Davangere University

Shivagangothri, Davangere- 577007

PROGRAM /COURSE STRUCTURE AND SYLLABUS

of

PHYSICS

as per the Choice Based Credit System (CBCS) designed in accordance with

Learning Outcomes-Based Curriculum Framework (LOCF) of National Education Policy (NEP) 2020

Bachelor of Science (B. Sc. Physics)

w.e.f.

Academic Year 2021-22 and onwards

Registrar
Davangere University
Shivagangotri, Davangere.

PREAMBLE

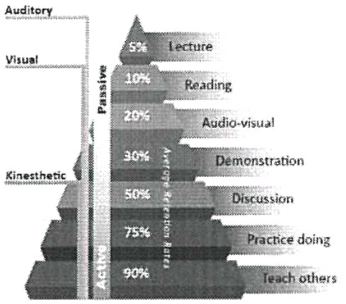
The New Education Policy (2020) is a paradigm shift from the conventional system we practice even today. Giving students the entire freedom to choose what to learn, how to learn, where to learn and when to learn, will enable a personalized education that suits his/her own personality. The drive to change the pedagogy in the curriculum and syllabi will cater to the cognitive, affective and psycho-motor domain of learning, which will fruitfully engage to student and guide him to ascend the Blooms levels of learning hierarchy, elevating them from just remembering to become creative through acquiring skills of application, evaluation and analysis. Such an approach will enable the institution and the individual to design and execute education that is suitable and doable. The wonderful Academic Credit accumulation and the multiple exit/entry options enable multi-displinarity obtainable from multiple institutions, and even from recognized digital platforms. This will create unprecedented opportunities to the students to self-evaluate and change course at every stage of education as they learn. Introducing the possibility of cutting across disciplines to pursue one's interest and talent can boost curricular and extra-curricular activities by an equal measure. This will definitely enable the blooming of creativity among individuals who will not only be excellent and productive employees, but also assume the mantle of becoming entrepreneurs and job providers. The opportunity for the teacher to adopt novel pedagogies will make classrooms vibrant, meaningful and effective. The student choices will also lead to a healthy cross-disciplinary interaction between institutions and consequently enhancing their capabilities and credibility.

The NEP-2020 is based on Outcome Based Education, where the Graduate Attributes and employment opportunities are first kept in mind to reverse-design the Programs, Courses and Supplementary activities to attain the graduate attributes and learning outcomes.

- Attribute 1: Deep discipline knowledge and intellectual breadth. ...
- Attribute 2: Creative and critical thinking, and problem solving. ...
- Attribute 3: Teamwork and communication skills. ...
- Attribute 4: Professionalism and leadership readiness. ...
- Attribute 5: Intercultural and ethical competency.

The learning outcomes-based curriculum framework for a degree in B.Sc. (Honours) Physics is intended to provide a comprehensive foundation to the subject and to help students develop the ability to successfully continue with further studies and research in the subject while they are equipped with required skills at various stages. The framework is designed to equip students with valuable cognitive abilities and skills so that they are successful in meeting diverse needs of professional careers in a developing and knowledge-based society. The curriculum framework takes into account the need to maintain globally competitive standards of achievement in terms of the knowledge and skills in Physics, as well develop scientific orientation, spirit of enquiry problem solving skills and human and professional will values which foster rational and critical thinking in the students.

It is imperative that in the spirit of the NEP, several academic matters have to change. The most important among these will be the pedagogy that will be adopted in the Teaching-Learning experience to enrol, engage and involve and inspire the students. The learning that happens by employing different types of pedagogies is shown below, and thus need to be adopted in the teaching-learning process for effective cognition by the students using the Auditory, Visual and Kinaesthetic approaches:



Types of Pedagogical Approaches

- *Constructivist Approach*
- *Reflective Approach*
- *Collaborative Approach*
- *Integrative Approach*
- *Inquiry-Based Approach*

Along with conventional teaching methods, Activity based pedagogies are seen to be extremely effective in achieving the Program Educational Objectives. The Committee has attempted to consider both the spirit of the NEP and the existing system and framed the syllabus within the Curriculum options offered by the Higher Education Council. The broad topic level syllabus for all the 5 years (10 semesters) for an integrated B.Sc + M.Sc program has been provided. However, a detailed syllabus has to been provided for the First Two Semester. Attempts have been made to sincerely bring in Activity based pedagogy. The activities have been listed and a few examples have been provided to guide the teacher of how to create their own activities that engage and illuminate students by group and self-involvement methods and a possible evaluation method.

Programme Outcomes:

Exit with:	Credits Required
Certificate upon the Successful Completion of the First Year (Two Semesters) of the multidisciplinary Four-year Undergraduate Programme/Five-year Integrated Master's Degree Programme	44 - 48

1. **Discipline Knowledge:** Knowledge of science and ability to apply to relevant areas.
2. **Problem solving:** Execute a solution process using first principles of science to solve problems related to respective discipline.
3. **Modern tool usage:** Use a modern scientific, engineering and IT tool or technique for solving problems in the areas of their discipline.
4. **Ethics:** Apply the professional ethics and norms in respective discipline.
5. **Individual and teamwork:** Work effectively as an individual as a team member in a multidisciplinary team.
6. **Communication:** Communicate effectively with the stake holders, and give and receive clear instructions.

