Shri Sangameshwar Education Society's

Sangameshwar College, Solapur [Autonomous]

(Affiliated to Punyashlok Ahilyadevi Holkar Solapur University, Solapur)

Kannada Linguistic Minority Institute

NAAC Accredited with 'A' Grade (III Cycle CGPA 3.39)

Academic Council 3(3.3)
10th August, 2021

UG Science Programme: B.Sc.-II: To be implemented from A.Y. 2021-2022

System: Choice Based Credit System (CBCS) with SGPA and CGPA

B.O.S. in*: **Physics**

Syllabus for: Discipline Specific Core Courses (DSC-C and DSC-D)

Structure and Examination for: Discipline Specific Core Courses (DSC-1C and DSC-1D)

Table-3

Semester	Course		Teaching Scheme/week			
			Course Code	Hours	Lectures	Credits
III						
	DSC-1C	PHYSICS-V: GENERAL PHYSICS AND SOUND	2131303	4.8	6	4
		PHYSICS -VI: ELECTRONICS	2131304			
		PHYSICS PRACTICAL-II	2131420	6.4	8	4
	SEC-1	PHYSICS -I: Gr. A: Programming skill using C–I Gr. B: Soil Health Management-I	2131319 2131320	4.8	6	2
IV	AECC-C	ENVIRONMENTAL STUDIES	2131315	3.2	4	4
	DSC-1D	PHYSICS -VII: Optics	2131403	4.8	6	4
		PHYSICS -VIII: MODERN PHYSICS	2131404			
		PHYSICS PRACTICAL-III	2131420	6.4	8	4
	SEC-2	PHYSICS -II: Gr. A: Programming skill using C–II Gr. B: Soil Health Management-II	2131428 2131429	4.8	6	2

Table-4

Semester	Course		EXAMINATION Marks			Credits
			CA	SEE	Total	
III	DSC-1C	PHYSICS -V: GENERAL PHYSICS AND SOUND	15	35	50	2
		PHYSICS -VI: ELECTRONICS	15	35	50	2
	SEC-1	PHYSICS -II: Gr. A: Programming skill using C–I Gr. B: Soil Health Management Theory Paper-I	15	35	50	2
IV	AECC-C	ENVIRONMENTAL STUDIES	15	35	50	4
	DSC-1D	PHYSICS -VII: Optics	15	35	50	2
		PHYSICS -VIII: MODERN PHYSICS	15	35	50	2
	SEC-2	PHYSICS -II: Gr. A: Programming skill using C–II Gr. B: Soil Health Management Theory Paper-II:	15	35	50	2
	DSC-1C & DSC-1D	PHYSICS PRACTICAL-II and III	60	140	200	8

CA: Continuous Assessment SEE: Semester End Examination

Note:-

The above structure (Table-3 and Table-4) is for Sem-III and Sem-IV of the undergraduate B.Sc.-II programmes* under science faculty.

***B.Sc.-II** Select any three DSC form the four core courses opted at B.Sc.- I.

DSC: Discipline Specific Core Course AECC: Ability Enhancement Compulsory Course

SEC: Skill Enhancement Course

Passing in each course is compulsory including Environment Studies course.

SGPA/CGPA and Total Marks will be calculated excluding AECC course.

Passing in each course is compulsory. SGPA/CGPA and Total Marks will be calculated excluding AECC course.

SEM-III

DSC-1C PHYSICS-V: GENERAL PHYSICS AND SOUND. **(Course Code: 2131303) (50 Marks and 2 Credits)**		**Hours** **36**
Course Objectives: Students should be able to; ● Analyze and evaluate the effect of gravitational forces on bodies on basis of inverse square law and superposition theorem. ● Apply and investigate the different motions of a body. ● Gain knowledge about elasticity of a body and will analyze, apply and synthesize the elastic properties of a body. ● Gain knowledge about Viscosity and learn to apply it to motion in viscous medium and they will comprehend, apply, analyze and evaluate viscous fluids with the help of Bernoulli's Theorem and Poiseuille's Equation. ● Understand the basics of acoustics and apply the acquired knowledge practically when needed.		
Unit 1	Contents: **~~1.~~ Gravitation:** 1.1. Basic forces of Nature. 1.2. Experimental determination of gravitation constant (G) by Cavendish method. 1.3. Principle of equivalence 1.4. Central forces –Inverse Square Law 1.5. Superposition Principle **1.6.** Tutorial.	7
Unit 2	Contents: **2. Precessional Motion:** 2.1. Precession 2.2. Gyroscope 2.3. Nutation 2.4. Lanchester's rules 2.5. Gyrostatic Pendulum 2.6. Motion of rolling disc 2.7. Gyroscopic applications in brief 2.8. Tutorial.	8

