

JSS COLLEGE FOR WOMEN

(AUTONOMOUS)

SARASWATHIPURAM, MYSURU-09



SUBJECT: PHYSICS

BACHELOR OF SCIENCE GRADUATE COURSE

REVISED NEP SCHEME

2026-27 ONWARDS

JSS College for Women (Autonomous), Saraswathipuram, Mysuru-09

PROCEEDINGS

Proceedings of the of the **Board of Studies in Physics** meeting held on 23rd July 2026.

The meeting of Board of Studies in Physics was convened at 11.30AM on 23rd July 2026 in the Department of Physics, JSS College for Women (Autonomous), Saraswathipuram, Mysuru-09

The Chairman welcomed the esteemed members of the board and requested to give their valuable suggestions to incorporate in the syllabus which is implemented from the academic year 2026-27.

The following members were Present in the meeting

1. Smt.Sowmya B, Assistant Professor, JSS College for Women (Autonomous), Mysuru - Chairman
2. Dr.S R Kumaraswamy, Professor, GFGC, Kabini Colony, T N Pura - Principal Nominee
3. Dr.Mahadevaprasad T N, Professor, GFGC, Gundlupet, Chamarajanagara - AC Nominee
4. Dr.Chandra, Assistant Professor, NIE College, Manathavadi Road, Mysuru- Principal Nominee
5. Mr.Amoghavarsha N, Project Associate-1, COSMOS Mysuru, Indian Institute of Astrophysics Vijnana Bhavan, Manasagangotri, Mysuru - Principal Nominee
6. Sri.Umesh V, Assistant Professor, JSS College for Women (Autonomous), Mysuru – Senior Faculty
- 7.Sri.Yashwanth D B, Assistant Professor, JSS College for Women (Autonomous),Mysuru–Senior Faculty
8. Kum.Divya A, Assistant Professor, MMS & SDM Mahila Vidyalaya, Mysuru.- Alumni- Principal Nominee

The following member took leave of Absence

1. Prof. Sridhar M A, Professor, DoS in Physics, Manasagangotri, Mysuru

With subject to the Syllabus provided by the University of Mysore, all the members of the Board discussed in length and made a deep analysis on various topics and recommended valuable suggestions to frame the Theory part and Practical part for the new **RNEP Scheme** Syllabus for Third Fourth, Fifth and Sixth semesters and the Value Added Program/COP on the title “**Basic Electronics**” for the Academic year 2026-2027 and onwards.

Resolutions:

The Board of studies approved both theory and practical syllabus for III semester to VI semester with minor changes in theory part along with the addition of few experiments in the Practical segments. The Board members also approved the course frame work, examination pattern, department regulations, the panel of examiners and question paper pattern.

This Approved RNEP scheme syllabus should be effective from the academic year 2026-2027.

The copy of the B.Sc Physics Syllabus under RNEP Scheme is annexed herewith.

JSS COLLEGE FOR WOMEN (AUTONOMOUS), SARASWATHIPURAM MYSURU-9
DEPARTMENT OF PHYSICS
COMPOSITION OF BOARD OF STUDIES 2026-27

Sl. No.	Name	Designation & Position	Category	Address	Phone No	Signature
1	Smt. Sowmya B.	Assistant Professor & Chairman	AC Nominee	JSS College for Women Saraswathipuram Mysuru	9886161982	
2.	Prof. Sridhar M A	Professor & Member	University (VC Nominee)	DoS in Physics University of Mysuru.	9448048645	
3.	Dr. Kumaraswamy S R	Professor & Member	Principal Nominee	GFGCW, Kabini Colony, T N Pura, Mysuru	9845718972	
4.	Dr. Mahadevaprasad T N	Professor & Member	AC Nominee	Dept. of Physics GFGC, Gundlupete Chamarajanagara University	9880361234	
5.	Dr. Chandra	Assistant Professor & Member	AC Nominee	Dept. of Physics The NIE College (VTU) Mananthavadi Road, Mysuru	9980209605	
6.	Mr. Amoghavarsha N	Member (Industrialist)	Principal Nominee	Project Associate-1 COSMOS Mysuru Indian Institute of Astrophysics Vijnana Bhavan, Manasagangotri Mysuru	6362159474	
7.	Kum. Divya A.	Lecturer & Member (Alumni)	Principal Nominee	MMS & SDM Mahila Vidyaleya, Mysuru	8050433575	
8.	Sri. Umesh V.	Assistant Professor & Senior faculty	Principal Nominee	Dept. of Physics JSSCW, Saraswathipuram, Mysuru-09	8453471291	