Registrar
Davangere University
Shivagangotri, Davangere.

Exit with:	Credits Required
A **Diploma** upon the Successful Completion of the Second Year (Four Semesters) of the multidisciplinary Four-year Undergraduate Programme/Five-year Integrated Master's Degree Programme	88 - 96

1. **Discipline Knowledge:** Knowledge of science and ability to apply to relevant areas.
2. **Conduct investigations:** Conduct investigations of technical issues as per their level of understanding and knowledge.
3. **Problem solving:** Formulate and implement a solution process using first principles of science to solve problems related to respective discipline.
4. **Modern tool usage:** Apply a modern scientific, engineering and IT tool or technique for solving problems in the areas of their discipline.
5. **Ethics:** Apply and commit to the professional ethics and norms in respective profession.
6. **Individual and teamwork:** Work effectively as an individual in a multidisciplinary team.
7. **Communication:** Communicate effectively with the stake holders, and give and receive clear instructions.

Exit with:	Credits Required
Basic Bachelor Degree at the Successful Completion of the Third Year (Six Semesters) of the multidisciplinary Four- year Undergraduate Programme/Five-year Integrated Master's Degree Programme	132 - 144

1. **Discipline Knowledge:** Knowledge of basics of science and ability to apply the understanding of fundamentals of major discipline in solving complex problems.
2. **Conduct investigations:** Conduct investigations of issues in their respective disciplines and arrive at valid conclusions.
3. **Problem solving:** Implement a solution process using first principles of science to solve problems related to respective discipline.
4. **Modern tool usage:** Select and use a modern scientific, engineering and IT tool or technique for solving problems in the areas of their discipline.
5. **Environment and Society:** Evaluate the impact of scientific solutions on society and environment and the need for sustainable solutions.
6. **Ethics:** Demonstrate professional ethics, responsibilities and norms in respective profession.
7. **Individual and teamwork:** Work effectively as an individual as a team member and as a leader in a multidisciplinary team.
8. **Communication:** Communicate effectively with the stake holders, write and comprehend project reports and documentation, deliver effective presentations, and give and receive clear instructions.
9. **Project Management and Finance:** Apply the knowledge of scientific and technological principles to one's own work to manage projects in multidisciplinary settings.
10. **Lifelong Learning:** Engage in lifelong learning in the context of changing trends in respective discipline.

Exit with:	Credits Required
Bachelor Degree with Honours in a Discipline at the Successful Completion of the Fourth Years (Eight Semesters) of the multidisciplinary Four-year Undergraduate Programme/Five-year Integrated Master's Degree Programme	176 - 192

1. **Discipline Knowledge:** Knowledge of basics of science and research, and ability to apply the understanding of fundamentals of specialized discipline in solving complex scientific problems.
2. **Conduct investigations:** Conduct investigations of issues using research methods and research-based discipline knowledge including design of experiments, data collection, interpretation and analysis to arrive at valid conclusions.
3. **Problem analysis:** Identify, formulate and analyze complex scientific problems using first principles of respective discipline.
4. **Design and Development of solutions:** Design solutions for complex scientific problems and execute them by considering the environmental, societal and public safety aspects appropriately.
5. **Modern tool usage:** Identify, select and use a modern scientific, engineering and IT tool or technique for modelling, prediction, data analysis and solving problems in the areas of their discipline.
6. **Environment and Society:** Evaluate the impact of scientific solutions on society and environment and design sustainable solutions.
7. **Ethics:** Demonstrate professional ethics, responsibilities and norms in respective profession.
8. **Individual and teamwork:** Work effectively as an individual as a team member and as a leader in a multidisciplinary team.
9. **Communication:** Communicate effectively with the stakeholders with emphasis on communicating with scientific community, comprehend scientific reports, write research papers and projects proposals and reports, deliver effective presentations, and give and receive clear instructions.
10. **Project Management and Finance:** Apply the knowledge of scientific and technological principles to one's own work to manage projects in multidisciplinary settings.
11. **Lifelong Learning:** Identify knowledge gaps and engage in lifelong learning in the context of changing trends in respective discipline.

Registrar
Davangere University
Shivagangotri, Davangere.

PROGRAM STRUCTURE

Proposed Curricular and Credits Structure under Choice Based Credit System [CBCS] of Physics Major & One Minor Discipline Scheme for the Four Years Physics B.Sc. Undergraduate Honors Programme with effect from 2021-22.

