RANI CHANNAMMA UNIVERSITY, BELAGAVI

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
for

Bachelor of Science (Physics)

w.e.f.

Academic Year 2021-22 and onwards

PREAMBLE

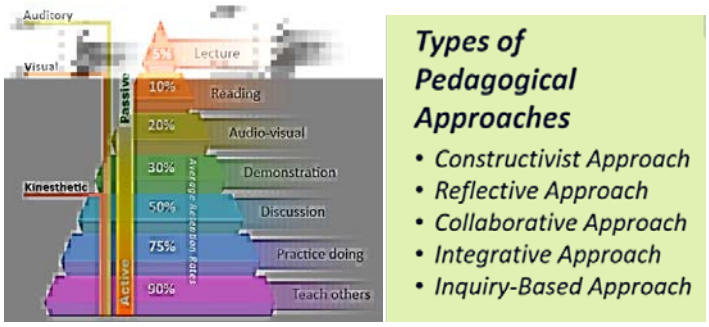
The New Education Policy (2020) is a paradigm shift from the conventional system we practice even today. Giving students the entire freedom to choose what to learn, how to learn, where to learn and when to learn, will enable a personalized education that suits his/her own personality. The drive to change 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- disciplinary 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:



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.

PROGRAM 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.

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.

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**	**P**		
L1	21BSC1L1LK1	Kannada	40	60	100	4	-	3	2
	21BSC1L1LFK1	Functional Kannada							
L2	21BSC1L2LEN2	English	40	60	100	4	-	3	2
	21BSC1L2LHI2	Hindi							
	21BSC1L2LSN2	Sanskrit							
	21BSC1L2LTE2	Telugu							
	21BSC1L2LUR2	Urdu							
DSC1	21BSC1C1PHY1L	Mechanics & Properties of Matter	40	60	100	4	-	4	2
	21BSC1C1PHY1P	Practical I	25	25	50	-	4	2	4
DSC1	Another Department Code	Another Department Course Title	40	60	100	4	-	4	2
			25	25	50	-	4	2	4
SEC1	21BSC1SEC1DF1	Digital Fluency	25	25	50	1	2	2	2
VBC1	21BSC1V1PE1	Yoga/Sports	25	--	25	-	2	1	--
VBC2	21BSC1V2HW1	H&W/NCC/NSS/R&R/CA	25	--	25	-	2	1	--
OEC1	21BSC1O1PHY1	Energy Sources	40	60	100	3	-	3	2
Total Marks					**700**	**Semester Credits**		**25**	

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	2
	21BSC2L3FKL2	Functional Kannada								
L4	21BSC2L4EN2	English	40	60	100	4	-	-	3	2
	21BSC2L4HI2	Hindi								
	21BSC2L4SN2	Sanskrit								
	21BSC2L4TE2	Telugu								
	21BSC2L4UR2	Urdu								
DSC2	21BSC2C2PHY1L	Electricity & Magnetism	40	60	100	4	-	-	4	2
	21BSC2C2PHY1P	Practical II	25	25	50	-	-	4	2	4
DSC2	Another Department Code	Another Department Course Title	40	60	100	4	-	-	4	2
			25	25	50	-	-	4	2	4
AECC1	21BSC2AE1ES1	Environmental Studies	25	25	50	1	-	2	2	2
VBC3	21BSC2V3PE2	Yoga/ Sports	25	--	25	-	-	2	1	--
VBC4	21BSC2V4NC2	H&W/NCC/NSS/ R&R/CA	25	--	25	-	-	2	1	--
OEC2	21BSC2O2PHY2	Optical Instruments	40	60	100	3	-	-	3	2
Total Marks					**700**	**Semester Credits**			**25**	

