

**JSS COLLEGE FOR WOMEN
(AUTONOMOUS)
SARASWATHIPURAM, MYSURU-09**



SUBJECT: PHYSICS

**BACHELOR OF SCIENCE GRADUATE COURSE
NEW SCHEME SYLLABUS UNDER CBCS**

2024-25 ONWARDS

COURSE STRUCTURE

Sem	Course	Paper	Title of paper	Instructions per week (Hrs)	Credits	Theory & Practical exams Max marks			Sub Total Marks C1+C2+C3	Grand Total Marks	Exam Duration (Hrs)
					L:T:P	C1	C2	C3			
I	DSC-1	Theory	Mechanics and properties of matter	03	3:0:0	10	10	80	100	150	03
		Practicals	Practical-1	04	0:0:2	05	05	40	50		03
II	DSC-2	Theory	Heat and Thermodynamics	03	3:0:0	10	10	80	100	150	03
		Practicals	Practical-2	04	0:0:2	05	05	40	50		03

PREFACE

The syllabus proposed herein for the B.Sc. course in Physics has evolved through detailed discussions with members of Physics faculty in our college as well as many other Physicists and Physics teachers. The changes proposed have constantly kept in mind certain basic approaches in Physics education along with the dynamism resulting from autonomy in education. We are very much aware that Physics forms a major driving force for the present day developments in technology and the consequent socio-economic development of the world at large. The rapid changes in technology and vast variety of the present day technologies put enormous pressure on the practitioners to ensure that their education is extensive as well as intensive. Consequently there is a need for constant upgrading and revision of basic inputs in education at all levels, ensuring a judicious mix of the topics chosen. We have taken the advantage of impetus gained through autonomy, the consequent academic freedom and the possibility of achieving high quality at the institutional level. We are equally aware of the immense responsibility it entails in ensuring a proper match between the products of the education and the professions they might get into restrictions arising primarily from considerations of the available time, manpower and financial resources have also been emphasized during the formulation of the contents. We also believe that there is a vast scope for future improvements and a pressing need for constant up gradation and revision of the contents. We would also urge that the individual teachers feel free to add, delete or modify topics of their choice and provide the relevant feedback to help improve the content formulation.

We thank and gratefully acknowledge the help we have received from all the member of the Physics community and a special thanks to all the members of the Board of Studies.

Program Outcomes (POs) for Bachelor of Science

PO 1: Domain Knowledge - Acquire and apply knowledge of science in relevant areas.

PO 2: Problem Analysis – Recognize real-world problems and user's requirements to propose solutions for the same using basic principles of science.

PO 3: Design and Development of Solutions – Developing solutions and inferences for complex problems using critical and analytical thinking.

PO 4: 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 5: Use of Modern Techniques/Tools – Use digital resources, various software/platforms and appropriate techniques to interpret concepts of science.

PO 6: Impact of Science on Society – To prepare competent human resources and to develop scientific attitudes at local and global levels for social benefit.

PO 7: Environment and Sustainability – Apply the knowledge gained for conserving the environment and to handle environmental issues with sustainable solutions.

PO 8: Moral and Ethical Values – Imbibe moral values and professional ethics to maintain integrity in a professional scenario while being aware of cultural diversities.

PO 9: Individual and Team Work with Time Management – Work productively in a team or as an individual while exhibiting time management skills.

PO 10: Communication – Develop the caliber to convey various concepts of science effectively.

PO 11: Project Management and Finance – Set up enterprises/companies and build entrepreneurship, project management and finance planning skills.

PO 12: Life-long Learning – Engage in the art of self-directed learning.

ISemesterB.ScPhysicsSyllabus

(DSC):MechanicsandPropertiesofMatter

Courseduration: 16weekswith3hoursofinstructionperweek.

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:16hours

Frames of Reference: Inertial and Non-inertial reference frames with examples.Uniform rectilinear motion in an inertial frame. Uniformly accelerated rectilinearmotion-concept of fictitious force-illustration; plumb line accelerometer and a freelyfalling elevator. Qualitative discussion of centrifugal force, Coriolis force and earthasanon-inertialframe,Numericalproblems.[4 hours]

Motion of a Point Particle: Point mass. The positionvector $r(t)$ of a movingpointparticleanditsCartesiancomponents.Velocityandaccelerationasthevector derivatives.Derivationofplanarvectorof a constant magnitude.Radial andtransverse components of velocity and acceleration for arbitrary planar motion,deductionofresultsforuniformcircularmotioncentripetalforce, Numerical problems.[4hours]

Rigid Body Dynamics: Review of definitions, Moment of inertia and radius ofgyration. Review of statements of the theorems of the parallel and perpendicularaxes.Relationbetweentorqueandangularacceleration.Expressionfor kineticenergy of a rigid body. Calculation of moment of inertia of rectangular lamina,circular lamina and of a solid cylinder. Theory of compound pendulum. Numericalproblems.[8hours]