SEMESTER-I											
Category	**Course code**	**Title of the Paper**	**Marks**			**Teaching hours/week**			**Credit**	**Duration of exams (Hrs)**
			IA	**SEE**	**Total**	**L**	**T**	**P**		
L1	21BSC1L1LK1	Kannada	40	60	100	4	-	-	3	3
	21BSC1L1LFK1	Functional Kannada								
L2	21BSC1L2LEN2	English	40	60	100	4	-	-	3	3
	21BSC1L2LHI2	Hindi								
	21BSC1L2LSN2	Sanskrit								
	21BSC1L2LTE2	Telugu								
	21BSC1L2LUR2	Urdu								
DSC1	21BSC1C1PHY1L	Mechanics and Properties of Matter	40	60	100	4	-	-	4	3
	21BSC1C1PHY1P	Practical I	25	25	50	-	-	4	2	3
DSC1	Another Department Code	Another Department Course Title	40	60	100	4	-	-	4	3
			25	25	50	-	-	4	2	3
SEC1	21BSC1SEC1DF1	Digital Fluency	25	25	50	1	-	2	2	2
VBC1	21BSC1V1PE1	Physical Education-Yoga	25		25	-	-	2	1	--
VBC2	21BSC1V2HW1	Health and Wellness	25		25	-	-	2	1	--
OEC1	21BSC1O1PHY1	Energy Sources	40	60	100	3	-	-	3	3
Total Marks					**700**	**Semester Credits**			**25**	

Registrar
Davangere University
Shivagangotri, Davangere.

SEMESTER-II										
Category	**Course code**	**Title of the Paper**	**Marks**			**Teaching hours/week**			**Credit**	**Duration of exams (Hrs)**
			IA	**SEE**	**Total**	**L**	**T**	**P**		
L3	21BSC2L3LK2	Kannada	40	60	100	4	-	-	3	3
	21BSC2L3FKL2	Functional Kannada								
L4	21BSC2L4EN2	English	40	60	100	4	-	-	3	3
	21BSC2L4HI2	Hindi								
	21BSC2L4SN2	Sanskrit								
	21BSC2L4TE2	Telugu								
	21BSC2L4UR2	Urdu								
DSC2	21BSC2C2PHY2L	Electricity & Magnetism	40	60	100	4	-	-	4	3
	21BSC2C2PHY2P	Practical II	25	25	50	-	-	4	2	3
DSC2	Another Department Code	Another Department Course Title	40	60	100	4	-	-	4	3
			25	25	50	-	-	4	2	3
AECC1	21BSC2AE1ES2	Environmental Studies	25	25	50	1	-	2	2	2
VBC3	21BSC2V3PE2	Physical Education-Sports	25	--	25	-	-	2	1	--
VBC4	21BSC2V4NC1	NCC/NSS/R & R (S&G) / Cultural	25	--	25	-	-	2	1	--
OEC2	21BSC2O2PHY2	Climate Science	40	60	100	3	-	-	3	3
Total Marks					**700**	**Semester Credits**			**25**	

Registrar
Davangere University
Shivagangotri, Davangere.

Concept Note, Abbreviation Explanation and Coding:

Concept Note:

1. **CBCS** is a mode of learning in higher education which facilitates a student to have some freedom in selecting his/her own choices, across various disciplines for completing a UG/PG program.
2. A credit is a unit of study of a fixed duration. For the purpose of computation of workload as per UGC norms the following is mechanism be adopted in the University:
   One credit (01) = One Theory Lecture (L) period of one (1) hour.
   One credit (01) = One Tutorial (T) period of one (1) hour.
   One credit (01) = One practical (P) period of two (2) hours.
3. Course: paper/subject associated with AECC, DSC, DSEC, SEC, VBC, OEC, VC, IC and MIL
4. In case of **B.Sc. Once a candidate chose two courses/subjects of a particular two department in the beginning, he/she shall continue the same till the end of the degree, then there is no provision to change the course(s) and Department(s).**
5. A candidate shall choose **one of the Department's courses as major and other Department course as minor in fifth and sixth semester and major course will get continued in higher semester.**
6. Wherever there is a practical there will be no tutorial and vice-versa
7. A major subject is the subject that's the main focus of Core degree/concerned.
8. A minor is a secondary choice of subject that complements core major/ concerned.
9. Vocational course is a course that enables individual to acquire skills set that are required for a particular job.
10. Internship is a designated activity that carries some credits involving more than **25 days** of working in an organization (either in same organization or outside) under the guidance of an identified mentor. Internship shall be an integral part of the curriculum.
11. **OEC: Open Elective course is for non- Physics students.**

Abbreviation Explanations:

1. AECC: Ability Enhancement Compulsory Course.
2. DSC: Discipline Specific Core Course.
3. DSEC: Discipline Specific Elective Course.
4. SEC: Skill Enhancement Course.
5. VBC: Value Based Course.
6. OEC: Open/Generic Elective Course
7. VC: Vocational Course.
8. IC: Internship Course
9. L1: Language One
10. L2: MIL
11. L= Lecture; T= Tutorial; P=Practical.
12. MIL= Modern Indian Language; English or Hindi or Telugu or Sanskrit or Urdu.