Unit 3	Contents: **3**. **Elasticity:** 3.1. Cantilever 3.2. Centrally loaded beam 3.2.1. Centrally loaded beam- with load 3.2.2. Centrally loaded beam- without load/self-weight 3.3. Y and η by Searle's method 3.4. Flat Spiral Spring- expression for Y and η 3.5. Problems	8
Unit 4	Contents: **4. Viscosity:** 4.1. Introduction- Newton's law of Viscosity, Streamline flow, Turbulent flow. 4.2. Bernoulli's theorem 4.2.1. Venturimeter 4.2.2. Atomizer 4.2.3. Dynamic Lift 4.3. Poiseuille's equation 4.4. Motion in a viscous medium- Stokes's law 4.5. Viscosity of liquid by rotating cylinder method 4.6. Searle's Viscometer 4.7. Ostwald's Viscometer 4.8. Factors affecting Viscosity 4.8. Tutorial.	8
Unit 5	Contents **5. Sound:** 5.1. Acoustic transducers 5.1.1. Pressure microphone- Carbon microphone 5.1.2. Condenser microphone 5.1.3. Crystal microphone 5.1.4. Moving coil loudspeaker 5.2. Acoustics and factors affecting acoustics 5.3. Reverberation time and its optimum value 5.4. Requirements of good acoustics	5

	5.5. Sabine's formula 5.6. Ultrasonic 5.6.1. Magnetostriction oscillator 5.6.2. Piezo- electric oscillator 5.7. Tutorial.	

Course Outcomes:

- **Unit 1.** Students will analyze and evaluate the effect of gravitational forces on bodies on basis of inverse square law and superposition theorem.
- **Unit 2.** Students will apply and investigate the different motions of a body.
- **Unit 3.** Students will gain knowledge about elasticity of a body and analyze, apply and synthesize the elastic properties of a body.
- **Unit 4.** Students will gain knowledge about Viscosity and will apply it to motion in viscous medium and they will comprehend, apply, analyze and evaluate viscous fluids with the help of Bernoulli's Theorem and Poiseuille's Equation.
- **Unit 5.** Students will understand the basics of acoustics and apply the acquired knowledge practically when needed.

Reference Books:

1. D. S. Mathur: Elements of Matter: S. Chand Publishing, 2008
2. C. L. Arora, P. S. Hemne: Physics for Degree students: S chand ; Publication date. 1 January 2019
3. N. S. Khare, S. K. Kumar: Text Book of Properties of Matter: Atmaram and sons. New Delhi. 9
4. Brijlal and Subramanyam: Text Book of Sound: Vikas Publishing House, 1985
5. Khanna and Bedi: Sound: Atma Ram and Sons, Delhi
6. A. B. Wood: Sound:
7. Engineering Physics Part I: Selladurai PHI Learning Pvt. Ltd., New Delhi