Course Structure

Discipline Specific Courses (DSC), Discipline Specific Elective (DSE) and Compulsory Skill/Practical paper (CSP)

II Year

Course type and Title		Hours/ week		Credits	Maximum Marks			Exam Duration	Total Marks
					IA	SEE			
		L	T/P		C1	C2	C3		
Physics- III Sem									
DSC(3)	Waves, Acoustics and Optics	3	0	3:0:2 5 credits	10	10	80	03 hours	150
DSC(3)- Lab	Waves, Acoustics and Optics	0	4		05	05	40	03 hours	
DSE(1)	Laser and fiber optics	2	0	2:0:0 2 credits	05	05	40	02 hours	50
Physics- IV Sem									
DSC(4)	Electricity and Electromagnetism	3	0	3:0:2 5 credits	10	10	80	03 hours	150
DSC(4)- Lab	Electricity and Electromagnetism	0	4		05	05	40	03 hours	
DSE(2)	Communication Systems	2	0	2:0:0 2 credits	05	05	40	02 hours	50
CSP(1)	Laser and Fiber Optics lab	0	4	0:0:2 2 credits	05	05	40	03 hours	50

Course type and Title		Hours/ week		Credits L: T: P	Maximum Marks			Exam Duration	Total Marks
		L	T/P		IA		SEE		
					C1	C2	C3		
Physics- V Sem									
DSC(5)	Classical Mechanics, Quantum Mechanics and Atomic Spectroscopy	3	0	3:0:0 3 credits	10	10	80	03 hours	100
DSC(6)	Nuclear and Particle Physics	3	0	3:0:0 3 credits	10	10	80	03 hours	100
DSC- Lab	Classical Mechanics, Quantum Mechanics, Atomic Spectroscopy and Nuclear Physics	0	4	0:0:2 2 credits	05	05	40	03 hours	50
Physics- VI Sem									
DSC(7)	Relativity and Solid State Physics	3	0	3:0:0 3 credits	10	10	80	03 hours	100
DSC(8)	Astrophysics and Molecular Spectroscopy	2	0	2:0:0 2 credits	05	05	40	02 hours	50
DSC- Lab	Relativity and Solid State Physics	0	4	0:0:2 2 credits	05	05	40	03 hours	50

Department Regulations

1. Teaching instruction per week:

For III to VI Semester:

“Course duration: 16 weeks with 3 hours of instructions per week.”

- a) Lecture classes: DSC-3 Hrs of duration per week (One Paper).
- b) Practical classes: DSC- 4Hrs of duration per week (One Practical).

2. Examination:

a) Theory:

C1- Will be assessed for III to VI semester for 10 marks after the completion first half of the semester by 8th week through test / assignment/ attendance/ seminar/ activity/ projectsin group/ poster presentation (after the completion of 50% of the syllabus).

C2- Will be assessed for III to VI semester for 10 marks after the completion second half of the semester by 16th week through test / assignment/ attendance/ seminar/ activity/ projectsin group/ poster presentation (after the completion of rest of 50% of the syllabus).