Program Coding:

1. Code 21: Year of Implementation
2. Code BSC: BSC Program under the faculty of Science.
3. Code 1: First Semester of the Program, (2 to 6 represent higher semesters)
4. Code AE: AECC, (C for DSC, S for SEC, V for VBC and O for OEC)
5. Code 1: First "AECC" Course in semester, similarly in remaining semester for such other courses
6. Code LK: Language Kannada, similarly Language English, Language Hindi, Language Telugu, Language Sanskrit, &Language Urdu
7. Code 1: Course in that semester.
8. PHY: Physics

Registrar
Davangere University
Shivagangotri, Davangere.

Course Content Semester – I

Mechanics and Properties of Matter

Course Title: Mechanics and Properties of Matter	Course Credits:4
Total Contact Hours: 52	Duration of ESA: 3 hours
Formative Assessment Marks: 40	Summative Assessment Marks: 60
Model Syllabus Authors: Physics Expert Committee	

Programme Outcomes (POs)

PO-1: Discipline Knowledge: Knowledge of science and ability to apply to relevant areas.

PO-2: Problem solving: Execute a solution process using first principles of science to solve problems related to respective discipline.

PO-3: Modern tool usage: Use a modern scientific, engineering and IT tool or technique for solving problems in the areas of their discipline.

PO-4: Ethics: Apply the professional ethics and norms in respective discipline.

PO-5: Individual and teamwork: Work effectively as an individual as a team member in a multidisciplinary team.

PO-6: Communication: Communicate effectively with the stake holders, and give and receive clear instructions.

Course Articulation Matrix:

Mapping of Course Outcomes (COs) with Program Outcomes (POs)

Course Outcomes (COs) *(UGC guidelines)*	1	2	3	4	5	6
CO-1: Able to understand the linear momentum and energy.	x	x				x
CO-2: Will know how g can be determined experimentally and derive satisfaction.	x					
CO-3: Will see the difference between simple and torsional pendulum and their use in the determination of various physical parameters.	x			x	x	x
CO-4: Will come to know how various elastic moduli can be determined.	x				x	x
CO-5: Will measure surface tension and viscosity and appreciate the methods adopted.	x	x				
CO-6: Will get hands on experience of different equipment.	x	x	x		x	x

Course Articulation Matrix relates course outcomes of course with the corresponding program outcomes whose attainment is attempted in this course are Marked 'X' in the intersection cell if a course outcome addresses a particular program outcome.

Registrar
Davangere University
Shivagangotri, Davangere.

COURSE-WISE SYLLABUS

Semester-I

Course Title: Mechanics and Properties of Matter		
Course Code: 21BSC1C1PHY1L	**Contact Hours: 52**	**Credits:04**
Formative Assessment Marks: 40	Summative Assessment Marks: 60	Duration of ESA/Exam: 3 Hours

Unit – 1		
Chapter No. 1	**Momentum and Energy**: Definitions of Work and energy, State and prove conservation of linear momentum. Conservation of energy – proof in the case of loaded spiral spring. Motion of rockets - expression for instantaneous and final velocities of single stage rocket. Problems.	13
Chapter No. 2	**Collisions:** Elastic and inelastic collisions - examples. Elastic head-on collision - expression for final velocities of colliding bodies, Oblique collision of identical masses in a plane (derivation). Problems.	
Chapter No. 3	**Special Theory of Relativity:** Mention Galilean transformation equations and limitations. Mention Lorentz transformation equations. Postulates of Special Theory of Relativity. Expression for Length contraction, time dilation and relativistic addition of velocities. Problems.	
Topics for self-study(If any)	Loss of energy in inelastic collisions. Angular momentum, inertial and non-inertial frames of references.	
	Suggested Activities	
Activity No. 1	Students can try and understand the conservation of energy in every day examples. For example: i) What happens in solar conservation panels ii) Pushing an object on the table it moves iii) Moving car hits a parked car causes parked car to move. In these cases, energy is conserved. How? Understand and verify.	
Unit – 2		
Chapter No. 4.	**Laws of Motion:** Newton's Laws of motion. Dynamics of single and a system of particles - Centre of mass, expression for coordinates of position, velocity & acceleration of centre of mass.	13
Chapter No. 5.	**Dynamics of Rigid bodies**: Rotational motion about an axis, moment of inertia, Relation between torque and angular momentum, Rotational energy. Expression for moment of inertia – M I of a circular disc and solid cylinders. Theory of Flywheel and compound pendulum. Problems.	

Chapter No. 6.	**Gravitation:** Law of Gravitation. Kepler's laws (statements). Principle of launching of satellites, expressions for orbital velocity, period and altitude of satellites. Escape velocity (derivation), Geo stationary satellites (brief) and Remote Sensing Satellites (brief). Problems.	
Topics for self study(If any)	Geosynchronous orbits. Basic idea of global positioning system (GPS).	
	Suggested Activities	
Activity No. 2	Activity: 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	
Activity No. 3	Activity: Prepare suitable charts and give seminar talks in the class.	