DSC-1C PHYSICS-VI: ELECTRONICS (Course Code: 2131304) (50 Marks and 2 Credits)		Hours 36
Course Objectives: Students should be able to; ● Comprehend, apply and design different audio amplifiers. ● Apply, analyze, synthesize and design different oscillators used in different audio amplifiers. ● Apply, analyze and design circuits for different applications of unipolar devices. ● Gain knowledge about CRO, Multimeter and F.G. and they will apply, analyze and use them in different applications. ● Analyze and design regulated power supply.		
Unit 1	Contents: **1. Transistor amplifier:** 1.1. Transistor biasing: voltage divider bias 1.2. Two stage R-C coupled transistor amplifier 1.3. Frequency response curve of an amplifier 1.4. Feedback 1.5. Effect of positive and negative feedback on the frequency response curve 1.6. Differential amplifier 1.7. Modes of operation 1.8. Common mode and differential mode signals 1.9. Comparison between normal amplifier and differential amplifier 1.10. Tutorial.	9
Unit 2	Contents: **2. Oscillators** 2.1. Types of waveforms 2.2 Oscillations from tank circuit 2.3 Barkhausen's criterion for sustained oscillations 2.4 Concept of AF and RF Oscillator 2.5 Phase shift oscillator 2.6. Colpitt's oscillator 2.7. Hartley oscillator	7

	2.8. Crystal Oscillator (qualitative treatment only) 2.9. Tutorial.	
Unit 3	Contents: **3. Unipolar Devices:** 3.1. FET: Construction, operation and characteristics 3.2. Application of FET as VVR 3.3. UJT: Construction, operation and characteristics 3.4. UJT as voltage sweep generator **3.5. Tutorial.**	6
Unit 4	Contents: **4. Electronic Instruments:** 4.1. Principle, Construction and working of CRT 4.2. Block diagram of CRO 4.3. Uses of CRO 4.4. Digital Multimeter (DMM) and its applications 4.5. Basics of F.G. (Function Generator) 4.6. Tutorial.	6
Unit 5	Contents: **5. Digital Electronics and Regulated Power Supply:** 5.1. De-Morgan's theorem 5.2. Half Adder and Full Adder 5.3. Construction and working of R-S flip-flop 5.4. Construction and working of J-K flip-flop 5.5. Regulated power supply (with block diagram) and its need 5.6. Line and load regulation 5.7. Transistor Series power supply 5.8. IC voltage regulators 5.8.1. Fixed output voltage regulators (using IC 78XX and 79XX) 5.9. Dual power supply using 3 pin IC 5.10. Tutorial.	8

Course Outcomes:

- **Unit 1.** Students will comprehend, apply and design different audio amplifiers.
- **Unit 2.** Students will apply, analyze, synthesize and design different oscillators used in different audio amplifiers.

- **Unit 3.** Students will apply, analyze and design circuits for different applications of unipolar devices.
- **Unit 4.** Students will apply, analyze and use them in different applications.
- **Unit 5.** Students will analyze and design regulated power supply.

Reference Books:

1. V.K. Mehta: Principles of Electronics: S Chand & Co Ltd., 2020

2. Electronics Principles: Malvino: (3rd and 6th edition): Tata Mcgraw-Hill Publishing Company Limited, 1976

3. Ramakant Gayakwad: Op-Amps and linear Integrated Circuits: (4th edition): Pearson

4. B. L. Theraja, A.K. Theraja: A Text book of Electrical Technology Vol. IV: HALL OF INDIA 2020

5. Malvino and Leach: Digital Principles and Application: (4th edition): McGraw Hill 1994

DSC-1D PHYSICS -VII: OPTICS (Course Code: 2131403) (50 Marks and 2 Credits)		Hours 36
Course Objectives: Students should be able to; ● Comprehend and analyze cardinal points for thin lenses and thick lenses. ● Apply, analyze and apply interference in practical light applications. ● Comprehend and apply in optical applications ● Apply, comprehend and analyze Polarization in practical light effects. ● Understand Optical fibers, Optical Fiber Communication System.		
Unit 1	Contents: **1. Cardinal points:** 1..1. Lagrange's equation 1.2. Cardinal points of optical system 1.3. Graphical construction of image using cardinal points & Newton's formula 1.4. Relation between focal lengths for any optical system 1.5. Relations between lateral, axial and angular magnifications 1.6. Thick lens (introduction) 1.7. Combination of two thin lenses 1.8. Tutorial.	8
Unit 2	Contents: **2. Interference of light:** 2.1 Michelson's Interferometer 2.2 Applications of Michelson's Interferometer to measure 2.2.1. Wavelength of light 2.2.2. Difference in wavelengths 2.2.3. Refractive Index of thin film 2.3. An Etalon (Introduction Only) 2.4. Construction and working of Fabry Perot Interferometer 2.5. Superiority of F.P. Interferometer over Michelson's Interferometer 2.6. Tutorial.	7
Unit 3	Contents: **3. Diffraction of light & Resolving Power:** 3.1. Fresnel's half period zones 3.2. Explanation of rectilinear propagation of light	8