SECOND YEAR; SEMESTER-III										
Category	**Course code**	**Title of the Paper**	**Marks**			**Teaching hours/week**			**Credit**	**Duration of exams (Hrs)**
			IA	**SEE**	**Total**	**L**	**T**	**P**		
L5	21BSC3L5LK3	Kannada	40	60	100	4	-	-	3	2
	21BSC3L5LFK3	Functional Kannada								
L6	21BSC3L6EN3	English	40	60	100	4	-	-	3	2
	21BSC3L6HI3	Hindi								
	21BSC3L6SN3	Sanskrit								
	21BSC3L6TE3	Telugu								
	21BSC3L6UR3	Urdu								
DSC3	21BSC3C3PHY1L	Wave motion and Optics	40	60	100	4	-	-	4	2
	21BSC3C3PHY1P	Practical III	25	25	50	-	-	4	2	4
DSC3	Another Department Code	Another Department Course Title	40	60	100	4	-	-	4	2
			25	25	50	-	-	4	2	4
SEC2	21BSC3SEC2AI1	Artificial Intelligence	25	25	50	1	-	2	2	2
VBC5	21BSC3V5PE3	Yoga/ Sports	25	--	25	-	-	2	1	--
VBC6	21BSC3V6NC3	H&W/NCC/NSS/R & R/CA	25	--	25	-	-	2	1	--
OEC3	21BSC3O3PHY3	Physics for All	40	60	100	3	-	-	3	2
Total Marks					**700**	**Semester Credits**			**25**	

SEMESTER-IV										
Category	**Course code**	**Title of the Paper**	**Marks**			**Teaching hours/week**			**Credit**	**Duration of exams (Hrs)**
			IA	**SEE**	**Total**	**L**	**T**	**P**		
L7	21BSC4L7LK4	Kannada	40	60	100	4	-	-	3	2
	21BSC4L7LFK4	Functional Kannada								
L8	21BSC4L8EN4	English	40	60	100	4	-	-	3	2
	21BSC4L8HI4	Hindi								
	21BSC4L8SN4	Sanskrit								
	21BSC4L8TE4	Telugu								
	21BSC4L8UR4	Urdu								
DSC4	21BSC4C2PHY4L	Thermal Physics And Electronics	40	60	100	4	-	-	4	2
	21BSC4C2PHY4P	Practical IV	25	25	50	-	-	4	2	4
DSC4	Another Department Code	Another Department Course Title	40	60	100	4	-	-	4	2
			25	25	50	-	-	4	2	4
AECC2	21BSC4AE1CoI1	Constitution of India	25	25	50	1	-	2	2	2
VBC7	21BSC4V5PE4	Yoga/ Sports	25	--	25	-	-	2	1	--
VBC8	21BSC4V6NC4	H&W,/NCC/NSS/R&R/CA	25	--	25	-	-	2	1	--
OEC4	21BSC4O4PHY4	Astronomy and Space Mission	40	60	100	3	-	-	3	2
Total Marks					**700**	**Semester Credits**			**25**	

SEMESTER-V										
Category	**Course code**	**Title of the Paper**	**Marks**			**Teaching hours/week**			**Credit**	**Duration of exams (Hrs)**
			IA	**SEE**	**Total**	**L**	**T**	**P**		
Physics as Major Discipline										
DSC5	21BSC5C5PHYMJ1L	Classical Mechanics and Quantum Mechanics-	40	60	100	3	-	-	3	2
	21BSC5C5PHYMJ1P	Practical V	25	25	50	-	-	4	2	4
DSC6	21BSC5C5PHYMJ2L	Elements of Atomic, Molecular Physics	40	60	100	3	-	-	3	2
	21BSC5C5PHYMJ2P	Practical VI	25	25	50	-	-	4	2	4
DSC5	Another Department Code as a Minor Subject	Another Department Course Title	40	60	100	3	-	-	3	2
			25	25	50	-	-	4	2	4
VC1	21BSC5VC1PHY1	Vocational 1	40	60	100	3	-	-	3	2
VBC9	21BSC5V5PE5	Yoga/ Sports	25	--	25	-	-	2	1	--
VBC10	21BSC5V6NC5	NCC/NSS/ R&R(S&G) / Cultural	25	--	25	-	-	2	1	--
SEC3	21BSC5SEC3	Cyber Security	25	25	50	1	-	2	2	2
Total Marks					**650**	**Semester Credits**			**22**	