C3-Examinations for III to VI semester are conducted at the end of every semester for THREE hours of duration. The question paper shall be set for a maximum of 80 marks.

b) Practical:

C1- Will be assessed for III to VI semester for 05 marks after the completion first half of the semester by 8th week through

experiment/continuous assessment of experimental work/record completion/procedure writing/viva/ attendance (after the completion of 50% of the experiments).

C2- Will be assessed for I & II semester 05 marks after the completion first half of the semester by 16th week through experiment/continuous assessment of experimental work/record completion/procedure writing/viva/ attendance (after the completion of rest of the 50% of the experiments).

C3-Examinations for III to VI semester are conducted at the end of every semester for THREE hours of duration for a maximum of 40 marks. ONE experiment shall be conducted in each practical examination (I & II semester).

3. Eligibility criteria for students :

Only the students who have scored minimum 40% in C1 and C2 are eligible to take C3 examination.

4. Eligibility criteria for teaching faculty:

- a) Paper setting-the teacher with minimum of 5 years of teaching experience in the first grade college are eligible to set the question paper.
- b) Paper valuation and practical examination – the teacher with minimum of 3 years of experience is eligible to become an examiner and evaluator.

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 feed back 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.

DSC(3) Syllabus for B.Sc. Physics

Semester III

Course Title: DSC(3)- Waves, Acoustics and Optics	
Course Title: DSC(3)- Lab: Waves, Acoustics and Optics	
Course Credits: 05 (3:0:2)	Hours of Teaching/Week: 03 (Theory) + 04 (Practical)
Total Contact Hours: 48 Hours (Theory) 64 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 Waves, Simple harmonic motion and their Analysis of complex waves.
CO2	Comprehending the topic of Acoustics, Ultrasonics, Velocity of light and Interference.
CO3	Acquiring knowledge on concepts of Diffraction and Polarization.

UNIT-I : 16 Hours

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.

[08 hours]

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

[05 hours]

Analysis of complex waves: Fourier theorem. Evaluation of Fourier co-efficient.

Analysis of square wave and saw tooth wave.

[03hours]

UNIT-II : 16 Hours

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.

[08 hours]

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

[02 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-anti reflective coatings, Newton's rings. Interference at a wedge. Michelson's interferometer - Measurement of λ and $d\lambda$. Numerical Problems.

[06 hours]

UNIT-III : 16 Hours

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. [08 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. [08 hours]

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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.
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DSE (1) Syllabus for B.Sc. Physics

Semester III

Course Title: DSE (1): Laser and fiber optics	
Course Credits: 02 (2:0:0)	Hours of Teaching/Week: 02 (Theory)
Total Contact Hours: 32 Hours (Theory)	Formative Assessment Marks: 10(Theory)
Exam Duration: 02 Hours (Theory)	Semester-End Examination Marks: 40 (Theory)

Course Outcomes (COs)	
CO1	Gaining the knowledge on parameters of Laser and its applications.
CO2	Acquiring the knowledge on Fibers optics types and its characteristics.

UNIT -I: 16 Hours

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, numerical problems. [5 hours]

Laser oscillator: Pumping schemes, gain, threshold conditions; optical resonators. numerical problems. [4 hours]

Types of lasers: Construction and principles of working of Nd-YAG, CO₂ and dye lasers and semiconductor laser. [3 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]

UNIT- II: 16 Hours

Fiber optics and dielectric wave guides: Waveguide – slab wave guide, modes, V number, modal material and waveguide dispersions, numerical problems. [4 hours]

Optical fiber: 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 fiber, multimode step-index fiber, graded index fiber; advantages and disadvantages. Numerical problems [4 hours]

Energy losses in optical fiber: Bit rate, dispersion optical fiber communication, and optical bandwidth, absorption and scattering, op to coupler. [4 hours]

References

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- 2.Singh, J. (1996). Optoelectronics: An introduction to materials and devices. McGrawHill. United States.