Unit - 3		
Chapter No. 7	**Elasticity:** Hooke's law - Stress-strain diagram, elastic moduli-relation between elastic constants (q, n & k), 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. Bending of beams, single cantilever and uniform bending. Theory of Torsional pendulum. Problems.	13
	Suggested Activities	
Activity No. 4	Arrange a steel spring with its top fixed with a rigid support on a wall and a meter scale alongside. Add 100 g load at a time on the bottom of the hanger in steps, 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.	
Activity No.5	Repeat the above experiment with rubber and other materials and find out what happens after exceeding elastic limit. Plot and interpret.	

Unit - 4		
Chapter No. 8	**Surface tension:** Definition of surface tension. Surface energy, relation between surface tension and surface energy. Expression for pressure difference across curved surface, excess pressure inside spherical liquid drop. Angle of contact (Definition with examples). Problems.	13
Chapter No. 9	**Viscosity:** Streamline flow, turbulent flow, equation of continuity. Expression of coefficient of viscosity by Poisulle's method and Stoke's method (by dimension analysis). Problems.	
Topics for self-study(If any)	Capillarity determination of surface tension by drop weight method.	
	Suggested Activities	
Activity No.6	1. Measure surface tension of water and other common liquids and compare and learn i) Why water has high ST? think of reasons. ii) Check whether ST is a function of temperature? You can do it by heating the water to different temperatures and measure ST. iii) 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. List the reasons.	
Activity No. 7	Activity: 2. Collect a set of different liquids and measure their viscosity. i) Find out whether sticky or non-sticky liquids are most viscous. List the reasons. ii) 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. iii) Do the above experiment by mixing sticky liquid to the non sticky liquid. Find out change in viscosity with increase of concentration of sticky liquid. List the applications where concept of Viscosity plays a dominant role	

Text Books for References:

Sl. No.	Title of the Book	Authors Name	Publisher	Year of Publication
1	Mechanics New Edition	D. S. Mathur	S. Chand & Co.	2000
2	Mechancis and Relativity by 3rd Edition,	Vidwan Singh Soni,	PHI Learning Pvt. Ltd.	2014
3	Mechanics Berkeley Physics Course, Vol.1:	Charles Kittel, *et.al.*	Tata McGraw-Hill	2007
4	Properties of Matter	Brijlal & Subramanyam.	John Wiley & Sons, Inc.	2003
5	Fundamentals of Physics, Sixth Edition,	David Halliday, Robert Resnick, and Jearl	John Wiley & Sons, Inc.	**2000**

6	Properties of Matter	R Murugesan	S Chand and Co., New Delhi	**2004**
7	Classical Mechanics & Properties of Matter,	A B Gupta,	Book & Allied Publishers, Kolkata	**2018**
8	Concept of Physics (Vol. 1),	Verma H C,	Bharathi Bhavan Publishers, Kanpur.	**2021**

List of Experiments to be performed in the Laboratory:

1.	Determination of g using bar pendulum (L versus T and L versus LT^2 graphs).
2.	Determination of moment of inertia of a Fly Wheel.
3.	Determination of rigidity modulus using torsional pendulum.
4.	Modulus of rigidity of a rod – Static torsion method.
5.	Determination of elastic constants of a wire by Searle's method.
6.	Young's modulus by Koenig's method.
7.	Viscosity by Stoke's method.
8.	Verification of Hook's law.
9.	Determination of surface tension of a liquid and the interfacial tension between two liquids using drop weight method.
10.	Study of motion of a spring and to calculate Spring constant, g and unknown mass.
11.	Determination of Young's modulus of a bar by the single cantilever method.
12.	Determination of Young's modulus of a bar by uniform bending method.
13.	Radius of capillary tube by mercury pellet method.
14	Verification of parallel and perpendicular axis theorems.

(Minimum EIGHT experiments have to be carried out)

Reference Book for Laboratory Experiments

Sl. No.	Title of the Book	Authors Name	Publisher	Year of Publication
1	Physics through experiments	B.Saraf	Vikas Publications	2013
2	A lab manual of Physics for undergraduate classes, 1st Edition,		Vikas Publications.	
3	BSc Practical Physics Revised Ed	CL Arora	S.Chand & Co.	2007
4	An advanced course in practical physics.	D. Chatopadhyay, PC Rakshit, B.Saha	New Central Book Agency Pvt Ltd.	2002

Formative Assessment	
Assessment Occasion	**Marks**
Any two Activity	15
Internal Test (After 8 &12 weeks)	10+10=20
Attendance	05
Total	40

OPEN ELECTIVE

ENERGY SOURCES

Course Title: ENERGY SOURCES		Time: 3 hrs./week
Course Code: 21BSC1O1PHY1	**Contact Hours: 42**	**Credits:03**
Formative Assessment Marks: 40	Summative Assessment Marks: 60	Duration of ESA/Exam: 3 Hours