SEMESTER-VI										
Category	**Course code**	**Title of the Paper**	**Marks**			**Teaching hours/week**			**Credit**	**Duration of exams (Hrs)**
			IA	**SEE**	**Total**	**L**	**T**	**P**		
Physics as Major Discipline										
DSC7	21BSC6C6PHYMJ1L	Elements of Nuclear Physics and Nuclear Instruments	40	60	100	3	-	-	3	2
	21BSC6C6PHYMJ1P	Practical VII	25	25	50	-	-	4	2	4
DSC8	21BSC6C6PHYMJ2L	Elements of Condensed Matter Physics	40	60	100	3	-	-	3	2
	21BSC6C6PHYMJ2P	Practical VIII	25	25	50	-	-	4	2	4
DSC6	Another Department Code as a Minor Subject	Another Department Course Title	40	60	100	3	-	-	3	2
			25	25	50	-	-	4	2	4
VC2	21BSC6VC2PHYVC2	Vocational 2	40	60	100	3	-	-	3	2
VBC1	21BSC6V5PE6	Yoga/ Sports	25	--	25	-	-	2	1	--
VBC2	21BSC6V6NC6	NCC/NSS/R&R(S&G) / Cultural	25	--	25	-	-	2	1	--
SEC4	21BSC6SEC4PC1	Professional Communication	25	25	50	1	-	2	2	2
INT	21BSC6IN1PHYIN	Internship between 5th and 6th semester	25	25	50	3 to 4 weeks			2	Report & Presentation
Total Marks					**700**	**Semester Credits**			**24**	
Total Marks for BSC Program					**4150**	**Total Credits for BSc Program**			**146**	

Physics Subject as a Minor Discipline

SEMESTER-V										
Category	**Course code**	**Title of the Paper**	**Marks**			**Teaching hours/week**			**Credit**	**Duration of exams (Hrs)**
			IA	**SEE**	**Total**	**L**	**T**	**P**		
DSC5 As a Minor Subject	21BSC5C5PHYMN1L	Modern Physics – I	40	60	100	3	-	-	3	2
	21BSC5C5PHYMN1P	Modern Physics - I lab	25	25	50	-	-	4	2	4

SEMESTER-VI										
Category	**Course code**	**Title of the Paper**	**Marks**			**Teaching hours/week**			**Credit**	**Duration of exams (Hrs)**
			IA	**SEE**	**Total**	**L**	**T**	**P**		
DSC6 As a Minor Subject	21BSC6C6PHYSMN1L	Modern Physics - II	40	60	100	3	-	-	3	2
	21BSC6C6PHYMN1P	Modern Physics - II lab	25	25	50	-	-	4	2	4

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 Applied Science of the University
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

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: 30	Summative Assessment Marks: 70

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: Will learn fixing units, tabulation of observations, analysis of data (graphical/analytical)	**X**	**x**				X
CO-2: Will learn about accuracy of measurement and sources of errors, importance of significant figures.	**X**	**x**				
CO-3: Will know how g can be determined experimentally and derive satisfaction.	**X**					
CO-4: Will see the difference between simple and torsional pendulum and their use in the determination of various physical parameters.	**X**			**x**	**x**	**X**
CO-5: Will come to know how various elastic moduli can be determined.	**X**				x	**X**
CO-6: Will measure surface tension and viscosity and appreciate the methods adopted.	**X**	**x**				
CO-7: 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.

COURSE-WISE SYLLABUS

Semester I

Mechanics and Properties of Matter

Year	I	**Course Code: 21BSC1C1PHY1L**	**Credits**	**04**
Sem.	1	**Course Title: Mechanics and Properties of Matter**	**Hours**	52
Course Pre-requisites, if any		NA		
Formative Assessment Marks: 40		Summative Assessment Marks: 60	Duration of ESA: 2 hrs.	

