JSS COLLEGE OF ARTS, COMMERCE AND SCIENCE

(Autonomous)

OOTY ROAD, MYSURU- 570 025

DEPARTMENT OF PHYSICS

Syllabus under

National Educational Policy (Modified)

For Ist and IInd BSc Programmes

- ✓ Physics, Chemistry, Mathematics
- ✓ Physics, Mathematics, Computer Science
- ✓ Physics, Mathematics, Electronics

Wef

2025-26

Program Outcomes (POs) for Bachelor of Science

PO 1	**Domain Knowledge -** Acquire and apply knowledge of science in relevant areas
PO 2	**Investigation & Research** – Ability to formulate a hypothesis, augment research questions and identify & refer relevant sources for examining or inspecting technical issues as per their level of understanding and knowledge
PO 3	**Impact of Science on Society** – To prepare competent human resources and to develop scientific attitudes at local and global levels for social benefit
PO 4	**Environment and Sustainability** – Apply the knowledge gained for conserving the environment and to handle environmental issues with sustainable solutions
PO 5	**Moral and Ethical Values** – Imbibe moral values and professional ethics to maintain integrality in a professional scenario while being aware of cultural diversities
PO 6	**Communication** – Develop the caliber to convey various concepts of science effectively

List of BoS Members

Sl No	Category	Name & Designation	Address for Communication	Email & Mobile No.
1	Chairperson	Dr. Vinaykumar.L Assistant Professor & HOD	Department of Physics JSS College of Arts,Commerce & Science (A), Ooty road, Mysuru - 25	vinaykumarphy@gmail.com 9844583597
2	AC Nominee	Dr. Shanmukhappa B Kaginelli Professor	Department of Physics JSSAHER Mysuru	drsbkaginelli@gmail.com 9902244859
3	Nominee by the Vice Chancellor	Dr. S.Krishnaveni Professor	DOS in Physics, Manasagangothri, Mysuru.	sk@physics.uni-mysore.ac.in 9844023568
4	Experts from Other University	Dr. Prasanna G D Assistant Professor	DOS in Physics, Shivagangothri, Davanagere University Davanagere	prasannagd@gmail.com 9845238106
5	Alumnus/ One Person from Industry/ Corporate Sector/Allied Area	Dr. Siddesha Associate Professor	Department of MCA SJCE, Mysuru	siddesh.shiv@sjce.ac.in 8884885076
6	Expert	Mr. Purushothama.R Assistant Manager Skanray Technologies private limited	Healthcare division, #360, KIADB Industrial area, Hebbal, Mysure-570018	purushothama.r@skanray.com 9980565981
7	Member	Jagadish B Assistant Professor	Department of Physics JSS College of Arts,Commerce & Science (A), Ooty road, Mysuru – 25	guru08mallesh@gmail.com 9880622421

Course Structure (2025-26)

Discipline Specific Courses (DSC) & Discipline Specific Elective (DSE)

Ist and IInd Year

Course type, Code and Title		Hours/week		Credits	Maximum Marks			Exam Duration	Total Marks
		L	T/P	L: T: P	C1	C2	C3		
Physics- I Sem									
DSC(1)	Mechanics and Properties of Matter **GPH 101**	3	0	3:0:2 5 credits	10	10	80	03 hours	150
	DSC(1)- Lab **GPH 102**	0	4		05	05	40	03 hours	
Physics- II Sem									
DSC(2)	Heat and Thermodynamics **GPH 201**	3	0	3:0:2 5 credits	10	10	80	03 hours	150
	DSC(2)- Lab **GPH 202**	0	4		05	05	40	03 hours	
Physics- III Sem									
DSC(3)	Waves, Acoustics and Optics **GPH 301**	3	0	3:0:2 5 credits	10	10	80	03 hours	150
	DSC(3)- Lab **GPH 302**	0	4		05	05	40	03 hours	
DSE	Analog and Digital Electronics **GPH 303**	3	0	3:0:0 3 credits	10	10	80	03 hours	100
Physics- IV Sem									
DSC(4)	Electricity and Electromagnetism **GPH 401**	3	0	3:0:2 5 credits	10	10	80	03 hours	150
	DSC(4)- Lab **GPH 402**	0	4		05	05	40	03 hours	
DSE	Communication systems, Laser and Fibre optics **GPH 403**	3	0	3:0:0 3 credits	10	10	80	03 hours	100
DSC	Practical / Skill **GPH 404**	0	3	0:0:2	05	05	40	03 hours	50

DSC(1) Syllabus for B.Sc. Physics

Semester I

Course Code: GPH 101 GPH 102	Course Title: DSC(1)- Mechanics and Properties of Matter (Theory) DSC(1)- Lab (Practical)
Course Credits: 05 (3:0:2)	Hours of Teaching/Week: 03 (Theory) + 04 (Practical)
Total Contact hours: 48 Hours (Theory) 60 Hours (Practical)	Formative Assessment Marks: 20 (Theory) 10 (Practical)
Exam Duration: 03 Hours (Theory) 03 Hours (Practical)	Semester-End Examination Marks: 80 (Theory) 40 (Practical)

	Course Outcomes (COs)
CO1	Gaining the knowledge on concepts of Frame of reference, Dynamics of Point Particles and theory of Rigid bodies.
CO2	Comprehending the conservation laws of Linear Momentum, Angular Momentum and Energy.
CO3	Apprehending the theory of elasticity, Fluid mechanics and surface tension.

PART A: 16 Hours

Frames of Reference: Inertial and Non-inertial reference frames with examples. Uniform rectilinear motion in an inertial frame. Uniformly accelerated rectilinear motion-concept of fictitious force-illustration; plumb line accelerometer and a freely falling elevator. Qualitative discussion of centrifugal force, Coriolis force and earth as a non-inertial frame, Numerical problems.

[4hours]

Motion of a Point Particle: Point mass. The position vector r (t) of a moving point particle and its Cartesian components. Velocity and acceleration as the vector derivatives. Derivation of planar vector of a constant magnitude. Radial and transverse components of velocity and acceleration for arbitrary planar motion, deduction of results for uniform circular motion centripetal force, Numerical problems.