PART - B: 16hours

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.[05 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 $\frac{dA}{dt} = \frac{1}{2} r^2 \dot{\theta}$. Central force: Physical insight into the nature of central forces. Kepler's laws of planetary motion- Derivations using Newton's laws. Numerical problems. [06 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). Conditions for a geostationary satellite. Numerical problems. [05 hours]

PART - C: 16 Hours

Elasticity: Concepts of moduli of elasticity, Hooke's Law and Poisson's ratio σ . Relation between the elastic constants σ , k , η and σ , limiting values for σ . Work done in stretching. Elastic potential energy. Bending moment. Theory of light single cantilever. I-section girders. Torsion – calculation of couple per unit twist. The Torsional pendulum, Static torsion. Searle's double bar experiment. Numerical problems. [7 hours]

Fluid Mechanics: Ideal fluid, equation of continuity, Bernoulli's theorem and application 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,SChandand Company (2007).
7. BrijLal, and Subrahmanyam N, Properties of Matter, 6th Edn., S Chand and Company (2002).
8. ShankaraNarayana S R, Mechanics and Properties of Matter, 2ndRevised Edn., Sultan Chand and Sons (1998).
9. Gaur R. K and S.L Gupta, Engineering Physics, DhanpantRai Publications, Eighth edition (2001).
10. AroraCL,RefresherCourseinB.Sc.PhysicsVol.1,RevisedEdn.,S ChandandCompany(2008).

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§ion=3>

ISemesterB.ScPhysicsPractical

DSC - 1:Practical

Courseduration: 16weekswith4hoursoflabworkperweek.

(MinimumEIGHT ofthefollowingexperimentsmust be done)

1. Barpendulum:Determinationoftheaccelerationduetogravityand radiusofgyration (graphicalmethod).
2. Flywheel:Determinationofmomentofinertia,massanddensity.
3. Dropweightmethod:Determinationofsurfacetensionofliquidand interfacialtension betweentwo liquids.
4. Young'smodulus:Singlecantilevermethodusingtravellingmicroscope
5. Searle'sdoublebar:DeterminationofYoung'smodulus,rigiditymod ulusandPoisson's ratio.
6. Torsionalpendulum:Determinationoftherigiditymodulusofthe givenwire.
7. DeterminationoftheYoung'smodulusbydynamicmethod(usinggraph).
8. Spiralspring:Determinationoftheaccelerationduetogravityandu nknownmass (graphicalmethod).
9. Determinationofradiusofgyrationandmomentofinertiaofarectan gularbodyin threedifferent axes.
10. Stokes'method:Determinationofcoefficientofviscosityofviscousl iquids.
11. Determinationofrigiditymodulusbythestatic-torsionmethod.
12. DeterminationofYoung'smodulusbythemethodofuniformbending.
13. Young's modulus byKoenig's method.
14. Verification of Hook's law.

II Semester B.Sc Physics Syllabus

DSC - 2: Heat and Thermodynamics

Course duration: 16 weeks with 3 hours of instruction per week.

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 $U = \frac{3}{2}RT$. 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 thermodynamics (Kelvin's & Clausius's statement 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 Transitions 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 the 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. Vander 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 with basic definition and units, Exhaust pump and their characteristics, Measurement of flow 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. ShankaraNarayana: Heat and Thermodynamics, 2nd edition, Sulthan Chand and Sons, 1990.
8. Gaur R.K and S.L Gupta, Engineering Physics, DhanpantRai 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>

IISemesterB.ScPhysicsPractical

DSC - 2:Practical

Courseduration:16weekswith4hoursoflabworkperweek.

(MinimumEIGHTofthefollowingexperiments must be done)

1. VerificationofGaussiandistributionandcalculationofstandarddeviation - MonteCarloexperiment.
2. SpecificheatbyNewton'slawofcooling-graphicalmethod.
3. VerificationofStefan-Boltzmannlawusingameterbridgeorapotentiometer.
4. DeterminationofthermalconductivityofabadconductorbyLee-Charlton method.
5. Determination of temperature coefficient of resistance ofa thermistor.
6. Determination of temperature coefficient of resistance ofa copper wire.
7. Determination of Boltzmann constant.
8. Dice experiment-Randomocityverification.
9. VerificationofStefan'sfourthpowerlawusinganelectricallamp.
10. Determination of surface temperature of a blackbody analyzing the blackbody spectrum.
- 11.CoefficientofthermalconductivityofcopperbySearle'sapparatus.
- 12.VerificationofClausius–
Clapeyronequationanddeterminationofspecificenthalpy.
- 13.DeterminationofSolarconstant.
14. Determination of boiling point of a liquid by using a platinum resistancethermometer.
15. MechanicalEquivalentofHeat byCallenderandBarne'smethod.
16. Determination of temperature coefficient of resistance ofa platinumresistancethermometer.