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DSE (2) Syllabus for B.Sc. Physics

Semester IV

Course Title: DSE (2): Communication Systems	
Course Credits: 02 (2:0:0)	Hours of Teaching/Week: 02 (Theory)
Total Contact Hours: 32 Hours (Theory)	Formative Assessment Marks: 10(Theory)
Exam Duration: 02 Hours (Theory)	Semester-End Examination Marks: 40 (Theory)

Course Outcomes (COs)	
CO1	Comprehension of characteristic importance in communication system, and behavoiural knowledge on transdurecers.
CO2	Acquiring the knowledge on Radio communication , Modulators,Amplifiers and other communication systems

UNIT -I: 16 Hours

Signal and 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]

UNIT- II: 16 Hours

Radio communication: Role of ionosphere in radio communication, need for modulation, amplitude modulation, modulation index, side bands, band width and the power of AM wave, frequency modulation (definition), difference between AM and FM, block diagram of super heterodyne AM receiver. [3 hours]

Demodulation: Detection and demodulation of FM signal using Foster Seeley discrimination. [3 hours]

Amplifiers used in communication: Classes and types of amplifiers, AF, IF and RF amplifier [3 hours]

Other Communication Systems: Principles of Microwave and satellite communication, wire telephone, simplex and duplex systems. [3 hours]

References

1. Dennis Roddy and John Coolen, J. (2008). Electronic communications (4th ed.). Pearson Education. New Delhi, India.
2. Wayne Tomaal, (2004). Electronic communications systems: Fundamentals through advanced (5th ed.). Pearson Education. New Delhi, India.
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CSP(1)

Compulsory (Practical Knowledge/Skill) -Syllabus for B.Sc. Physics

Semester IV

Course Title: CSP (1) –CSP Lab	
Course Credits: 02 (0:0:2)	Hours of Teaching/Week: 04 (Practicals)
Total Contact Hours: 64 Hours (Practicals)	Formative Assessment Marks: 10 (Practicals)
Exam Duration: 03 Hours (Practicals)	Semester-End Examination Marks: 40 (Practicals)

Course Outcomes (COs)	
CO1	Applying the skill of determining the characteristics of laser and its applications.
CO2	Executing the skill to determine the characteristics of Optical fiber and its applications

CSP (2) -CSP Lab

Any EIGHT of the following experiments:

1. To determine the Wavelength of LASER light using plane diffraction grating
2. Diffraction of LASER by thin wire
3. Divergence of LASER beam
4. Diffraction hallows experiment to determine the size the particle
5. Measurement of Numerical Aperture of optical fiber
6. To determine refractive index of the material of a prism
7. Optocoupler experiment
8. Attenuation coefficient of optical fiber
9. PN junction diode characteristics.
10. Zener diode characteristics
11. Zener diode as voltage regulator.
12. Young's Modulus by Cornu's method
13. LED Characteristics
14. Solar Cell characteristics

References

1. Wilson, J., & Hawkes, J. F. B. (1998). Optoelectronics: An introduction (3rd ed.). Prentice Hall. United Kingdom.
2. Singh, J. (1996). Optoelectronics: An introduction to materials and devices. McGrawHill. United States.
4. Nambiar, K. R. (2004). Lasers: Principles, types and applications. New Age International. India.

5. Ghatak, A. K., & Thyagarajan, K. (2017). An introduction to fiber optics (Reprint ed.). Cambridge University Press. India.

DSC(5) Syllabus for B.Sc. Physics

Semester V

Course Title: Classical Mechanics, Quantum Mechanics and Atomic Spectroscopy	
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	Comprehension of Newton's laws of motion, conservation momentum and energy. Also to gain knowledge on constraints, degrees of freedom and harmonic oscillator and Hamiltonian mechanics.
CO2	Explaining the minimum uncertainty of measuring both observables on any quantum state and Analyze the time-dependent and time-independent Schrödinger equation for simple potentials like for instance one-dimensional potential well and Harmonic oscillator.
CO3	Interpretation of Electron, atomic spectra of elements and Zeeman effect.