[4 hours]

Rigid Body Dynamics: Review of definitions, Moment of inertia and radius of gyration. Review of statements of the theorems of the parallel and perpendicular axes. Relation between torque and angular acceleration. Expression for kinetic energy of a rigid body. Calculation of moment of inertia of rectangular lamina, circular lamina and of a solid cylinder. Theory of compound pendulum. Numerical problems.

[8 hours]

PART B: 16 Hours

Conservation of linear Momentum: Conservation of the linear momentum for a system of two particles. Rocket motion in a uniform gravitational field (single stage rocket equation with and without gravity). Multistage rocket elementary ideas. Elastic and inelastic collisions – Elastic head-on collision and elastic oblique collision in a lab frame, reduced mass. Numerical problems.

[5 hours]

Conservation of Angular Momentum: Review of angular momentum and Torque. Relation between angular momentum and torque. Law of conservation of angular momentum. Areal velocity derivation $\frac{dA}{dt} = \frac{1}{2} r^2 \dot{\theta} \, \hat{n}$. Central force: Physical insight into the nature of central forces. Kepler's laws of planetary motion- Derivations using Newton's laws. Numerical problems.

[6 hours]

Conservation of Energy: Conservative force and non-conservative forces with examples. Conservation of energy in a conservative force field. Applications: (i) Vertical oscillations of a loaded light spiral spring (derivation) and (ii) Calculation of escape velocity in the gravitational field of the earth (derivation). Condition for a geo-stationary satellite. Numerical problems.

[5 hours]

PART C: 16 Hours

Elasticity: Concept of moduli of elasticity, Hooke's Law and Poisson's ratio σ. Relation between the elastic constants q, k, η and σ, Limiting values for σ. Workdone in stretching. Elastic potential energy. Bending moment. Theory of light single cantilever. I-section griders. Torsion- calculation of a couple per unit twist. The torsional pendulum, Static torsion, Searle's double bar experiment. Numerical problems.

[7hours]

Fluid Mechanics: Ideal fluid, equation of continuity, Bernoulli's theorem and applications of Bernoulli's equation-curved flight of a spinning ball-Magnus effect, the lift on an aircraft wing. Streamline flow and turbulent flow. Critical velocity and Reynolds number. Viscosity-Variation of viscosity of liquids with temperature and pressure. Theory of rotation viscometer. Numerical problems.

[5 hours]

Surface Tension: Surface Energy and Surface Tension-examples. Pressure inside curved liquid surface, excess of pressure inside a soap bubble. Angle of contact. Surface tension and interfacial tension by drop-weight method. Surface tension of mercury by Quincke's method – Theory. Numerical problems.

[4 hours]

References

1. Halliday D, Resnick R, and Walker J, *Principles of Physics*, 9th Edn., Wiley India Pvt. Ltd. (2013).
2. Upadhyaya J C, *Classical Mechanics*, 2nd Edn., Himalaya Publishing House (2017).
3. Arora C L, and Hemne P S, *Physics for Degree Students*, Revised Edn., S Chand and Company (2012).
4. Charles Kittel, and Walter Knight, *Berkeley Physics Course, Mechanics* Vol1, 2nd Edn., Tata McGraw Hill (2011).
5. Mathur D S, *Elements of Properties of Matter*, S Chand and Company(2007).
6. Mathur D S, *Mechanics*,S Chandand Company (2007).
7. Brij Lal, and Subrahmanyam N, *Properties of Matter*, 6th Edn., S Chand and Company (2002).
8. Shankara Narayana S R, *Mechanics and Properties of Matter*, 2nd Revised Edn., Sultan Chand and Sons (1998).
9. Gaur R. K and S.L Gupta, *Engineering Physics*, Dhanpant Rai Publications, Eighth edition (2001).

Weblinks

- https://www.fullonstudy.com/bsc-1st-year-physics-notes
- https://byjus.com/chemistry/properties-of-matter/
- https://edscl.in/course/view.php?id=347&section=3

DSC(1) lab

List of Experiments   Credit : L:T:P
0:0:2

(Minimum EIGHT experiments must be completed)

Sl. No.	Experiments
1.	Determination of acceleration due to gravity using bar pendulum.
2.	Determination of the moment of inertia of a Fly Wheel.
3.	Determination of rigidity modulus using a 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.	Determination of surface tension of a liquid and the interfacial tension between two liquids using the drop weight method.
9.	Study of motion of the spring and to calculate the Spring constant, g and unknown mass.
10.	Determination of Young's modulus of a bar by the single cantilever method.
11.	Determination of Young's modulus of a bar by uniform bending method.
12.	Determination of Young's modulus of a bar by dynamic method.
13.	Verification of parallel and perpendicular axis theorems
14.	Determination of acceleration due to gravity using Kater's pendulum.
15.	Determination of surface tension of Mercury using Quincke's method

Course Articulation Matrix- Course code : GPH 101						
Course Outcomes	Program outcomes					
	PO1	PO2	PO3	PO4	PO5	PO6
CO1	3	2	1	1	2	2
CO2	3	2	2	1	2	2
CO3	3	2	1	1	2	2
Weighted average	3	2	1.3	1	2	2

DSC(2) Syllabus for B.Sc. Physics

Semester II

Course Code: GPH 201 GPH 202	Course Title: DSC(2)- Heat and Thermodynamics (Theory) DSC(2)- Lab
Course Credits: 05 (3:0:2)	Hours of Teaching/Week: 03 (Theory) + 04 (Practical)
Total Contact Hours: 48 Hours (Theory) 60 Hours (Practical)	Formative Assessment Marks: 20 (Theory) 10 (Practical)
Exam Duration: 03 Hours (Theory) 03 Hours (Practical)	Semester-End Examination Marks: 80 (Theory) 40 (Practical)

Course Outcomes (COs)	
CO1	Comprehension of kinetic theory and radiation laws, Thermal conductivity and statistical physics.
CO2	Gaining the knowledge on the Concepts of Thermodynamics and Entropy.
CO3	Acquiring the knowledge on thermodynamics systems through derived thermodynamic relations, low temperature physics and vacuum technology.

PART A : 16 Hours

Kinetic Theory: Maxwell's law of distribution of molecular velocity (no derivation); its interpretation. Degrees of freedom. Principle of equipartition of energy based on Kinetic theory of gases. Derivation of $U = 3/2\ RT$. Mean free path, expression for mean free path, probability of a particle having mean free path. Real gases, Andrew's isothermals, Van der Waals equations – expression for critical constants, calculation of mean velocity, most probable velocity and RMS velocity. Numerical problems.