Unit No.	**Course Content**	**Hours**
Unit I	**Conservation Laws:** Law of conservation of linear momentum. Centre of mass and expression for position vector, velocity, acceleration and force of centre of mass. Distinction between laboratory frame of reference and centre of mass frame of reference. Concept of elastic collision and inelastic collisions. Derivation of final velocities in case of elastic collision in (i) laboratory frame of reference (ii) centre of mass frame of reference. Derivation of final velocities in case of inelastic collision in (i) laboratory frame of reference (ii) centre of mass frame of reference. Conservation of linear momentum in case of variable mash. Principle of rocket and derivation for equation of motion for single stage rocket. Necessity of multi stage rocket. Basics of angular momentum and torque, relation between angular momentum and torque. Law of conservation of angular momentum with examples. Concept of work and power. Law of conservation of energy with examples. Work energy theorem. Simple harmonic oscillations of light spiral spring. Problems	13
Activity/ Self Study	1 Students can try and find every day examples of conservation of energy. For example: i) What happens in solar 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 if possible.	
Unit II	**Gravitation:** Newton's law of Gravitation (statement). Expressions for escape velocity and orbital velocity. Kepler's laws of planetary motion. Derivation for Kepler's 2nd and 3rd law. Concept of Satellite, derivation for binding energy of satellite. Artificial Satellite: Geostationary satellite and polar orbit satellite with different types of orbits (qualitative). Concept of weightlessness. Basic ideas of G.P.S. and NAVIC. Problems **Rigid Body Dynamics**: Moment of Inertia. Radius of Gyration. Statements of theorem of parallel axis and theorem of perpendicular axis. Derivation of expressions for moment of inertia for (i) rectangular lamina (ii) thin uniform rod and (iii) circular disc. Theory of compound pendulum and bar pendulum. Theory of flywheel and its applications. Problems	13
Activity/ Self Study	1. Moment of inertia is an abstract concept. It simply gives a measure of rotational inertia of a rigid body. 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.	

	2. Performing experiments on gravity and Kepler's laws are somewhat difficult. However, students can prepare suitable charts, understand and give seminar talks in the class. Websites can help in this regard.	
Unit III	**Elasticity:**Definition of Stress-strain, Hooke's law. Types of elastic constants. modulus of elasticity and derivation of expression for relation between elastic constants, Poisson's ratio, expression for Poisson's ratio in terms of elastic constants. Work done in stretching and twisting wire. Theory of torsional pendulum, determination of rigidity modulus and time period. Bending moments. Theory of cantilever. Determination of Youngs modulus by bending of beam supported at its ends and loaded at middle. Problems	13
Activity/ Self Study	1.Verification of Hook's law 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. 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.	
Unit IV	**Surface tension :** Definition of surface tension, Angle of contact, Surface energy, relation between surface tension and surface energy, pressure difference across curved surface. Excess of pressure inside spherical liquid drop, Capillary rise, derivation of expression for rise of liquid in a capillary tube. Determination of surface tension by Quinke's method. Effect of temperature, impurity on surface tension. Problems **Viscosity :** Streamline flow, turbulent flow, equation of continuity, determination of coefficient of Viscosity by Poisulle's method, Stoke's law with derivation and expression for terminal velocity. Effect of temperature on viscosity. Problems	13
Activity/ Self study	1. Measure surface tension of water and other common liquids and compare and learn i) Why water has high ST? Give 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. iv) 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. Give reasons. 2**.** Collect a set of different liquids and measure their viscosity. i) Find out whether sticky or non-sticky liquids are most viscous. Think of reasons. ii) Mix non-sticky liquid to the sticky liquid in defined quantities and measure viscosity. Find out whether 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. iv) Think why one should know viscosity of the liquid.	