	Unit-I Non-Renewable energy sources	
Chapter-1:	**Introduction:** Energy concept-sources in general, its significance & necessity. Classification of energy sources: Primary and Secondary energy, Commercial and Non-commercial energy, Renewable and Non-renewable energy, Conventional and Non-conventional energy, Based on Origin-Examples and limitations.	**14**
Chapter-2	**Conventional energy sources:** Fossil fuels & Nuclear energy- production & extraction, usage rate and limitations. Impact on environment and their issues& challenges. Overview of Indian & world energy scenario with latest statistics-consumption & necessity. Need of eco-friendly & green energy.	
	Unit-II Renewable energy sources	
Chapter-3	**Introduction:** Need of renewable energy, non-conventional energy sources. An overview of developments in Offshore Wind Energy, Tidal Energy, Wave energy systems, Ocean Thermal Energy Conversion, solar energy, biomass, biochemical conversion, biogas generation, geothermal energy tidal energy, Hydroelectricity.	**14**
Chapter-4	**Solar energy:** Solar Energy-Key features, its importance, Merits & demerits of solar energy, Applications of solar energy. Solar water heater, flat plate collector, solar distillation, solar cooker, solar green houses, solar cell -brief discussion of each. Need and characteristics of photovoltaic (PV) systems. PV models and equivalent circuits and sun tracking systems.	
	Unit-III Wind and Tidal Energy harvesting:	
Chapter-5	Fundamentals of Wind energy, Wind Turbines and different electrical machines in wind turbines, Power electronic interfaces, and grid interconnection topologies. Ocean Energy Potential against Wind and Solar, Wave Characteristics and Statistics, Wave Energy Devices. Tide characteristics and Statistics, Tide Energy Technologies, Ocean Thermal Energy.	**14**
Chapter-6	**Geothermal and hydro energy:** Geothermal Resources, Geothermal Technologies. Hydropower resources, hydropower technologies, environmental impact of hydro power sources. Carbon captured technologies, cell, batteries and power consumption.	
	Activity for tutorial classes 01 lectures/week 1. Demonstration of on Solar energy, wind energy, etc, using training modules at Labs.	

	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.	
	Reference Books: 1. Non-conventional energy sources - G.D Rai - Khanna Publishers, New Delhi 2. Solar energy - M P Agarwal - S Chand and Co. Ltd. 3. Solar energy - Suhas P Sukhative Tata McGraw - Hill Publishing Company Ltd. 4. Godfrey Boyle, "Renewable Energy, Power for a sustainable future", 2004, Oxford University Press, in association with The Open University. 5. Dr. P Jayakumar, Solar Energy: Resource Assessment Handbook, 2009 6. J.Balfour, M.Shaw and S. Jarosek, Photovoltaics, Lawrence J Goodrich (USA). 7. http://en.wikipedia.org/wiki/Renewable_energy	

Semester – II
Electricity and Magnetism

Course Title: Electricity and Magnetism	Course Credits: 4
Total Contact Hours: 52	Duration of ESA: 3 hours
Formative Assessment Marks: 40	Summative Assessment Marks: 60
Model Syllabus Authors:	Physics Expert Committee

Programme Outcomes

1. Discipline Knowledge: Knowledge of science and ability to apply to relevant areas.
2. Problem solving: Execute a solution process using first principles of science to solve problems related to respective discipline.
3. Modern tool usage: Use a modern scientific, engineering and IT tool or technique for solving problems in the areas of their discipline.
4. Ethics: Apply the professional ethics and norms in respective discipline.
5. Individual and teamwork: Work effectively as an individual as a team member in a multidisciplinary team.
6. Communication: Communicate effectively with the stake holders, and give and receive clear instructions.

Course Articulation Matrix: Mapping of Course Outcomes (COs) with Program Outcomes (POs)

	Program Outcomes (POs)					
Course Outcomes (COs)	**1**	**2**	**3**	**4**	**5**	**6**
i. Demonstrate Gauss law, Coulomb's law for the electric field, and apply it to systems of point charges as well as line, surface, and volume distributions of charges.	x	x				
ii. Explain and differentiate the vector (electric fields, Coulomb's law) and scalar (electric potential, electric potential energy) formalisms of electrostatics.	x					
iii. Apply Gauss's law of electrostatics to solve a variety of problems.	x	x			x	
iv. Describe the magnetic field produced by magnetic dipoles and electric currents.	x					
v. Explain Faraday-Lenz and Maxwell laws to articulate the relationship between electric and magnetic fields.	x					
vi. Describe how magnetism is produced and list examples where its effects are observed.	x				x	x
vii. Apply Kirchhoff's rules to analyze AC circuits consisting of parallel and/or series combinations of voltage sources and resistors and to describe the graphical relationship of resistance, capacitor and inductor.	x	x			x	x

Course Articulation Matrix relates course outcomes of course with the corresponding program outcomes whose attainment is attempted in this course. Mark 'X' in the intersection cell if a course outcome addresses a particular program outcome.