[8 hours]

Thermal Conductivity: Equation for the flow of heat through a solid bar. Determination of thermal conductivity of a bad conductor by Lee and Charlton method. Numerical problems.

[2 hours]

Statistical Physics: The Maxwell-Boltzmann, Bose-Einstein and Fermi-Dirac energy distribution formulae (no derivation). A qualitative comparison of the MB, BE and FD statistics and their applications.

[2 hours]

Radiation: Planck's quantum theory of radiation. Induced and spontaneous emission of radiation. Derivation of Planck's law of radiation using Einstein's A and B coefficients. Deduction of Rayleigh-Jeans law, Stefan's law and Wien's displacement law from Planck's law. Numerical problems.

[4 hours]

PART B : 16 Hours

Thermodynamics: Review of basic concepts of heat and temperature - the Zeroth law of thermodynamics. Differential form of the first law of thermodynamics, Work done in an isothermal and adiabatic process for an ideal gas (Derivations). Second law of hermodynamics (Kelvin's & Clausius' statements and their equivalence), Reversible and irreversible processes with examples. Carnot theorem (statement and proof). Carnot cycle and its efficiency (derivation). Carnot Engine. Refrigerator-Coefficient of performance. Thermodynamic scale of temperature and its identity with perfect gas scale. First order Phase transition with examples. Clausius-Clapeyron first latent heat equation. Numerical problems

[10 hours]

Entropy: The concept of entropy. Change of entropy in reversible and irreversible cycles. Entropy and non-available energy. Second law of thermodynamics in terms of entropy. Entropy of ideal gas, entropy of steam and mixtures. T-S diagram. Third law of thermodynamics - statement, significance and unattainability of absolute zero. Microscopic interpretation of entropy (Boltzmann relation). Numerical problems.

[6 hours]

PART C : 16 Hours

Thermodynamic Potentials and Maxwell's Thermodynamic Relations:
Internal Energy, Enthalpy, Helmholtz function, Gibbs function, relations among these functions, Gibbs-Helmholtz Equations. Derivation of Maxwell's Thermodynamic Relations (using Thermodynamic Potentials). TdS equations for C_P and C_v. Heat Capacity equations. Derivation of $C_P - C_v = R$ using Maxwell's Relations. Internal Energy equations. Numerical problems.

[6 hours]

Low Temperature Physics: Ideal gas and real gas. Van der Waals equation of state. Porous plug experiment and its theory. Joule-Thomson expansion expression for the temperature of inversion, inversion curve. Relation between Boyle temperature, temperature of inversion and critical temperature of a gas. Principle of regenerative cooling. Liquefaction of air by Linde's method. Adiabatic demagnetization. Cryogenics and its applications(qualitative). Numerical problems.

[6 hours]

Vacuum Technology: Introduction, Exhaust pump and their characteristics, Measurement of low pressure, Pirani gauge. Numerical problems.

[4 hours]

References

1. Halliday and Resnick: *Fundamentals of Physics*, 9th edition, Wiley India, 2011.

2. R. H. Dittaman and M. W. Zemansky: *Heat and Thermodynamics*, 7th edition, Tata McGraw-Hill companies, 2007.

3. S. J. Blundell and K. M. Blundell: *Concepts in Thermal Physics*, 2nd edition, Oxford University Press, 2006.

4. Brijlal, N. Subramanyam P.S. Hemne: *Heat Thermodynamics and Statistical Physics*, 1st edition. S Chand Publishing, 2007.

5. S C Gupta: *Thermodynamics*, 1st edition, Pearson, 2005.

6. C. L. Arora: *Refresher Course in Physics* Vol I, S Chand publishing, 2011.

7. S. R. Shankara Narayana: *Heat and Thermodynamics*, 2nd edition, Sulthan Chand and Sons, 1990.

8. Gaur R.K and S.L Gupta, *Engineering Physics*, Dhanpant Rai Publications, 8th edition (2001).

9. Mark W. Zemansky, *Heat and Thermodynamics*,Tata McGraw Hill, 7th edition (1997).

Weblinks
- https://deepblue.lib.umich.edu/bitstream/handle/2027.42/75853/ayd_1.pdf/
- https://sites.ualberta.ca/gingrich/courses/phys395/notes/phys395/
- https://www.researchgate.net

DSC(2) lab
List of Experiment   Credit : L:T:P
                                                      0:0:2

(Minimum EIGHT experiments must be completed)

Sl.No.	Experiments
1	Verification of Gaussian distribution law and calculation of standard deviation – Monte Carlo experiment.
2	Specific heat by Newton's law of cooling -graphical method
3	Verification of Stefan's Boltzmann fourth power law using Meter bridge.
4	Determination of Stefan's constant.
5	Determination of thermal conductivity of a bad conductor by Lee- Charlton method.
6	Verification of Stefan's fourth power law using an electrical lamp.
7	Determination of Mechanical equivalent of heat
8	Determination of decay constant using Dice
9	Determination of boiling point of a liquid by using a platinum resistance thermometer.
10	Determination of temperature coefficient of resistance of a platinum resistance thermometer.
11	Determination of Solar constant.
12	Coefficient of thermal conductivity of copper by Searle's apparatus
13	Determination of Latent heat of fusion of ice with radiation correction
14	Determination of specific heat of solid with radiation correction

Course Articulation Matrix- Course code : GPH 201						
Course Outcomes	**Program outcomes**					
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**
CO1	3	2	1	1	2	2
CO2	3	2	1	1	2	2
CO3	3	2	1	1	2	2
Weighted average	**3**	**2**	**1**	**1**	**2**	**2**

DSC(3) B.Sc Physics Syllabus

III Semester

Course Code: GPH 301 GPH 302	Course Title: DSC(3)- Waves,Acoustics and Optics (Theory) DSC(3)- Lab
Course Credits: 05 (3:0:2)	Hours of Teaching/Week: 03 (Theory) + 04 (Practical)
Total Contact Hours: 48 Hours (Theory) 60 Hours (Practical)	Formative Assessment Marks: 20 (Theory) 10 (Practical)
Exam Duration: 03 Hours (Theory) 03 Hours (Practical)	Semester-End Examination Marks: 80 (Theory) 40 (Practical)

Course Outcomes (COs)	
CO1	Analyze the frequency of vibration of a stretched string, understand harmonics and longitudinal vibrations in rods
CO2	Explain and derive the theory of Fresnel's biprism, Newton's rings,thin film interference, differentiate between Fresnel and Fraunhofer diffraction and explain the principle of rectilinear propagation of light using wave theory
CO3	Explain the working of retarding plates and analyze the production and analysis of linearly, circularly, and elliptically polarized light.