Recommended Leaning Resources	
Text Books	**Textbooks** 1. Mechanics by D.S.Mathur, New Edition 2000, S. Chand& Co. 2. Classical Mechanics by J. C.Upadhya,2019, Himalaya Publishers. 3. Mechanics and Relativity by Vidwan Singh Soni,3rd Edition, PHIL earning Pvt.Ltd. 4. Mechanics Berkeley PhysicsCourse,Vol.1: Charles Kittel, *et.al*.2007,Tata McGraw-Hill. 5. Engineering Mechanics, Basudeb Bhattacharya, 2ndEdn, 2015, Oxford University Press. 6. Elements of properties of matter by D.S.Mathur, 2010, S. Chand & Co. 7. Properties of Matter by Brijlal & Subramanyam.
Reference Books	1. Physics:Resnick,Halliday&Walter,9thEdn,2010,Wiley. 2. Physics by Halliday and Resnick,Vol1. 3. University Physics,Ronald Lane Reese,2003,Thamson Brooks/Cole.

Laboratory Experiments:

NOTE: Minimum of Eight experiments has to be performed

Year	I	**Course Code: 21BSC1C1PHY1P**	**Credits**	2
Sem.	1	**Course Title: Practical- I**	**Hours**	4 hrs/week

Formative Assessment Marks: 25	Summative Assessment Marks: 25	Duration of ESA: 4 hrs.

Sl. No	**Experiment**
1	Determination of g using bar pendulum (L versus T and L versus LT^2graphs)
2	Determination of moment of inertia of a Fly Wheel
3	Determination of moment of inertia of an irregular body
4	Determination of rigidity modulus using torsional pendulum
5	Verification of parallel axis theorem
6	Verification of perpendicular axis theorem
7	Determination of Young's Modulus of a bar by bending method
8	Verification of Hook's Law by Searle's method.
9	Young's modulus by cantilever–Load versus Depression graph
10	Young's modulus by Koenig's method
11	Young's modulus by stretching (Searle's apparatus).
12	Modulus of rigidity (twisting)
13	Viscosity by Stoke's method
14	Radius of capillary tube by mercury pellet method
15	Surface tension by drop weight method
16	Critical pressure for streamline flow

Recommended Leaning Resources

Text Books	1.Practical Physics-M.A. Hipparagi
Reference Books	1. Physics through experiments,by B. Saraf,2013,Vikas Publications. 2. A labmanual of Physics for undergraduate classes, 1st Edition, Vikas Publications. 3. BSc Practical Physics by CL Arora, Revised Edition 2007, S. Chand & Co. 4.Anadvanced course in practical physics, D. Chattopadhyay, PC Rakshit, B.Saha, Revised Edition 2002, New Central Book Agency Pvt Ltd.

OPEN-ELECTIVE SYLLABUS:

Year	I	**Course Code: 21BSC1O1PHY1**	**Credits**	03
Sem.	1	**Course Title: Energy Sources**	**Hours**	40
Formative Assessment Marks: 40		Summative Assessment Marks: 60	Duration of ESA: 02 hrs.	

Unit No.	**Course Content**	**Hours**
Unit I	**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. Importance of Non-commercial energy resources.	**05**
	Renewable energy sources: 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.	**05**
Unit II	**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 & their related technology.	**10**
Unit III	**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.	**10**
Unit IV	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.	**08**
	Geothermal and hydro energy: Geothermal Resources, Geothermal	**02**

	Technologies. Hydropower resources, hydropower technologies, environmental impact of hydro power sources.	
	Activity 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). http://en.wikipedia.org/wiki/Renewable_energy	

Semester – II

Electricity & Magnetism

Course Title: Electricity and Magnetism	Course Credits: 4
Total Contact Hours: 52	Duration of ESA: 2 hours
Formative Assessment Marks: 40	Summative Assessment Marks: 60

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)

Course Outcomes (COs)	Program Outcomes (POs) 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**
viii.	Apply various network theorems such as Superposition, Thevenin, Norton, Reciprocity,• Maximum Power Transfer, etc. and their applications in electronics, electrical circuit analysis, and electrical machines.	**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.