UNIT-I : 16 Hours

Lagrangian formulation: Constraints, Holonomic constraints, non-holonomic constraints, Scleronomic and Rheonomic constraints. Generalized coordinates, degrees of freedom, Principle of virtual work, D'Alembert's principle (no derivation), Lagrange equations. Newton's equation of motion from Lagrange equations, simple pendulum, Atwood's machine. Numerical problems. [07 hours]

Variational principle: Hamilton's principle, Deduction of Hamilton's principle, Lagrange's equation of motion from Hamilton's principle. [03 hours]

Hamiltonian Mechanics: The Hamiltonian of a system, Hamilton's equations of motion, Hamilton's equations from variational principle, Canonical transformations, Poisson Brackets, fundamental properties and equations of motion in Poisson Brackets. Numerical problems. [06 hours]

UNIT-II : 16 Hours

Introduction to Quantum Mechanics: Matter waves, de Broglie hypothesis of matter waves, Group and Phase velocities and relation between them, Experimental evidence for matter waves: Davisson- Germer experiment, G.P Thomson's experiment and its significance. Numerical problems. [04 hours]

Elementary proof of Heisenberg's relation between momentum and position, energy and time, angular momentum and angular position, illustration of uncertainty principle by Gamma ray microscope thought experiment. Consequence of the uncertainty relation (electron cannot exist in nucleus). [05 hours]

Wave function and its admissibility, Born's interpretation of the wave function, Normalization and orthogonality of wave functions, Schrödinger time dependent and independent equations. Eigen values and Eigen functions, Application of Schrödinger equation for i) Free particle in one dimensional box of infinite height, ii) Simple harmonic oscillator (Qualitative), Concept of zero - point energy. Numerical problems. [07 hours]

UNIT-III : 16 Hours

Electron: Properties of electron, determination of e/m of an electron by Thomson method, determination of the charge of the electron by Millikan's oil-drop method. Numerical problems . [04 hours]

Atomic spectra: A qualitative account of Sommerfeld relativistic atomic model, excitation and ionization potentials – Frank - Hertz experiment, vector model of an atom - electron spin and space quantisation, quantum numbers associated with vector atom model. Magnetic moment of an electron due to its orbital motion, evaluation of Bohr magneton, Stern-Gerlach experiment with necessary theory. Spin-orbit interaction and the fine structure of spectral lines. Pauli's exclusion principle, electronic configuration of atoms, LS and jj coupling for multi electron system. Numerical problems. [08hours]

Zeeman effect : Zeeman effect and its types, experimental study of normal Zeeman effect, classical theory of normal Zeeman effect (expression for Zeeman shift). Stark effect and Paschen back effect (qualitative). Numerical problems. [04 hours]

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DSC(6) Syllabus for B.Sc. Physics

Semester V

Course Title: DSC(6): Nuclear and Particle Physics	
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	Comprehension of the topics of properties of Nuclei, Radioactivity decay and Detectors.
CO2	Gaining the knowledge on the concepts of Accelerators, Interaction of nuclear radiation with matter , Mass spectrography and Nuclear Models.
CO3	Acquiring the knowledge on Nuclear reactions, Nuclear Fission and Fusion, Cosmic rays and Elementary particles.