PART – A

Waves: Plane and spherical Waves. Longitudinal and transverse waves. Characteristics of wave motion. Differential equation of wave motion. Relation between amplitude and intensity. Group and phase velocity, relation between group and phase velocity. Expression for velocity of progressive waves in a medium-Newton's formula, Laplace's correction. Expression for frequency of vibration of a stretched string – harmonics, longitudinal vibrations in a rod. Kundt's tube experiment. Numerical problems.

[8 hours]

Simple harmonic motion: Superposition of two perpendicular simple harmonic motions of equal frequency- Lissajous' figures. Equation for damped vibrations. Forced vibration-solution in exponential form. Resonance-expression for amplitude and phase at resonance. Numerical problems.

[5 hours]

Analysis of complex waves: Fourier theorem. Evaluation of Fourier co- efficients. Analysis of square wave and saw tooth wave.

[3 hours]

PART – B

Acoustics: Noise and music, limits of human audibility, intensity and loudness, bel and decibel, the acoustics of halls, absorption coefficient, Reverberation and reverberation time, Sabine's reverberation formula (derivation), Factors affecting acoustics in buildings, requisites for good acoustics. Ultrasonics: properties, production of ultrasonic waves-piezoelectric method, detection of ultrasonic waves. Determination of velocity of ultrasonic waves in liquids-acoustic grating. Applications of ultrasonics. Numerical problems.

[8 hours]

Velocity of light: Kerr cell, Kerr effect. Determination of velocity of light by Kerr cell method. Numerical problems.

[2 hours]

Interference: Review of basic concepts, Coherent sources. Interference by division of wave front – Theory of Fresnel's biprism, Interference by division of amplitude-Thin films of uniform thickness-antireflective coatings, Newton's rings. Interference at a wedge. Michelson's interferometer - Measurement of λ and $d\lambda$. Numerical Problems.

[6 hours]

PART – C

Diffraction: Fresnel and Fraunhofer diffraction. Explanation of rectilinear propagation of light. Theory of the zone plate. Comparison with a convex lens. Fresnel diffraction at a straight edge. Fraunhofer diffraction at a single slit. Transmission grating-theory for the case of normal incidence, Resolving power and dispersive power of plane grating. Numerical problems.

[8 hours]

Polarization: Double refraction in uniaxial crystals. Huygen's theory. Positive and negative crystal. Principal refractive indices. Huygen's constructions of O and E wave fronts in a uniaxial crystal – (i) optic axis in the plane of incidence and parallel to the crystal surface at normal incidence, (ii) optic axis in the plane of incidence and perpendicular to the crystal surface at normal incidence. Retarding plates. Production and analysis of linearly, Circularly and elliptically polarized light. Optical activity, Fresnel's theory of rotatory polarization. Interference of polarized light-expression for resultant intensity, calculation of thickness of wedge-shaped crystal plate (negative and positive), calculation of fringe width. Numerical problems.

[8 hours]

References:

1. Halliday, D., Resnick, R., & Walker, J. (2008). *Fundamentals of Physics Extended* (8th ed.). John Wiley & Sons (Asia) Pte. Ltd.

2. Subrahmanyam, N., & Brij Lal. (2001). *Waves and Oscillations* (2nd ed.). Vikas Publishing House Pvt. Ltd.

3. Khanna, D. R., & Bedi, R. S. (1952). *A Textbook of Sound*. Atma Ram & Sons.

4. Gupta, S. K., & Varma, O. P. (Year Unknown). *Waves and Oscillations* (3rd ed.). R. Chand & Co.

5. Saihgal, R. L. (1977). *Text Book of Sound* (Rev. ed.). S. Chand & Company Ltd.

6. Mittal, P. K., & Anand, J. D. (2011). *A Text Book of Sound*. Har-Anand Publications.

7. Suryanarayana, N. V. (1988). *Electrical Measurements and Measuring Instruments*. McGraw-Hill.

8. Kalsi, H. S. (2004). *Electronic Instrumentation*. Tata McGraw-Hill Publishing Co. Ltd.

9. Bhattacharya, A. B., & Bhattacharya, R. (Year Unknown). *Undergraduate Physics, Volume I*. New Central Book Agency (P) Ltd.

10. Subrahmanyam, N., Brij Lal, & Avadhanulu, M. N. (2006). *A Textbook of Optics* (24th rev. ed.). S. Chand & Company Ltd.

11. Prakash, S. (Year Unknown). *Optics and Atomic Physics* (8th rev. ed.). Educational and University Publishers.

12. Khanna, D. R., & Gulati, H. R. (2011). *Fundamentals of Optics* (15th ed.). R. Chand & Co.

13. Murugeshan, R., & Sivaprasath, K. (2010). *Optics and Spectroscopy* (17th rev. ed.). S. Chand & Company Ltd.

III Semester BSc Physics Practicals

PHY302(DSC): Physics Practicals-III

(Minimum Eight experiments to be completed)

Sl. no	Experiments
1.	Study of stationary wave on a stretched string – Determination of speed of the transverse waves over the sonometer wire.
2.	Helmholtz resonator – Determination of frequency of a tuning fork
3.	Air wedge – Determination of thickness of a thin paper/diameter of a thin wire.
4.	Diffraction at a straight wire – Determination of diameter of a wire
5.	Newton's rings – Determination of radius of curvature of a plano convex lens
6.	Diffraction grating – Determination of grating constant and wave length (minimum deviation method)
7.	Cauchy's constants using spectrometer
8.	Polarization – Determination of unknown concentration of sugar solution by graphical method using a polarimeter
9.	To determine wavelength of sodium light using Fresnel Biprism.
10.	To determine dispersive power and resolving power of a plane diffraction grating.
11.	Determination of refractive indices of calcite and quartz crystal using spectrometer and sodium light.
12.	Kundt's tube experiment – velocity of sound in air at room temperature

