistance measurement using Kelvin's double bridge method. Measurement of inductance, Theory of Maxwell's bridge and Anderson's bridge. Comparison of capacities of two condensers by de Sauty's method.

Suggested Activities: please refer to foot note

UNIT-3 **(14 hours)**

Magnetostatics and Thermoelectricity:

Magnetostatics: Overview of basics of Magnetostatics: Statement of Biot-Savart' law, derive the expression for magnetic field due to Straight conductor carrying current, mention the expression for the field along the axis of a circular coil & discuss the special cases. Tangent law, Helmholtz galvanometer-principle, construction & working. Ampere's circuital law-statement, proof & its applications (for D. C.) to derive the magnetic field due to Solenoid & Toroid.

Thermoelectricity: Seebeck effect, Variation of thermo emf with temperature, neutral temperature & temperature of inversion. Thermoelectric series. Peltier effect, Thomson effect. Thermoelectric laws. Derivation of the relations $\pi = T\,(de/dT)$ and $\sigma_a - \sigma_b = T\,(d^2e/dT^2)$. Tait diagram and its uses. Thermoelectric generators (TEG), Peltier-cooling, Thermoelectric cooler (TEC). Qualitative discussion on different types of Thermocouples (J-type, K-type and RTD type).

Suggested Activities: please refer to foot note

UNIT -4 **(14 Hours)**

Electromagnetic Induction and Electromagnetic Theory:

Overview of basics of EMI, Determination of self-inductance (L) by Rayleigh's method and mutual inductance by direct method, with necessary theory.

Electromagnetic Theory: Fields, types of fields, flux and circulation of a vector field, gradient of a scalar field and its significance, vector point function (electric field intensity) and scalar point function (electric potential) and relation between them for an electrostatic charge distribution. Divergence and curl of a vector field and their significance; Gauss divergence theorem (derivation), Stokes theorem (derivation) and Green's theorem (statement and explanation). Electromotive force (emf) as the circulation of electric field intensity (derivation); continuity equation (proof) and its significance. Inconsistency in Ampere's circuital law and the concept of displacement current. Integral form of Maxwell's equations of electromagnetic theory (mention and explanation); Setting up of the differential form of Maxwell's equations (derivations). Application of Maxwell's equations to dielectric and conducting media; electromagnetic potentials - their non-uniqueness and significance; Coulomb, Lorenz gauge and their significance; Poynting's theorem (statement and derivation).

Note:

1. Total teaching hours are inclusive of solving numerical problems on all the topics.
2. Preference may kindly be given to solve maximum number of numerical problems and thought-provoking problems are to be solved wherever necessary.
3. Questions should not be framed on review of basic aspects in the semester end examination as it is revision of topics in the lower class.
4. Guide/Students are permitted to do any relevant and thought provoking activity, which gives in depth understanding of physics concepts and their application in a specific chapter.
5. Guide/students are also permitted to take up any innovative project work/field work/ problem solving activity, so that students get clear understanding of underlying principles of physics/concepts of physics in a particular topic/area of physics.
6. Teacher should encourage students to think out of the box and take up activity beyond the syllabus.

Reference books:

1. Fundamentals of Electricity and Magnetism – Basudev Ghosh – Books & Allied New Central Book Agency, Calcutta, 2009.
2. Electricity and magnetism- D.N. Vasudev- S. Chand Publication, New Dehli.
3. Electricity and Magnetism- B.S.Agarwal- S. Chand Publication, New Dehli.
4. Electricity and magnetism- Brij lal & Subramasnyam.
5. Electricity and magnetism and Atomic physics vol-I – John Yarwood.
6. Electricity and magnetism – A. N. Matveer-Mir publisher,Moscow 1986.
7. Introduction to electrodynamics- D. J. Griffith (3rd ed)Prentice Hall of India, New Delhi.
8. Electricity and Magnetism by R. Murgeshan.
9. Vector Analysis-Hague
10. Electricity and Magnetism- D. Chattopadhya & Rakshit.
11. Electricity and magnetism- K. K. Tiwari
12. Electricity and magnetism by B. S. Agarwal.
13. Fundamentals of electricity and magnetism- D. N. Vasudev.
14. Electricity and Magnetism- Segal and Chopra
15. Text book of Electrical Technology, Vol. 1 – B.L. Theraja and A.K Theraja.
16. Feynmenn Lectures in Physics Volume II
17. Electromagnetics by B. B. Laud.
18. Introduction to Electrodynamics Third Edition by David J. Griffiths.
19. Electrodynamics by Jacson
20. B.Sc. practical Physics – C.L. Arora.
21. Advanced practical Physics – Samir Kumar Ghosh.
22. Advanced practical Physics – Worshnop and Flint.

Pedagogy: Problem solving seminar, presentation, activities, group discussion, field visit etc.,

B.Sc Semester- II Practicals

Course Title: **PHYDSCCP 2.1: Electricity and Magnetism**

List of Experiments:

1. Determination of dielectric constant of a liquid.
2. Determination of the constants of B.G.
3. Helmholtz galvanometer
4. Determination of magnetic field along the axis of a coil
5. Measurement of capacity by absolute method, using B.G.
6. Determination of high resistance by leakage method
7. Measurement of capacity by method of mixtures
8. Determination of coefficient of self-inductance (L) by Rayleigh's method/ Anderson's bridge method.
9. Low resistance measurement using Kelvin's double bridge method.
10. Measurement of thermo-emf and verification of laws of thermoelectricity using / ordinary potentiometer/Crompton potentiometer.
11. Thermoelectricity power Generator (TEG)
12. Study of Seeback / Peltier Effect (Thermoelectric Cooler-TEC).
13. Series /parallel resonance circuit.