	3.3. Zone plate 3.4. Fresnel's diffraction at Straight Edge 3.5. Geometrical and Spectral Resolution 3.6. Distinction between Magnification and Resolution 3.7. Rayleigh's criterion for the limit of resolution 3.8. Modified Rayleigh's criterion 3.9. R.P. of Plane Diffraction Grating 3.10. R. P. of Prism 3.11. Tutorial.	
Unit 4	Contents: **4. Polarization:** 4.1. Concept of Polarization 4.2. Double refraction 4.3. Huygens's explanation of Double refraction through uni-axial crystals 4.4. Nicole's prism 4.4. Optical rotation 4.5. Optical Activity and Specific Rotation 4.6. Laws of rotation and plane of Polarization 4.7. Polaroid and their use for Polarization 4.8. Applications: 4.8.1. Polarimeter 4.8.2. Liquid Crystal Displays (LCDs) 4.9. Tutorial.	8
Unit 5	Contents: **5. Optical Fibers:** 5.1. Structure of Optical fiber 5..2. Types of optical fiber 5.3. Numerical Aperture 5.4. Pulse Dispersion in Step Index fiber 5.5. Fiber Optic Communication System 5.6. Advantages of Optical fiber 5.7. Tutorial.	5
Course Outcomes:		

- **Unit 1.** Students will comprehend and analyze cardinal points for thin lenses and thick lenses.
- **Unit 2.** Students will apply, analyze and apply interference in practical situations.
- **Unit 3.** Students will use gained knowledge on Diffraction and Resolving Power to comprehend and apply it in optical applications.
- **Unit 4.** Students will apply, comprehend and analyze Polarization in practical situations.
- **Unit 5.** Students will comprehend and explain Optical fibers, Optical Fiber Communication System.

Reference Books:

1. R. Murigation: Optics and Spectroscopy: S Chand & Co Ltd
2. Brijlal and Subramanyam: Text book of Optics: (new edition): Sultan Chand & Sons.
3. Ajay Ghatak: **Optics: (Second** edition): Tata McGraw Hdl **Publishing** Company Limited
4. D. S. Mathur: Geometrical and Physical Optics: McGraw-Hill Inc.,US ;
5. Jenkins and White: Fundamental of Optics: McGraw-Hill, 1976
6. Satya Prakash: Optics and Atomic Physics: Ratan Prakashan Mandir, 1983
7. S. Selladurai: Engineering Physics: PHI Learning Pvt. Ltd
8. Jain,Mathur (Kanpur IIT): Optical Communication:

10th August, 2021

DSC-1D PHYSICS -VIII: MODERN PHYSICS (Course Code: 2131404) (50 Marks and 2 Credits)		Hours 36
Course Objectives: Students should be able to; ● Understand, apply and analyze the relativistic mechanics and operations. ● Comprehend and analyze the Matter Waves and their properties. ● Understand and analyze the Vector Atom Model Zeeman Effect. ● Understand X-rays, X-ray production and Compton Effect. Student will analyze and evaluate the properties, practical applications with precautions to be taken while handling X-ray production devices. ● Analyze and evaluate the properties and practical applications with precautions to be taken while handling Nuclear energy production devices.		
Unit 1	Contents: **1. Theory of Relativity:** 1.1. Inertial Frame of Reference 1.2. Galilean Transformation 1.3. Invariance of laws of Mechanics under Galilean transformation 1.4. Ether hypothesis 1.5. Michelson-Morley experiment 1.6. Einstein's postulates of the Special Theory of Relativity 1.7. Lorentz Transformation 1.8. Variation of length with velocity 1.9. Variation of time with velocity 1.10. Velocity Addition Theorem 1.11. Variation of mass with velocity 1.12. Mass Energy Relation 1.13. Twin Paradox 1.14. Tutorial.	8
Unit 2	Contents: **2. Matter waves:** 2.1 De Broglie's hypothesis of Matter waves 2..2 De Broglie's wavelength 2.3. Particle velocity, Group velocity, Phase velocity & their interrelationship	8