III Semester B.Sc Physics Syllabus

Course Code: GPH 303	Course Title: DSE - Analog and Digital Electronics (Theory)
Course Credits: 03 (3:0:0)	Hours of Teaching/Week: 03 (Theory)
Total Contact Hours: 48 Hours (Theory)	Formative Assessment Marks: 20 (Theory)
Exam Duration: 03 Hours (Theory)	Semester-End Examination Marks: 80 (Theory)

Course Outcomes (COs)	
CO1	Explain the formation of energy bands in solids and the difference between conductors, insulators, and semiconductors using energy level diagrams.
CO2	Identify and explain the active, cutoff, and saturation regions of transistor operation and analyze their significance in switching and amplification.
CO3	Identify and explain the operation of basic logic gates, Design and construct adder circuits, working of flip-flops, Explain the working principles of Analog to Digital Converters and Digital to Analog Converters

PART − A

Semiconductors: concept of bands in solids, energy level diagram. Effect of temperature on semiconductors. Intrinsic and extrinsic semiconductors. Concept of doping. P and N type semiconductors with examples. Majority and minority charge carriers, PN junction, properties of PN junction-depletion region, biasing a PN junction-forward bias and reverse biased PN junction diode. V-I characteristics of PN junction diode. PN junction fabrication.

[8 hours]

Semiconductor diode applications: Rectifier diode, half-wave rectifier. Centre- tapped and bridge full-wave rectifiers, calculation of ripple factor and rectification efficiency, filters, Zener diode and voltage regulation. Principle, structure and characteristics of LED, photodiode and solar cell, qualitative idea of Schottky diode and tunnel diode.

[8 hours]

PART − B

Transistors: N-P-N and P-N-P Transistors. I-V characteristics of CB and CE configurations. Active, cutoff and saturation regions. Current gains α and β. Relations between α and β. Load line analysis of transistors. DC load line and Q- point. Physical Mechanism of current flow. FET, UJT working and its characteristics.

[8 hours]

Amplifiers: h-parameters A.C. equivalent circuit of a transistor in terms of the h-parameters. Derivation of the expressions for voltage gain. Current gain, power gain, input resistance and output resistance for CE mode.

[4 hours]

Oscillators: Positive and negative feedback. Barkhausen's criterion for self- sustained oscillations. RC phase shift oscillator, determination of frequency. Hartley oscillator.

[4 hours]

PART – C

Digital circuits: Difference between analog and digital Circuits. Binary Numbers. Decimal to binary and binary to decimal conversion, AND, OR and NOT Gates. NAND and NOR gates as Universal gates. XOR and XNOR Gates. De Morgan's theorems. Boolean laws. Simplification of logic circuit using Boolean Algebra. Binary addition. Binary subtraction using 2's complement method.

[8 hours]

Combinational & sequential circuits: Half adder, full adder using basic gates & Ex-OR gates, RS and JK flip flop (clocked version).

[3 hours]

Analog to Digital Converters: Counter comparator ADC, Successive approximation type ADC.

[3 hours]

Digital to Analog Converters: Weighted resistor DAC, Resistor ladder DAC.

[2 hours]

References:

1. Albert P Malvino, *Electronic Principles*, Fifth edition, Tata Mc-Graw Hill, 2008.

2. Donald P Leach, Albert Paul Malvino and Goutam Saha, *Digital Principles and Applications*, McGraw Hill Education, 8th edition, 2nd Reprint, 2015.

3. B. L. Theraja, Dr. R. S. Sedha, *Principles of Electronics Devices and Circuits (Analysis and Digital)*, S. Chand & Co., Revised edition, Reprint, 2015.

4. Bapat Y. N., *Electronic Circuits and Systems*, TMH, New Delhi, 2012.

5. Alan Mottershead, *Electronic Devices and Circuits*, Prentice Hall of India Ltd, New Delhi, 2013.

6. R. P. Jain, *Modern Digital Electronics*, McGraw Hill Education, 4th edition, 14th Reprint, 2015.

7. B. Zbar, A. P. Malvino, M. A. Miller, *Basic Electronics: A Text Lab Manual*, McGraw Hill, 1994.

8. J. D. Ryder, *Electronics: Fundamentals and Applications*, Prentice Hall, 2004.

9. R. A. Gayakwad, *OP-Amps and Linear Integrated Circuit*, 4th edition, Prentice Hall, 2000.

10. J. Millman and C. C. Halkias, *Integrated Electronics*, Tata Mc-Graw Hill, 1991.

11. J. D. Ryder, *Electronics: Fundamentals and Applications*, Prentice Hall, 2004.

12. B. G. Streetman & S. K. Banerjee, *Solid State Electronic Devices*, 6th Edition, PHI Learning, 2009.

13. S. Salivahanan & N. S. Kumar, *Electronic Devices & Circuits*, 3rd Edition, Tata McGraw Hill, 2012.

14. S. M. Sze, *Semiconductor Devices: Physics and Technology*, 2nd Edition, Wiley India, 2002.

Note:** Electronics students are not eligible to opt this paper

IV Semester B.Sc Physics Syllabus

Course Code: GPH 401 GPH 402	Course Title: DSC(4)- Electricity and Electromagnetism (Theory) DSC(4)- Lab
Course Credits: 05 (3:0:2)	Hours of Teaching/Week: 03 (Theory) + 04 (Practical)
Total Contact Hours: 48 Hours (Theory) 60 Hours (Practical)	Formative Assessment Marks: 20 (Theory) 10 (Practical)
Exam Duration: 03 Hours (Theory) 03 Hours (Practical)	Semester-End Examination Marks: 80 (Theory) 40 (Practical)

Course Outcomes (COs)	
CO1	Describe the construction, working principle, and applications of the attracted disc electrometer and galvanometers, Apply KVL and KCL to analyze simple electrical circuits
CO2	Explain and distinguish between series and parallel resonance, and determine half-power frequencies, bandwidth, and quality factor
CO3	Derive and interpret Maxwell's equations in free space and isotropic dielectrics, and explain their physical significance.

PART– A

Electrostatics: Mechanical force and electric pressure on a charged surface. The path traced by a charged particle in an electric field. The attracted disc electrometer-construction, theory and applications. Numerical Problems.