UNIT-I : 16 Hours

Properties of nuclei: Constituents of nucleus and their intrinsic properties, Nuclear mass, density, charge and size. Binding energy curve and its significance. Nuclear force and its characteristics. Numerical problems. [04 hours]

Radioactivity decay: Radioactivity, half-life, mean life, relation between half-life and mean life, theory of successive disintegration, (condition for secular and transient equilibrium), Alpha decay, expression for alpha disintegration energy, experimental determination of range and energy of alpha particle, Geiger-Nuttall law, β -decay (β^+ and β^- decay), electron capture, neutrino hypothesis, Gamma decay, internal conversion, nuclear isomerism and auger transition. Numerical problems. [08 hours]

Detectors: GM Counter (construction, working and its characteristics), Basic principle of Scintillation detector, construction and working of photo-multiplier tube (PMT), Principle of semiconductor detector. Numerical problems. [04 hours]

UNIT-II : 16 Hours

Accelerators: Construction, Working and Theory of LINAC, Cyclotron and Betatron. Numerical problems. [04 hours]

Interaction of nuclear radiation with matter: γ -ray interaction through matter, photoelectric effect, Compton scattering, pair-production, energy loss due to ionization (qualitative description of Bethe Bloch formula), energy loss of electrons introduction of Cerenkov radiation. [05 hours]

Mass spectrographs: Construction, Working and Theory of Dempster's and Aston's mass spectrograph. Numerical problems. [03 hours]

Nuclear Models: Liquid-drop model, Semi-empirical mass formula, Salient features of Shell model and magic numbers. Numerical problems. [04 hours]

UNIT-III : 16 Hours

Nuclear reactions: Q-values Threshold energy of an endoergic reaction. Reactions induced by proton, deuteron and α -particles. Numerical problems. [03 hours]

Nuclear Fission & Fusion: Estimation of the fission energy on the basis of the liquid-drop model, four-factor formula, nuclear reactors - Pressurized Heavy Water Reactor, Thermo nuclear reactions-sources of stellar energy (C-N cycle and P-P cycle), Electric and magnetic confinement of plasma-Tokamak, nuclear waste management, radiation dose. Numerical problems. [06 hours]

Cosmic Rays: Discovery, Primary and secondary cosmic rays- their composition, Cosmic ray showers, Origin of cosmic rays, elements of Cascade theory, Geomagnetic, Latitude and Altitude effects. [04 hours]

Elementary particles: Particles and anti- particles. Classification of particles Mention of the basic interactions in nature and conservation laws a qualitative introduction to quarks (quark model). [03 hours]

References

1. Concepts of nuclear physics by Bernard L. Cohen. (Tata McGraw Hill, 1998).
2. Introduction to the physics of nuclei & particles, R.A. Dunlap. Thomson Asia, 2004.
3. Introduction to High Energy Physics, D.H. Perkins, Cambridge Univ. Press
4. Basic ideas and concepts in Nuclear Physics - An Introductory Approach by K. Heyde (Institute of Physics (IOP) Publishing, 2004).
5. Radiation detection and measurement, G.F. Knoll, John Wiley & Sons, 2000.
6. Physics and Engineering of Radiation Detection, Syed Naeem Ahmed (Academic Press, Elsevier, 2007).
7. Atomic and molecular spectra and lasers: Saxena A K, 1stEdn.,CBS publishers and distributors (2009)
8. Nuclear Physics: Kaplan I,2ndEdn., Narosa Publishing House(2002)'
9. Fundamentals of modern physics: Duggal and chabra, 8th edition S. Chand Publishing. 1997
10. Modern Physics, R. Murugesan and K. Shivaprasath S; Chand Publishing, 2025.

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1. <https://helgeson.es/types-radiation-detectors>
2. <https://gcgldh.org/downloads/e-Content/Learning-Material/Physics/GENERAL-PROPERTIES-OF-NUCLEI.pdf>

DSC Lab Syllabus for B.Sc. Physics

Course Title: DSC lab- Classical Mechanics, Quantum Mechanics, Atomic Spectroscopy and Nuclear Physics	
Hours of Teaching/Week: 04 (Practical)	
Total Contact Hours: 64 Hours (Practical)	Formative Assessment Marks: 10 (Practical)
Exam Duration: 03 Hours (Practical)	Semester-End Examination Marks: 40 (Practical)

Course Outcomes (COs)	
CO1	Analyse and Apply the concepts of Classical Mechanics, Quantum Mechanics and Atomic Spectroscopy to Physics laboratory work.
CO2	Apply the principles of nuclear and particle physics to analyze nuclear phenomena, radioactive processes and the fundamental constituents and interactions of matter.