	2.4. Davisson and Germer Experiment 2.5. Properties of Matter waves 2.6. Bohr's quantum condition on the basis of Matter wave hypothesis 2.8. Heisenberg's Uncertainty Principle and its illustration. 2.9. Tutorial.	
Unit 3	Contents: **3. Vector Atom Model:** 3.1. Space quantization 3.2. Spin hypothesis 3.3. Stern-Gerlache experiment 3.4. Quantum numbers associated with Vector Atom Model 3.5. Pauli's Exclusion Principle 3.6. Spin orbit coupling 3.7. Hund's rule 3.8. Total Angular Momentum 3.9. L-S coupling 3.10. j-j coupling 3.11. Zeeman Effect 3.12. Normal and Anomalous Zeeman Effect 3.13. Debye's explanation of Normal Zeeman Effect **3.15. Tutorial.**	8
Unit 4	Contents: **4. X-rays and Compton Effect:** 4.1. Production of X-rays 4.2. Coolidge tube X-ray production 4.3. Types of X-ray Spectra 4.3.1. Characteristic X-ray spectrum 4.3.2. Continuous X-ray spectrum 4.4. Mosley's law 4.5. Compton Effect 4.2. Expression for change in wavelength for scattered photon 4.3 Experimental verification of Compton Effect 4.4. Tutorial.	7
Unit 5	Contents: **5. Nuclear Energy sources:**	5

	5.1. Radioactivity: α, β and γ radiations 5.2. Neutron induced nuclear reaction 53. Nuclear fission 5.4. Energy released in fission 5.5. Chain reaction (Atomic Bomb) 5.6. Nuclear reactor 5.7. Atomic energy in India 5.8. Tutorial.	

Course Outcomes:

- **Unit 1.** Student will understand, apply and analyze the relativistic mechanics and operations.
- **Unit 2.** Student will comprehend and analyze the Matter Waves and their properties.
- **Unit 3.** Student will explain and analyze the Vector Atom Model Zeeman Effect.
- **Unit 4.** Student will comprehend and explain X-rays, X-ray production and Compton Effect. Student will analyze and evaluate the properties, practical applications with precautions to be taken while handling X-ray production devices.
- **Unit 5.** Student will explain, analyze and evaluate the properties and practical applications with precautions to be taken while handling Nuclear energy production devices.

Reference Books:

1. Robert Reshnik: Introduction to Special Relativity: Wiley India Pvt. Ltd
2. Arther Beiser: Perspective of Modern Physics: McGraw-Hill, 1969
3. Gupta and Ghosh: Atomic and Nuclear Physics: 2nd Edition: Books & Allied Ltd; 2nd Revised edition (1 January 2009)
4. Singh, Bagade, Kamal Singh: Quantum Mechanics: Chand and Co.:
5. H. Semat and Albrought: Introduction to Atomic and Nuclear Physics: Holt, Rinehart and Winston, 1972
6. Rajam: Atomic Physics: S. Chand, 1966
7. S. H. Patil (IIT): Modern Physics:
8. Kaplan: Nuclear Physics: Addison-Wesley, 1963

DSC-1C PHYSICS PRACTICAL - II (Course Code: 2131420) (50 Marks and 2 Credits) (36 hours)	
Experiment	Title: **Group I – General Physics and Sound**
1	Y of the material in the form of wire by Searle's method.
2	Kater's Pendulum Part-I (Movable knife edges)
3	Kater's Pendulum Part-II (Fixed knife edges)
4	Surface tension by Quinke's method.
5	Velocity of sound by Kundt's tube
6	Velocity of sound by Resonating Bottle.
7	η of the material in the form of wire by Searle's method.
8	Young's Modulus (Y) by bending of the centrally loaded beam. (Wood) (Practical Activity)
9	Young's modulus (Y) by Vibration of a bar (Wood) (Practical Activity).
10	Surface Tension of liquid by capillary rise method (Water) (Practical Activity).