Year	I	**Course Code:21BSC2C2PHY2L**	**Credits**	4
Sem.	2	**Course Title : Electricity and Magnetism**	**Hours**	52

Course Pre-requisites, if any	NA	
Formative Assessment Marks: 40	Summative Assessment Marks: 60	Duration of ESA: 2 hrs.

Unit No.	**Course Content**	**Hours**
Unit I	**Vector Analysis:** Scalar and Vector Products. Gradient of scalar and its physical significance. Divergence of vector and its physical significance. Curl of vector and its physical significance. Vector integration; line, surface & volume integrals of a vector field. Gauss Divergence theorem & Stokes theorem (statement). Problems **Maxwell's Electromagnetic Theory:** Derivation of Maxwell's equations in differential form. Mention of Maxwell's equations in integral form and their physical significances. Derivation for general plane wave equation in free space. Transverse nature of radiation. Derivation of Poynting's theorem. Problems	13
Activity/Self Study	Solving problems on gradient, divergence & curl of a vector	
Unit II	**DC Circuit Analysis:** Voltage and current sources. Kirchhoff's current and voltage laws. Derivation of Thevenin's Theorem. Derivation of Norton's Theorem. Derivation of Superposition Theorem. Derivation of Maximum Power Transfer Theorem. Problems **Transient Circuits:** Theory of growth and decay of current in RL circuit. Theory of charging and discharging of capacitor in RC circuit. Time constants of RL and RC circuits. Measurement of high resistance by leakage method. Problems	13
Activity/Self Study	1.Solving problems on Thevenin's, Norton's, Superposition and Maximum Power Transfer Theorems. 2.Charging and discharging of a capacitor through high resistance. 3.Measurment of time constant of RL and RC circuit.	
Unit III	**Magneto statics:** Statement of Biot Savart's law. Derive an expression for Magnetic field at a point (1) due to a straight conductor carrying current (ii) along the axis of the circular coil carrying current (iii) along the axis of solenoid. Principle, construction and theory of Helmholtz Galvanometer. Problems **Alternating Current:** Definitions of average, peak and rms values of AC. AC circuits containing LR, CR and their responses (using j operator). Expressions for impedance, current & phase angle in series LCR circuit using j operator. Expressions for admittance and condition for resonance in parallel, LCR circuit using j operator. Concept of Series resonance & parallel resonance (sharpness, half power frequency, quality factor, voltage magnification). Comparison between Series resonance & parallel resonance. De Sauty's Bridge. Problems	13
Activity/Self Study	1.Experiments to show the magnetic field due to straight conductor, circular coil and solenoid. 2.Construction of Helmholtz coil using PVC pipe and copper wire.	

	3.To show the lagging of current and voltage in RL, RC and RLC circuits.	
Unit IV	**Electrical Instrument:** Ballistic Galvanometer; Theory of Ballistic Galvanometer (Derivation for current and Charge). Constants of Ballistic Galvanometer and their relationship. Condition for moving coil galvanometer to be ballistic. Determination of self-inductance (L) by Rayleigh's method. Theory of Earth inductor, Measurement of $B_{H,}$ Bv and angle of dip at a place. CRO block diagram. Use of CRO in the measurement of Voltage, Frequency and Phase. Problems **Dielectrics:** Types of dielectrics (polar and non-polar molecules). Electric dipole moment (p), electric polarization (P). Gauss law in dielectrics. Derivation for Relation between D, E and P. Derivation for relation between dielectric constant and electric susceptibility. Boundary conditions for E & D. Problems	13
Activity/Self-Study	1.To show the working of Ballistic Galvanometer 2.Working of CRO and its applications.	
Recommended Leaning Resources		
Print Resources	1) Electricity and magnetism by Brij Lal and N Subrahmanyam, Rathan Prakash an Mandir, Nineteenth Edition, 1993. 2) Principles of Electronics by V K Mehta and Rohit Mehta, S Chand & Company, Eleventh Edition,2008. 3) Fundamentals of Magnetism & Electricity: D. N. Vasudeva, S Chand Publication, (2011). 4) Fundamentals of Electricity and Magnetism – Basudev Ghosh (Books & Allied New Central Book Agency, Calcutta, 2009). 5) Electricity & Magnetism: B. S. Agarwal, Kedarnath Ramnath Publication (2017). 6) Electricity and Magnetism with Electronics: Dr. K.K. Tewari, S. Chand Publications (1995). 7) Fundamentals of electric circuit theory: Dr. D. Chattopadhyay & Dr. P. C. Rakshit, S. Chand Publications, 7th Rev. Edn. (2006). 8) Electricity and Magnetism: John Yarwood, University Tutorial Press, (1973). 9) Electricity & Magnetism, N S Khare& S S Srivastava, AtmaRam & Sons, New Delhi. 10) Electricity & Magnetism, D L Sehgal, K L Chopra, N K Sehgal, S Chand & Co, Sixth Edition, (1988). 11) Electricity & Electronics, D C Tayal, Himalaya Publishing House, Sixth Edition (1988). 12) Electricity and Magnetism, S P Taneja, R Chand & Co. New Delhi.	