DSC- Lab

Classical Mechanics, Quantum Mechanics, Atomic Spectroscopy and Nuclear Physics

List of Experiments

(Minimum EIGHT experiments must be completed)

Unit I

Sl. No.	Experiments
1.	Determination of 'g', the acceleration due to gravity, at a given place, by simple pendulum (L v/s T^2).
2.	Determination of acceleration of gravity by Flywheel.
3.	Determination of acceleration due to gravity by Stoke's method
4.	To study the characteristics of solar cell.
5.	Determination of wavelength of laser using diffraction grating.
6.	To determine the diameter of the given wire by LASER diffraction.
7.	To determine the ionization potential of Xenon.

Unit II

1.	Study the characteristics of Geiger-Muller Tube.
2.	Verification of inverse square law for gamma rays using GM counter.
3.	Determination of range of electrons in aluminium using GM Counter.
4.	Attenuation of gamma rays in lead foil using Cs-137 source and G M counter.
5.	Analysis of Stellar Spectra..
6.	Absorption coefficient of beta rays in aluminium foil using GM counter.
7.	Analysis of HBr Spectra.

DSC(7) Syllabus for B.Sc. Physics

Semester VI

Course Title: DSC(7): Relativity and Solid State Physics	
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	Gaining the knowledge on Special theory of relativity and Superconductors.
CO2	Comprehending the knowledge of Free electron theory of metals and Dielectrics.
CO3	Acquire knowledge about Crystal structure and X-rays, Magnetism and Specific heat of solids.

Unit- I: 16 Hours

Special theory of relativity: Michelson–Morley experiment and discussion of negative results, basic postulates of relativity, Lorentz transformation, Lorentz–Fitz Gerald length contraction, Einstein time dilation, velocity addition theorem, relativity of simultaneity, variation of mass with velocity, Einstein mass–energy relation, energy–momentum relation. Numerical problems. [12 Hours]

Superconductivity: Elementary Ideas, Isotopic Effect, Meissner Effect, Persistent Current, Critical Magnetic Field, Type I and Type II Superconductors, BCS Theory (Qualitative), applications. Numerical problems. [04 hours]

Unit-II: 16 Hours

Free electron theory of metals: Classical free electron model (Drude–Lorentz model), expression for electrical and thermal conductivity, Wiedemann–Franz law, failure of classical free electron theory. Quantum free electron theory (Assumptions), statement of number of available energy states between E and $E+dE$, Fermi energy and Fermi level, expression for Fermi energy at absolute zero and $\langle E \rangle = 3/5 E_{F0}$. Numerical problems. [08 hours]

Dielectrics: Dielectric material and its properties, static dielectric constant, polarizability (electronic, ionic and orientational polarizability – qualitative), calculation of Lorentz field (derivation), Clausius–Masotti relation, dielectric loss, piezoelectric effect, application of Piezoelectric effect (Production of Ultrasonic Waves), Methods of determining dielectric constant of solids and liquids. Numerical problems. [08 hours]

Unit-III: 16 Hours

Crystal structure and X-rays: Crystal, space lattice, translational vectors, basis of crystal structure (definition only), primitive and non-primitive cells, a brief mention of crystal systems, Miller indices, expression for inter planar spacing, continuous X-ray spectra, Duane–Hunt limit, characteristic X-ray spectra, Moseley’s law and its

significance, Bragg's law, Bragg's spectrometer (construction and working), Compton effect – expression for Compton shift. Numerical problems. [07 hours]