Semester-II

Course Title: Electricity & Magnetism		
Course Code: 21BSC2C2PHY2L	**Contact Hours: 52**	**Credits:04**
Formative Assessment Marks: 40	Summative Assessment Marks: 60	Duration of ESA/Exam: 3 Hours

Unit – 1		
Chapter No. 1	Electric charge and field: Coulomb's law, electric field strength, electric field lines, point charge in an electric field and electric dipole, work done by a charge (derivation of the expression for potential energy). Problems.	13
Chapter No. 2	Gauss's law and its applications - electric fields of a (i) spherical charge distribution, (ii) line charge and (iii) an infinite flat sheet of charge. Problems.	
Chapter No. 3	Electric potential, line integral, gradient of a scalar function, relation between field and potential. Expression for Potential due to point charge, Potential due to infinitely charged long wire and Potential due to uniformly charged circular disc. Constant potential surfaces. Potential due to a dipole and electric quadrupole. Problems.	
Topics for self-study (If any)	Constant potential surfaces -	
	Suggested Activities	
Activity No. 1	i) Learn the difference between and DC and AC electricity and their characteristics. Voltage and line frequency standards in different countries. ii) A small project report on production of electricity as a source of energy: Different methods.	
Activity No. 2	• Learn to use a multimeter (analog and digital) to measure voltage, current and resistance. Continuity testing of a wire. • Learn about household electrical connection terminals: Live, neutral and ground and voltage between the terminals. Role of earthing and safety measures	

Unit – 2		
Chapter No. 4.	Conductors in electrostatic field: Conductors and insulators, capacitors and capacitance. Expression for capacitance in a parallel plate capacitor, parallel plate capacitor with and without dielectric. Expression for energy stored in a capacitor. Guass's law-Statement and proof. Problems.	13
Chapter No. 5.	Electric currents and current density: Physics of electrical conduction. Conduction in metals on the basis of free electron theory (Drude -Lorentz theory). Expression for electrical conductivity and Ohm's law. Conduction in semiconductors. Circuits and circuit elements: Response of capacitor alone, resistor alone and inductor alone circuits to sinusoidal voltages using j-operators. Problems.	
Topics for self-study(If any)	Currents and voltage in combination of R, L and C circuits.	
	Suggested Activities	
Activity No. 3	• Learn about electrical appliances which work with AC and DC electricity. • Learn about types of resistors and their colour codes and types of capacitors(electrolytic and non-electrolytic).	
Activity No. 4	• Learn about power transmission: 3-phase electricity, voltage and phase • Visit a nearby electrical power station. Interact with line men, Electrical engineers and managers. Discuss about power loss in transmission. How to reduce it? • Prepare a small project report on street lighting and types of electrical bulbs.	
Unit – 3		
Chapter No.6	Magnetism: Definitions of magnetic force, magnetic field and magnetic flux. Statement and proof of Ampere's circuital law. Biot-Savart's law statement and explanation. Expression for magnetic force on a current carrying conductor. Electromagnetic induction: Conducting rod moving in a magnetic field (motional EMF), Faradays laws of electromagnetic induction.Concept of self-inductance and mutual inductance. Expression for energy stored in a inductors. Problems.	13
Chapter No. 7	Alternating current circuits: Definitions of alternating current, admittance and impedance. Response of RL, RC and LC circuits to sinusoidal voltages using j-operators. Series LCR resonant circuit - Expression for current and impedance using j-operators. Electrical Resonance (Expression for resonant frequency) and quality factor (definition). Electrical power in series LCR circuits. Problems.	
Topics for self-study(If any)	Hall Effect.	
	Suggested Activities	

Activity No. 5	• Prepare a small project report on street lighting and types of electrical bulbs. • Learn the measurement of electric current using tangent galvanometer.	
Activity No.6	• Build a small coil with insulated copper wire. Connect an ammeter micro/milli ammeter. Verify magnetic induction using a powerful bar magnet.	
Unit - 4		
Chapter No. 8	Electromagnetic Waves: Equation of continuity, Displacement current, Mention of Maxwell's equations, Expression for electromagnetic waves in free space and electromagnetic waves in dielectric medium. Statement of Poynting theorem and Poynting vector. Current loop as magnetic dipole (brief). Electric current in atoms - electron spin and magnetic moment (brief). Definitions of magnetization and magnetic susceptibility.	13
Chapter No. 9	Types of magnetic materials: Explanation of diamagnetic, paramagnetic and ferromagnetic materials on the basis of electron theory. Explanation of B-H hysteresis curves.	
Topics for self-study(If any)	B-H curves and its characteristics. Ferrites.	
	Suggested Activities	
Activity No.7	• Prepare a small project report on production of magnetic field: Permanent magnets, electromagnets and superconducting magnets. • Learn the principle of working of a Gauss meter to measure magnetic field	
Activity No. 8	• Model the earth's magnetic field with a diagram. Explain the effect of tilt of the earth's axis and reasons for the change in the tilt of the earth's axis over thousands of years.	