Laboratory Experiments:

NOTE: Minimum of Eight experiments has to be performed

Year	I	**Course Code: 21BSC2C2PHY2P**	**Credits**	2
Sem.	2	**Course Title: Practical-II**	**Hours**	4 hrs/week
Formative Assessment Marks: 25		Summative Assessment Marks: 25	Duration of ESA: 4 hrs.	

Sl. No	**Experiment**
1	Thevenin's & Norton's theorem (Ladder Network)
2	Thevenin's & Norton's theorems (Whetstone Bridge)
3	High resistance by leakage method
4	Time constant of RC circuit by charging and discharging method.
5	Calibration of Ammeter using Helmholtz Galvanometer
6	Constants of Ballistic Galvanometer
7	LCR series / parallel resonance circuit
8	De Sauty's AC bridge
9	Self-Inductance by Rayleigh's method
10	Use of CRO to find voltage, frequency and phase.
11	L & C by Equal Voltage Method
12	Black Box- Identify & Measure R, L & C
13	Anderson's Bridge to determine the self-inductance of the coil (L).
14	Verification of Superposition Theorem
15	Verification of maximum Power Transfer Theorem

Recommended Leaning Resources

Reference Books	1. Physics through experiments. B Saraf etc, - Vikas Publications (2013) 2. D P Khandelwal – A Laboratory Manual of Physics for Undergraduate Classes, Vikas Publications First ed (1985) 3. Advanced Practical Physics for Students – Workshop & Flint, Methuen & Co, London. 4. An Advanced Course in Practical Physics, D Chattopadhyay, P C Rakshit, B Saha, New Central Book Agency (P) Limited, Kolkata, Sixth Revised Edition, (2002) 5. BSC, Practical Physics, CL Arora, SChand& Co, New Delhi, (2007) Revised Edition. 6. B.Sc. Practical Physics, Geeta Sanon R. Chand & Co. New Delhi Rani Channam University, Belagavi, B.Sc. (CBCS) Physics Syllabus

OPEN-ELECTIVE SYLLABUS:

Year	I	**Course Code: 21BSC2O2PHY1**	**Credits**	03
Sem.	2	**Course Title:** OPTICAL INSTRUMENTS	**Hours**	40
Formative Assessment Marks: 40		Summative Assessment Marks: 60	Duration of ESA:.02 hrs.	