[4 hours]

Galvanometers: Moving coil galvanometer-construction, theory, damping correction, current sensitivity and charge sensitivity. Helmholtz galvanometer – Theory. Numerical Problems.

[4 hours]

Thermo-electricity: Seebeck, Peltier and Thomson effects. Thermodynamic theory of thermoelectric effect. The law of intermediate metals and the law of intermediate temperatures. Thermocouple.Numerical Problems.

[4 hours]

Network Theorems: Mesh analysis circuits using KVL and KCL. Statement and proof of Thevenin's theorem and Norton's theorem, Numerical problems.

[4 hours]

PART – B

Alternating current: R.M.S. values. Response of LR, CR and LCR circuits to sinusoidal voltages (discussion using the 'j' symbols). Series and parallel resonance-half-power frequencies, band-width and Q-factor. Power in electrical circuits- power factor. Maximum power transfer theorem for ac circuits. Numerical Problems.

[8 hours]

Applications of AC circuits: AC bridges – Anderson's bridge, Maxwell's bridge, Desauty bridge, Robinson's bridge. Numerical Problems.

[4 hours]

Electrical measurement: CRO–construction & working. Measurement of voltage, frequency and phase using a CRO.

[2 hours]

Filters: High-pass and low-pass filters with RC combination. Expression for cut- off frequency. Numerical Problems.

[2 hours]

PART – C

Electromagnetism: Scalar and Vector fields. The gradient of a scalar field. The divergence and curl of a vector field. The physical significance of gradient, divergence and curl. Statement and physical significance of Gauss and Stokes theorems. Numerical Problems.

[4 hours]

Electromagnetic theory: Review of Basic concepts. Equation of continuity, Maxwell's modification of Ampere circuital law- Displacement current. Setting up of Maxwell's field equations. Maxwell's field equations in free space, Poynting vector (definition). Wave equation for the field vectors in free space and in isotropic dielectric. Energy density of electromagnetic wave and Poynting Theorem (Proof). Plane monochromatic electromagnetic waves – Transverse nature. Helmholtz equation. Characteristic impedance of free space. Numerical Problems.

[10 hours]

Production of Electromagnetic waves: Accelerated charges and oscillating dipole. Hertz's experiment. Radiation loss - Synchrotron radiation.

[2 hours]

References:

1. Halliday, D., Resnick, R., & Walker, J. (2008). *Fundamentals of Physics* (8th ed.). John Wiley & Sons (Asia) Pte. Ltd.
2. Tewari, K. K. (2007). *Electricity and Magnetism* (3rd ed.). S. Chand & Co. Ltd.
3. Laud, B. B. (1987). *Electromagnetics* (2nd ed.). Wiley Eastern Limited.
4. Griffiths, D. J. (1999). *Introduction to Electrodynamics* (3rd ed.). Prentice Hall.
5. Hayt, W. H., & Buck, J. A. (2006). *Engineering Electromagnetics* (6th ed.). Tata McGraw-Hill.
6. Mehta, V. K., & Mehta, R. (2022). *Principles of Electronics* (11th ed.). S. Chand Publishing.
7. Subrahmanyam, N., & Brij Lal. (1980). *Text Book of Electricity and Magnetism* (9th ed.). Ratan Prakashan Mandir.
8. Bhattacharya, A. B., & Bhattacharya, R. (2008). *Undergraduate Physics: Volume II*. New Central Book Agency.
9. Vasudeva, D. N. (2011). *Fundamentals of Magnetism and Electricity* (12th ed.). S. Chand & Co. Ltd

IV Semester B.Sc Physics Practicals

GPH402 (DSC): Physics Practicals-IV

(Minimum Eight experiments to be completed)

Sl. No.	Experiments
1	LCR series circuit – Determination of L & Q factor
2	Voltage triangle – Measurement of phase difference
3	de-Sauty bridge – Verification of laws of combination of capacitances
4	Variation of thermo-emf across two junctions of a thermocouple with temperature
5	Anderson's Bridge – Determination of the self-inductance of the coil
6	LCR parallel circuit – Determination of L & Q factor
7	RC Low and High pass filters – Determination of the cut-off frequency
8	To study the variation of X_C with f and determination of C
9	Maxwell's Bridge – Determination of the self-inductance of the coil
10	CRO- determination of voltage and frequency.
11	B_H using Helmholtz double coil galvanometer and potentiometer
12	High resistance by leakage
13	Capacity of a condenser using a BG

IV Semester B.Sc Physics Syllabus

Course Code: GPH 403	Course Title: DSE(2) – Communication systems, Laser and Fibre optics (Theory)
Course Credits: 03 (3:0:0)	Hours of Teaching/Week: 03 (Theory)
Total Contact Hours: 48 Hours (Theory)	Formative Assessment Marks: 20 (Theory)
Exam Duration: 03 Hours (Theory)	Semester-End Examination Marks: 80 (Theory)

Course Outcomes (COs)	
CO1	Distinguish between signal and noise in communication systems and explain the concept and importance of signal-to-noise ratio (SNR).
CO2	Describe the coherence properties of laser light, including temporal and spatial coherence, and explain the concepts of monochromaticity, directionality, and brightness.
CO3	Classify different types of optical fibres and explain the principles of light propagation, including critical angle, acceptance angle, numerical aperture, and mode of propagation.

PART-A

Signal & noise: Distinction between signal and noise. Signal to noise ratio and its importance in communication.

[3 hours]

Electro-acoustic transducers: Microphone types- Carbon, Moving coil, condenser and ribbon microphones, sensitivity, directivity, phasing and testing.

[6 hours]

Loudspeakers: Direct radiator dynamic type, expression for efficiency, radiated output power, horn loudspeaker, cutoff frequency, measurement of acoustic power and pressure response of a speaker. Numerical Problems.

[7 hours]

PART-B

Laser basics: Coherence properties of laser light, temporal coherence, monochromaticity, spatial coherence, directionality, line width, brightness, divergence, line shape broadening, focusing properties of laser radiation, laser modes, axial and transverse, mode selection, single mode operation, selection of laser emission line.

[5 hours]

Laser oscillator: Pumping schemes, gain, threshold conditions; optical resonators. Numerical problems.