DSC-1C PHYSICS PRACTICAL - III (Course Code: 2131420) (50 Marks and 2 Credits) (36 hours)	
Experiment	Title: **Group II – Electronics**
1	Transistor series voltage regulator.
2	Use of C.R.O. for measurement of AC, DC voltage and Frequency.
3	Characteristics of FET.
4	UJT as voltage sweep generator.
5	Colpitt's oscillator.
6	Phase shift oscillator.
7	De Morgan's theorems.
8	Two stage RC coupled amplifier
9	Construction of half adder & full adder using gates
10	Biasing Network (Practical Activity).
	Group I & II: Practical Activity Based on PBL
1	Young's Modulus (Y) by bending of the centrally loaded beam. (Wood) (Practical Activity)
2	Young's modulus (Y) by Vibration of a bar (Wood) (Practical Activity).
3	Surface Tension of liquid by capillary rise method (Water) (Practical Activity).

4	Biasing Network (Practical Activity)
DSC-1D PHYSICS PRACTICAL - II **(Course Code: 2131420) (50 Marks and 2 Credits) (36 hours)**	
Experiment	Title: **Group III – Optics**
1	Biprism: To determine the wavelength of monochromatic light
2	Goniometer: Equivalent focal length for different thick lenses.
3	Goniometer: Cardinal points
4	Determination of Cauchy's Constants
5	Double refracting prism
6	Diffraction at single slit
7	Resolving power of grating
8	Diffraction due to cylindrical obstacle.
9	Investigation of Plane Polarized light
10	Wedge shaped film: Measurement of thickness (Air) (Practical Activity).

DSC-1D PHYSICS PRACTICAL - III **(Course Code: 2131420) (50 Marks and 2 Credits) (36 hours)**	
Experiment	Title: **Group IV – Electricity, Magnetism and Modern Physics**
1	Constants of B.G.
2	Comparison of Capacities by De-Sauty's method.
3	Mutual Induction of two separate coils or transformer coils
4	Low resistance of wire using Carey Foster's Bridge
5	Solar cell characteristics (Fill Factor and Efficiency)
6	Impedance of LCR series circuit
7	Sharpness of series resonance circuit
8	Study of Characteristics of G M tube (operating voltage, Plateau length and slope etc.)
9	Verification of inverse square law for gamma rays
10	Solar Module characteristics (Fill Factor, Power and Efficiency) (Practical Activity).
	Group III & IV: Practical Activity Based on PBL
1	Wedge shaped film: Measurement of thickness (Air) (Practical Activity).

2	Solar Module characteristics (Fill Factor, Power and Efficiency) (Practical Activity).

Teaching-Learning Equipments/Tools/Methods/etc:

- Laboratory setup as per requirement of instruments and apparatus for each experiment.
- Experimental method.

Reference Books: -

1	Nelkon: Advanced Practical Physics: Heinemann Educational Publishers; 3rd Revised edition (1 January 1970)
2	Rajopadhye: Practical Physics: Pragati Prakashan
3	S. K. Sharma: Practical Physics:
4	Harnam Singh and P. S. Hemne: Practical Physics: S. Chand Publishing, 2000

Practical Examination marks distribution:

Continuous Assessment (**CA**) examination (**60** marks):

- 1 Practical Activity: = 20
- 1 Experiment = 30
- Explain Physics behind any Physical Activity/ Process/Phenomenon = 05
- Completed Journal = 05
- Total = **60**

Semester End Examination (**SSE**) (**140** marks):

- 1 experiment from each group: 4 x 30 = 120
- Certified Journal 1 x 10 = 20
- Total marks = **140**

Signature: SSG

Name: **Mrs. S. S. Gavande**

Chairman

BOS in Physics