Unit No.	**Course Content**	**Hours**
Unit I	**Basics of Optics** Scope of optics, optical path, laws of reflection and refraction as per Fermat's principle, magnifying glass, Lenses (thick and thin), convex and concave lenses, Lens makers formulae for double concave and convex lenses, lens equation.	10
Unit II	Focal and nodal points, focal length, image formation, combination of lenses, dispersion of light: Newton's experiment, angular dispersion and dispersion power. Dispersion without deviation. (Expressions need not be derived, but have to be discussed qualitatively).	10
Unit III	**Camera and microscopes** Human eye (constitution and working), Photographic camera (principle, construction and working), construction, working and utilities of Simple microscopes, Compound microscope, Electron microscopes, Binocular microscopes **Self study** Experimental determination of magnifying power of a microscope. (Construction part can be discussed through block diagrams)	10
Unit IV	**Telescopes and Spectrometer** Construction, working and utilities of Astronomical telescopes Terrestrial telescopes Reflecting telescopes, Construction, working and utilities of Eyepieces or Oculars (Huygen, Ramsden's, Gauss) Spectrometer - Construction, working and utilities, measurement of refractive index. **Self study** Telescopes used at different observatories in and outside India. Hydropower resources, hydropower technologies, environmental impact of hydro power sources. Carbon captured technologies, cell, batteries, power consumption	10
	Activities: 1) Find position and size of the image in a magnifying glass and magnification. 2) Observe rain bows and understand optics. 3) Create a rainbow. 4) Find out what makes a camera to be of good quality.	

	5) Observe the dispersion of light through prism. 6) Make a simple telescope using magnifying glass and lenses. 7) Learn principle of refraction using prisms. 8) Check bending of light in different substances and find out what matters here. 9) Learn about different telescopes used to see galaxies and their ranges. Many more activities can be tried to learn optics by going through you tubes and webistes such as https://spark.iop.org, http://www.yenka.com, https://publiclab.org etc.	

ASSESSMENT METHODS

Evaluation Scheme for Internal Assessment:

Theory:

Assessment Criteria	40 marks
1st Internal Assessment Test for 30 marks 1 hr after 8 weeks and 2nd Internal Assessment Test for 30 marks 1 hr after 15 weeks . Average of two tests should be considered.	30
Assignment	05
Activity	05
Total	**40**

Assessment Criteria	25 marks
1st Internal Assessment Test for 20 marks 1 hr after 8 weeks and 2nd Internal Assessment Test for 20 marks 1 hr after 15 weeks. Average of two tests should be considered.	20
Assignment/Activity	05
Total	**25**

Practical:

Assessment Criteria	25 marks
Internal test	15
Viva Voce / basic understanding of the concept	05
Journal/Practical Record	05
Total	**25**

Scheme of Evaluation for Practical Examination

Sl. No.	Particulars	Marks Allotted Max. 25
1.	Basic formula with description, nature of graph if any & indication of unit	05
2.	Tracing of schematic ray diagram/Circuit diagram with description and tabulation	05
4.	Experimental skill & connection	05
5.	Record of observation,	05
6.	Calculation including drawing graph	04
7.	Accuracy of result with unit	01
	Total	**25**

Question Paper Pattern:

RANI CHANNAMMA UNIVERSITY
Department of PHYSICS

I /II Semester B.Sc.

Sub: **Code:** **Maximum Marks: 60**

Q.No.1.	**Answer any Six Questions** ***(Two question from Each Unit to be asked)*** **a.** **b.** **c.** **d,** **e.** **f.** **g.** **h.**	**6X2=12**
Q.No.2.	**(Questions from Unit-I)** **a.** **b.** **OR** **c.** **d.**	 **08** **04** **08** **04**
Q.No.3.	**(Questions from Entire Unit-II)** **a.** **b.** **OR** **c.** **d.**	 **08** **04** **08** **04**
Q.No.4.	**(Questions from Unit-III)** **a.** **b.** **OR** **c.** **d.**	 **08** **04** **08** **04**
Q.No.5.	**(Questions from Unit-IV)** **a.** **b.** **OR** **c.** **d.**	 **08** **04** **08** **04**

Note:

i. There should be a problem of marks from each unit and may be asked in either b or d in questions 2 to 5.

ii. If necessary, sub questions a and c from 2 to 5 may be subdivided in to i. and ii. Without exceeding maximum 08 marks.