[3 hours]

Types of lasers: Construction and principles of working of Nd-YAG, CO_2 and dye lasers and semiconductor laser.

[4 hours]

Laser diodes: Lasing conditions and gain in a semiconductor, selective amplification and coherence, materials for laser diodes, quantum well lasers, surface emitting lasers, characterization and modulation of lasers. Numerical problems.

[4 hours]

PART-C

Fibre optics and dielectric wave guides: Waveguide – slab wave guide, modes, V number, modal material and waveguide dispersions, Numerical problems.

[3 hours]

Optical fibre: Types, functions, light propagation, optical power, velocity of propagation, critical angle, acceptance angle, numerical aperture, mode of propagation. Numerical problems.

[4 hours]

Index profile: Single mode step-index optical fibre, multimode step-index fibre, graded index fibre; advantages and disadvantages. Numerical problems.

[3 hours]

Energy losses in optical fibre: Bit rate, dispersion optical fibre communication, and optical bandwidth, absorption and scattering, optocoupler.

[6 hours]

References:

1. Roddy, D., & Coolen, J. (2008). *Electronic Communications* (4th ed.). Pearson Education. India.

2. Tomasi, W. (2004). *Electronic Communications Systems: Fundamentals through Advanced* (5th ed.). Pearson Education. India.

3. Kennedy, G., Davis, B., & Prasanna, S. R. M. (2011). *Kennedy's Electronic Communication Systems* (5th ed.). McGraw-Hill Education. India.

4. Kinsler, L. E., Frey, A. R., Coppens, A. B., & Sanders, J. V. (2000). *Fundamentals of Acoustics* (4th ed.). Wiley. United States.

5. Wilson, J., & Hawkes, J. F. B. (1998). *Optoelectronics: An Introduction* (3rd ed.). Prentice Hall. United Kingdom.

6. Singh, J. (1996). Optoelectronics: *An introduction to Materials and Devices*. McGraw-Hill. United States.

7. Bhattacharya, P. (1997). *Semiconductor Optoelectronic Devices* (2nd ed.). Prentice Hall. United States.

8. Nambiar, K. R. (2004). *Lasers: Principles, types and applications*. New Age International. India.

9. Ghatak, A. K., & Thyagarajan, K. (2017). *An introduction to Fiber Optics* (Reprint ed.). Cambridge University Press. India.

IV Semester B.Sc Physics Practicals

Compulsory (Practical Knowledge/Skill)

GPH404 (DSC): Physics Practicals-IV (Analog and Digital Electronics)

(This paper should not be offered to students studying Electronics Major)

(Minimum Eight experiments to completed)

Sl. No.	Experiments
1	PN junction diode characteristics.
2	Zener diode characteristics and Zener diode as voltage regulator.
3	Transistor characteristics (CE mode).
4	Transistor characteristics (CB mode).
5	Phase shift oscillator.
6	CE Amplifier gain and bandwidth.
7	Hartley oscillator.
8	Negative feedback amplifier.
9	Basic logic gates using transistors.
10	Logic gates-AND, OR, NOT, NOR, and XOR using IC 7400 and 7402.
11	Bridge rectifier with C and Pi filter.
12	FET characteristics.
13	Half adder.
14	Full adder.

(Course duration: 16 weeks with 4 Hours of instruction per week)

I, II, III & IV Semester Physics (Major-DSC) Question Paper Pattern

Max. Marks: 80   **Time: 3 hours**

PART – A

Answer any TWO of the following   **2 x 10 = 20**

(3 Long answer questions with two sub questions each (5+5/6+4)). Each question carrying 10 Marks to be asked from PART A.)

PART – B

Answer any TWO of the following   **2 x 10 = 20**

(3 Long answer questions with two sub questions each (5+5/6+4)). Each question carrying 10 Marks to be asked from PART B.)

PART – C

Answer any TWO of the following   **2 x 10 = 20**

(3 Long answer questions with two sub questions each (5+5/6+4)). Each question carrying 10 Marks to be asked from PART C.)

PART – D

Answer any FOUR of the following   **4 x 5 = 20**

(6 Numerical problems of 5 marks each, 2 from each PART to be asked)

III & IV Semester Physics (Elective-DSE)

Question Paper Pattern

Max. Marks: 80   **Time: 3 hours**

PART – A

Answer any TWO of the following   **2 x 10 = 20**

(3 Long answer questions with two sub questions each (5+5/6+4)). Each question carrying 10 Marks to be asked from PART A.)

PART – B

Answer any TWO of the following   **2 x 10 = 20**

(3 Long answer questions with two sub questions each (5+5/6+4)). Each question carrying 10 Marks to be asked from PART B.)

PART – C

Answer any TWO of the following   **2 x 10 = 20**

(3 Long answer questions with two sub questions each (5+5/6+4)). Each question carrying 10 Marks to be asked from PART C.)

PART – D

Answer any FOUR of the following   **4 x 5 = 20**

(6 concept-based questions/problems of 5 marks each, 2 from each PART to be asked)

Scheme of Valuation for Practicals (DSC)

C1 and C2 are internal tests to be conducted during 8th and 16th Weeks respectively of the semester. C3 is the semester-end examination conducted for 3 hours. The student will be evaluated on the basis of skill, comprehension and recording the results.

The student has to compulsorily submit the practical record for evaluation during C1 and C2. For C3, the record has to be certified by the Head of the Department.

The student is evaluated for 40 marks in C1, C2 and C3 as per the following scheme:

Component	Marks(C1)	Marks(C2)	Marks(C3)
Formula with proper units and explanation	5	5	8
Setting up the apparatus / circuit connections	5	5	5
Taking readings and tabulating	10	10	10
Calculations with or without Graph	8	8	10
Accuracy of result	2	2	2
Record	5	5	--
Viva	5	5	5
Total	**40**	**40**	**40**
Reduced to	**5**	**5**	

Panel of Examiners recommended by Board of Studies in Physics (2025-26)