Text Books for References:

Sl No	Title of the Book	Authors Name	Publisher	Year of Publication
1	Physics-Part-II,	David Halliday and Robert Resnick	Wiley Eastern Limited	2001
2	Berkeley Physics Course, Vol-2, Electricity and Magnetism, Special Edition	Edward M Purcell	Tata Mc Graw-Hill Publishing Company Ltd, New Delhi	20 08
3	Electricity & Magnetism, S.	K K Tewari,	Chand & Co., New Delhi.	2007
4	Electricity & Magnetism,	Mahajan & Rangawala,	Tata McGraw Hill, New Delhi	2015
5	Electricity & Magnetism, S.	R Murugesan,	Chand & Co., New Delhi.	2011
6	Electricity & Magnetism,	D C Tayal,	Himalaya Publishers, Mumbai	2016
7	Electricity & Magnetism,,	D Chattopadhyay & PC Rakshit,	New Central Book Agency (P)	2018

List of Experiments to be performed in the Laboratory

1.	Experiments on tracing of electric and magnetic flux lines for standard configuration.
2.	Determination of components of earth's magnetic field using a Ballistic galvanometer.
3.	Determination of capacitance of a condenser using B.G.
4.	Determination of high resistance by leakage using B.G.
5.	Magnetic field along the axis of a circular coil – Determination of B_H.
6.	Charging and discharging of a capacitor (energy dissipated during charging and time constant measurements.
7.	Series and parallel resonance circuits (LCR circuits).
8.	Impedance of series RC circuits- determination of frequency of AC.
9.	Study the characteristics of a series RC and RL Circuit.
10.	Determination of self-inductance of a coil.
11.	Verification of laws of combination of capacitances and determination of unknown capacitance using de - Sauty bridge.
12.	Determination of B_H using Helmholtz double coil galvanometer

(Minimum EIGHT experiments have to be carried out)

Formative Assessment	
Assessment Occasion	**Marks**
Any two Activity	15
Internal Test (After 8 &12 weeks)	10+10=20
Attendance	05
Total	40

OPEN ELECTIVE

Climate Science

Course Title: Climate Science		**Time: 3 hrs./week**
Course Code: 21BSC2O2PHY1	**Contact Hours: 42**	**Credits:03**
Formative Assessment Marks: 40	Summative Assessment Marks: 60	Duration of ESA/Exam: 3 Hours

	Unit-I	
Chapter-1	**Atmosphere:** Atmospheric Science (Meteorology) as a multidisciplinary science. Physical and 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), sources and sinks of gases in the atmosphere. Green house 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	**14**
	Unit-II	
Chapter-2	**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 growth and 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	**14**
	Unit-III	
Chapter-3	**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.	**14**
	Activities to be carried out on Climate Science: 1. Try to find answer to the following questions:	

Registrar
Davangere University
Shivagangotri, Davangere.

	(a) Imagine you are going in a aircraft at an altitude greaten than 100 km. The air temperature at that altitude will be greater than 200°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 the stratosphere. 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 (produced by amateur film makers and promoted by British Council and BBC).	
	Reference Books: 1. Basics of Atmospheric Science – A Chndrashekar, PHI Learning Private Ltd. New Delhi, 2010. 2 Fundamentals of Atmospheric Modelling- Mark Z Jacbson, Cambridge University Press, 2000.	

Registrar
Davangere University
Shivagangotri, Davangere.

Scheme of Evaluation

Scheme of Evaluation for Theory Internal Assessment

Sl. No.	Particulars	Marks Allotted
1.	First Internal test (After 8 week)	10
2.	Second Internal test (After 12 week)	10
3.	Any two activity	15
4.	Attendance	05
	Total	**40**

Scheme of Evaluation for Practical Internal Assessment

Sl. No.	Particulars	Marks Allotted
1.	Internal test	15
2.	Attendance	05
3.	Journal	05
	Total	**25**

Scheme of Evaluation for Practical Examination

Sl. No.	Particulars	Marks Allotted
1.	Basic formula with description, nature of graph if any & indication of unit	04
2.	Tracing of schematic ray diagram/Circuit diagram with description	02
3.	Tabular column	02
4.	Experimental skill & connection	05
5.	Record of observation	04
6.	Calculation including drawing graph	04
7.	Accuracy of result with unit	02
8.	Oral performance	02
	Total	**25**

Registrar
Davangere University
Shivagangotri, Davangere.

B. Sc. QUESTION PAPER PATTERN

B.Sc. _____ Semester Degree Examination; December, 2021

(CBCS Scheme; New Syllabus: 2020-21)

SUBJECT: _____ Paper: _____ Paper Code: _____

Time: 3 Hours **Max. Marks: 60**

PART-A

1. Answer any **FIVE** questions. **5×2=10M**

Note: Two questions from each unit.

1.
2.
3.
4.
5.
6.
7.
8.

PART-B

2. Answer any **FIVE** of the following questions. **5×4=20 M**

1.
2.
3.
4.
5.
6.
7.
8.

Note: Two questions from each unit.

PART-C

3. Answer any **Three** of the following questions. **3×10=30 M**

1. **(5+5) M**
2. **(5+5) M**
3. **(5+5) M**
4. **(5+5) M**
5. **(5+5) M**

Note: Maximum one questions from each unit.

Registrar
Davangere University
Shivagangotri, Davangere.