Note:

1. Minimum of Eight experiments to be performed.

2. Any new experiment may be added to the list with the prior approval from the BOS.

Reference books:

1. Physics For Degree Students B. Sc. First Year, S. Chand & Company.
2. Electronics Instrumentation by H. S. Kalasi.
3. B.Sc. practical Physics – C.L. Arora.
4. Advanced practical Physics – Samir Kumar Ghosh.
5. Advanced practical Physics – Worsnop and Flint.

B.Sc. Semester – II

Open Elective Course (OEC)-II

Course Title: PHYOET 2.1: Climate Science

Type of Course	Theory / Practical	Credits	No. of Classes/Week	Total No. of Lectures/Hours	Duration of Exam in hrs	Internal Assessment Marks	Semester End Exam Marks	Total Marks
OEC-II	Theory	03	03	42	3	30	70	100

UNIT-1 **(14 hours)**

Atmosphere: Atmospheric Science (Meteorology) as a multidisciplinary science. Physicaland dynamic meteorology, some terminology, difference between weather and climate, weather and climate variables, composition of the present atmosphere: fixed and variable gases, volume mixing ratio (VMR), sourcesand sinks of gases in the atmosphere. Greenhouse gases. Structure (layers) of the atmosphere. Temperature variation in the atmosphere, temperature lapse rate, mass, pressure and density variation in the atmosphere. Distribution of winds.

UNIT-2 **(14 Hours)**

Climate Science: Overview of meteorological observations, measurement of : temperature, humidity, wind speed and direction and pressure. Surface weather stations, upper air observational network, satellite observation. Overview of clouds and precipitation, aerosol size and concentration, nucleation, droplet growthand condensation (qualitative description). Cloud seeding, lightning and discharge. Formation of trade winds, cyclones. Modelling of the atmosphere: General principles, Overview of General Circulation Models (GCM) for weather forecasting and prediction.Limitations of the models. R and D institutions in India and abroad dedicated to climate Science, NARL, IITM, CSIR Centre for Mathematical Modeling and Computer Simulation, and many more.

UNIT-3 **(14 Hours)**

Global Climate Change: Greenhouse effect and global warming, enhancement in concentration of carbon dioxide and other green house gases in the atmosphere, conventional and non-conventional energy sources and their usage. EL Nino/LA Nino Southern oscillations. Causes for global warming: Deforestation, fossil fuel burning, industrialization. Manifestations of global warming: Sea level rise, melting of glaciers, variation in monsoon patterns, increase in frequency and intensity of cyclones, hurricanes, tornadoes. Geo-engineering as a tool to mitigate global warming? Schemes of geo-engineering.

Activities to be carried out on Climate Science:

1. Try to find answer to the following questions:

(a) Imagine you are going in a aircraft at an altitude greater than 100 km. The air temperature at that altitude will be greater than200^{o}C. If you put your hands out of the window of the aircraft, you will not feel hot.

(b) What would have happened if ozone is not present in thestratosphere.

2. Visit a nearby weather Station and learn about their activities.
3. Design your own rain gauge for rainfall measurement at your place.
4. Learn to determine atmospheric humidity using wet bulb and dry bulb thermometers.
5. Visit the website of Indian Institute of Tropical Meteorology (IITM), and keep track of occurrence and land fall of cyclone prediction.
6. Learn about ozone layer and its depletion and ozone hole.
7. Keep track of melting of glaciers in the Arctic and Atlantic region through data base available over several decades.
8. Watch documentary films on global warming and related issues
9. (Produced by amateur film makers and promoted by British Counciland BBC).

Note:

1. Total teaching hours are inclusive of solving numerical problems on all the topics.
2. Preference may be given to solve maximum number of numerical problems and thought-provoking problems are to be solved wherever necessary.
3. Questions should not be framed on review of basic aspects in the semester end examination as it is revision of topics in the lower class.
4. Guide/Students are permitted to do any relevant and thought provoking activity, which gives in depth understanding of physics concepts and their application in a specific chapter.
5. Guide/students are also permitted to take up any innovative project work/field work/ problem solving activity, so that students get clear understanding of underlying principles of physics/concepts of physics in a particular topic/area of physics.
6. Teacher should encourage students to think out of the box and take up activity beyond the syllabus.

References books:

1. Basics of Atmospheric Science:A Chndrashekar,PHILearningPrivate Ltd. New Delhi, 2010.
2. Fundamentals of Atmospheric Modelling-Mark Z Jacbson,Cambridge University Press, 2000
3. Aviation Meteorology, I.C. Joshi, 3rd edition 2014, Himalayan Books
4. The weather Observers Hand book, Stephen Burt, 2012, Cambridge University Press.
5. Meteorology, S.R. Ghadekar, 2001, Agromet Publishers, Nagpur.
6. Text Book of Agrometeorology, S.R. Ghadekar, 2005, Agromet Publishers, Nagpur.
7. Why the weather, Charles Franklin Brooks, 1924, Chpraman & Hall, London.
8. Atmosphere and Ocean, John G. Harvey, 1995, The Artemis Press.

Faculty of Science & Technology
04 - Year UG Honors programme: 2021-22

GENERAL PATTERN OF THEORY QUESTION PAPER FOR DSCC/ OEC
(70marks for semester end Examination with 3 hrs duration)
Part-A

1. Question number 1-6 carries 2 marks each. Answer any 05 questions : 10 marks

Part-B

2. Question number 7- 14 carries 05Marks each, Answer any 06 questions : 30 marks

Part-C

3. Question number 15-18 carries 10 Marks each, Answer any 03 questions : 30 marks

(Minimum 1 question from each unit and 10 marks question may have sub questions for 7+3 or 6+4 or 5+5 if necessary)

Total: 70 Marks

Note: Proportionate weightage shall be given to each unit based on number of hours prescribed.