Dr. Vinaykumar. L JSS College of Arts, Commerce & Science (Autonomous), BN Road, Mysuru-25	**Prof. Madhusudhan G J** Associate Professor, Govt. First grade college, Bengaluru
Dr. T.N.Mahadeva Prasad Govt. First Grade College Gundulpete	**Mr. Dhanushchandraguru H M** Sharadavilas College, Mysuru
Prof. Nagesh babu Yuvaraja college Mysuru	**Sri.M.Mallikarjunaswamy** JSS College for Women, Chamarajanagar.
Dr.S R Kumarswamy GFGWC, Byrapura T.N.Pura	**Smt.N.Bharathi** MMK & SDM College, Mysuru
Dr.Tippeswamy Government first grade college K.R.Nagara	**Mr. Niranjan** KSOU, Mysuru
Smt. Sowmya. B JSS College for Women, Saraswathipuram Mysuru	**Mr. Gowtham G K** Shivagangothri, Davangere University, Davangere
Sri. Umesh JSS College for Women, Saraswathipuram, Mysuru	**Mr. Karthik G** JSS College of Arts, Commerce & Science (Autonomous), BN Road, Mysuru-25
Sri. Jagadish.B JSS College of Arts, Commerce & Science (Autonomous), BN Road, Mysuru	**Sri. Sukanth.B.M** Yuvaraja College, Mysuru
Dr. Prasanna G D Shivagangothri, Davangere University, Davangere	**Dr. Khaleel Ahmed** Govt. Science College, Hassan
Sri. Sadashivaiah Yuvaraja college Mysuru	**Mr. Krishna Mohan** Maharani's science college for women Mysuru
Dr. Manjunatha. B.C. Yuvaraja college Mysuru	**Smt. Lakshmi S** JSS College of Arts, Commerce & Science (Autonomous), BN Road, Mysuru-25
Mr. Yashwanth D B JSS College for Women, Saraswathipuram, Mysore	**Smt. Shwetha** Yuvaraja college, Mysuru
Smt. Asharani T S JSS college for women Chamarajanagar	**Mr. Ravitheja R** JSS College, Nanjangud
Smt. Harshitha D B JSS college for women Chamarajanagar	**Smt. Sowmya.H.B** JSS college, Nanjangud

Smt. Thejakshi Govt. college for Boys , Mandya	**Smt. Roopadevi** Govt. First Grade College for Women's, Chamarajanagar
Kum. Manjuladevi.M Marimallappa college, Mysuru	**Smt. Mahalakshmi** Govt. College for boys, Mandya
Dr.Raman RIE , Mysuru	**Mr. Elizer vishwas** St. Philomenea's college, Mysuru
Dr.Santhosh RIE , Mysuru	**Dr. Shankarashan** NIE, Mysuru
Mr. Madhusudhana R NIE, Mysuru	**Mr. Mahadevaprasad P** SJCE, Mysuru
Smt. Shwetha U S JSS College of Arts, Commerce & Science (Autonomous), BN Road, Mysuru-25	**Smt. Thejaswini** Yuvaraja college, Mysuru
Smt. Milana Nagaraju Yuvaraja college, Mysuru	**Mr. Prathap** Sharadavilas College, Mysuru
Ms. Geethanjali Sharadavilas college, Mysuru	**Ms. Krupashree P** Yuvaraj's science college Mysuru

JSS COLLEGE OF ARTS, COMMERCE AND SCIENCE (AUTONOMOUS)
OOTY ROAD, MYSURU-25

DEPARTMENT OF PHYSICS

PROCEEDINGS OF THE MEETING OF BOARD OF STUDIES FOR THE PROGRAMMES BSc IN PHYSICS-CHEMISTRY-MATHEMATICS, PHYSICS-MATHEMATICS-COMPUTER SCIENCE AND PHYSICS-MATHEMATICS-ELECTRONICS, HELD ON 26th JULY 2025 AT 10.30 AM IN THE CHAMBER OF THE CHAIRMAN, DEPARTMENT OF PHYSICS, JSS COLLEGE, OOTY ROAD, MYSURU-25

MEMBERS PRESENT	SIGNATURE
Dr. Vinaykumar. L Asst. Professor & HOD Department of Physics JSS College, Ooty Road, Mysuru-25 **Chairman**	
Dr. S. Krishnaveni Professor and Chairperson DOS in Physics, Manasagangothri University of Mysore **(VC Nominee)**	
Dr. Shanmukhappa B Kaginelli Professor Department of Physics JSSAHER, Mysuru **(AC Nominee)**	
Dr. Prasanna .G. D Assistant Professor, Dos in Physics Shivagangothri, Davangere University, Davangere **(AC Nominee)**	
Mr. Purushothama .R Assistant Manager Skanray Technologies private limited Healthcare division, #360, KIADB Industrial area, Hebbal, Mysure-570018 Mob:9980565981, Email: Purushothama.r@skanray.com **Expert**	
Dr. Siddesha Associate Professor Department of MCA, SJCE, Mysuru Mob: 8884885076, Email: siddesh.shiv@sjce.ac.in **Alumini**	
Mr. Jagadish.B Assistant Professor, Department of Physics JSS College, Ooty Road, Mysuru-25 **Senior faculty**	

At the outset, the Chairman, BOS in Physics, welcomed the members to the meeting of BOS and briefed about the agenda to be discussed. The following agenda was placed by the Chairman which was discussed and resolved as follows:

Agenda 1: To frame/ revise, discuss and approve the Scheme/ Syllabus under modified NEP for the programmes: BSc in PCM, PMCs, PME from the academic year 2025-26 onwards.

The Chairman appraised the members about the three year modified NEP implementation for degree students as per University of Mysore norms and a draft revised/ modified Scheme/ Syllabus/panel of examiners was presented and placed before the Board for their opinion and approval.

Resolution: The BOS discussed about various aspects of the modified NEP and also suggested that as per the guidelines of University of Mysore and Government of Karnataka, the modified NEP programme can be implemented for the academic year 2025-26.

Agenda 2: To prepare the Panel of Examiners for the examinations for the year 2025-26.

The Chairman presented the proposed Panel of Examiners to I to VIII Semester examinations of 2025-26.

Resolution: After incorporating of certain changes suggested by the members, the Panel of Examiners was approved.

Agenda 3: Approval of Reference Books

The Chairman presented the proposed list of Reference Books to the Members.

Resolution: After incorporating of certain changes suggested by the members, the list of Reference Books was approved.

Agenda 4: Any other matter with the permission of the Chairman

--NIL--

Finally the meeting was concluded with the Chairman thanking the Members for their active participation in the deliberations of the meeting.

Chairman