Scheme of Valuation for Theory & Practical

Theory: The student performance is evaluated for 20 marks each in C1 and C2, and they must be normalised to 10 marks each. C3 should be conducted for 80 marks as per the university order.

Practical:

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. The record certified by the Head of the Department has to be submitted during C3.

The student is evaluated for 10 marks in C1 and C2 as per the following scheme:

Experiment: 8 marks, **Record:** 2 marks.

The marks scored are then normalized to 5 marks.

The student is evaluated for 40 marks in C3 as per the following scheme:

Component	Marks
Experiment	35
Viva	05
Total	40

The evaluation of experiment conducted is carried out as per the following scheme:

Component	Marks
Formula with proper units and explanation	5
Setting up the apparatus / circuit connections	5
Taking readings and tabulating	10
Calculations	10
Graph and accuracy of result	5
Total	35

DSC–Physics QuestionPaper Pattern for I and II Semester

MaxMarks: 80

Time:03hours

PART – A

Answer any TWO of the following: 2 x 8 = 16

(3 Long answer questions with two or three sub questions to be asked from Unit-1. Each question carrying 8 Marks)

PART – B

Answer any TWO of the following: 2 x 8 = 16

(3 Long answer questions with TWO or three sub questions to be asked from PART - B. Each question carrying 8 Marks)

PART – C

Answer any TWO of the following: 2 x 8 = 16

(3 Long answer questions with TWO or THREE sub questions to be asked from PART - C. Each question carrying 8 Marks)

PART – D

Answer any FOUR of the following: 4 x 4 = 16

(Numerical problems: TWO from each Unit to be given)

PART – E

Answer any EIGHT of the following: 8x2=16

(4 short answer questions from each Unit to be given)

PANEL OF EXAMINERS

SL.NO	NAME OF EXAMINER	NAME OF THE COLLEGE	CONTACT NO
1.	Dr.Vinaykumar.L	JSS College Ooty road, Mysore	
2.	Karthik	JSS College Ooty road, Mysore	
3.	Jagadeesh B	JSS College Ooty road, Mysore	
4.	Lakshmi S	JSS College Ooty road, Mysore	
5.	Shwetha U S	JSS College Ooty road, Mysore	
6.	Meghana R	JSS College Ooty road, Mysore	
7.	Sri.Mallikarjunswamy	JSS College chamarajanagar	
8.	Sri.C. Nageshbabu	Yuvaraja's College, Mysore	
9.	Dr.B.C. Manjunath	Yuvaraja's College, Mysore	
10.	Sri.T.Sadashiviah	Yuvaraja's College, Mysore	
11.	Sukhanth	Yuvaraja's College, Mysore	
12.	Sunitha Rani	Yuvaraja's College, Mysore	
13.	Milana	Yuvaraja's College, Mysore	
14.	Krupashree P	Yuvaraja's College, Mysore	
15.	Sushma	Yuvaraja's College, Mysore	
16.	Dr S R Kumaraswamy	GFGC for Women, Kabini Colony, Byrapura, T N Pura	
17.	Dr.Rashmi P E	Maharani's Science College, Mysore	
18.	Dr.Nagaraju	Maharani's Science College, Mysore	
19.	Dr.Srinivas P	Maharani's Science College, Mysore	
20.	Girish L N	Maharani's Science College, Mysore	
21.	Dr.VinduVahini	Maharani's Science College, Mysore	
22.	Shivu	Maharani's Science College, Mysore	
23.	Dr.Krishnamohan	GFGC, Hassan	
24.	Reema	GFGC, Channapatna	
25.	Dr. GalebheSatishBabu	GFGC, Hunsur	
26.	Sophia	Terisian College, Mysuru	

27.	Dr.Mahadeva Prasad T N	GFGC, Gundlupet	
28.	Kavitha	GFGC, Pandavpura	
29.	Dr.Shivaprasad	GFGC, Chamarajanagar	
30.	Chandan	GFGC, Chamarajanagar	
31.	Manjunath	GFGC, Chamarajanagar	
32.	Prof.Gunasheelan	St Philomenas college Mysore	
33.	Prof.NagarajUrs	St Philomenas college Mysore	
34.	Ravitheja	JSS College, Nanjangud	
35.	Prof.Roopu	Govt First grade college,Bannur	
36.	Sri. S Shreekanth	NIE First Grade College, Mysore	
37.	Dr.Poornima S	SBRR Mahajana FGC, Mysuru	
38.	Umesh V.	JSSCW,Saraswathipuram, Mysore	
39.	Yashwanth D.B.	JSSCW,Saraswathipuram, Mysore	
40.			

Chairman, BOE is authorized to approve additional members if required.