Magnetism: Magnetic intensity (H), magnetic induction (B), magnetization (M), permeability (μ), susceptibility (χ), classification of magnetic materials, classical theory of dia and paramagnetism (Langevin theory), Curie's Law, Curie–Weiss Law, ferromagnetic domain (qualitative), hysteresis curve (B–H curve) and its significance, hard and soft magnetic materials. Numerical problems. [05 hours]

Specific heat of solids: Dulong and Petit's Law (statement only) and its limitations, Einstein's theory of specific heat, Debye's theory of specific heat. Numerical problems. [4 hours]

References

1. Modern Physics, R. Murugesan and K. Shivaprasath S; Chand Publishing
2. Gravity: An Introduction to Einstein's General Relativity; James B. Hartle; Cambridge University Press
3. A First Course in General Relativity; Bernard Schutz; Cambridge University Press
4. Introduction to General Relativity: A Course for Undergraduate Students of Physics ;James B. Hartle; Cambridge University Press
5. Feynman Lectures Volume 1 – Chapters on Special Relativity ;Addison-Wesley
6. Solid State Physics; S. O. Pillai; New Age International Publishers
7. Solid State Physics (Theory, Applications and Problems); S. L. Kakani & C. Hemarajani; Sultan Chand & Sons
8. Solid State Physics; Adrianus J. Dekker; Macmillan Publishers / Red Globe Press (Palgrave Macmillan)
9. Introduction to Solid State Physics; Charles Kittel; John Wiley & Sons;
10. Solid State Physics; Vijay Kumar & Bhupinder K. Gupta; S. Chand Publishing
11. Solid State Physics; P. K. Palanisamy; Scitech Publications
12. Solid State Physics; S. L. Kakani & C. Hemarajani; Sultan Chand & Sons

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1. https://sist.sathyabama.ac.in/sist_coursematerial/uploads/SPH1316.pdf
2. <https://byjus.com/physics/special-theory-of-relativity/>
3. https://asutoshcollege.in/new-web/Study_Material/Electric%20properties_Notes_6_23042020.pdf

DSC(8) Syllabus for B.Sc. Physics

Semester VI

Course Title: DSC(8)- Astrophysics and Molecular Spectroscopy	
Hours of Teaching/Week: 02 (Theory)	
Total Contact Hours: 32 Hours (Theory)	Formative Assessment Marks: 10 (Theory)
Exam Duration: 02 Hours (Theory)	Semester-End Examination Marks: 40 (Theory)

Course Outcomes (COs)	
CO1	Acquiring the knowledge on Stellar Properties, Stellar Classification and Evolution and Stellar pressure and temperature
CO2	Gaining knowledge on the concepts of Molecular spectroscopy and Raman effect concept.

UNIT-I : 16 Hours

Stellar Properties: Introduction, Stellar parallax, Units of stellar distance, Definition of absolute magnitude, Apparent brightness, Apparent magnitude, Absolute magnitude, Bolometric magnitude, Expression for radius of a star. Numerical problems. [04 hours]

Stellar Classification and Evolution: Mass–luminosity relation , Hertzsprung–Russell (H–R) diagram, Gravitational P.E. of a star, Virial theorem (statement), Birth of stars, Source of stellar energy (p-p cycle, C–N cycle), Red giant phase, White dwarf, Chandrasekhar mass limit, Supernova, Neutron star, Maximum mass of neutron star, Pulsars, Black holes. Numerical problems. [05 hours]

Stellar pressure and temperature: Pressure gradient inside a star, Reformulating ideal gas equation, Core pressure of a star, Core temperature of a star, Average temperature of a star, Surface temperature and colour of a star, Photon diffusion time, Shift for main sequence of stars, Expression for lifetime of a star. Numerical problems. [07 hours]

UNIT-II : 16 Hours

Molecular Spectroscopy: Types of molecules based on their moment of inertia, types of molecular motions and energies, Salient features of molecular spectra, theory of pure rotational spectra, qualitative discussion on non-rigid rotator and centrifugal distortion, theory of vibrating molecule as simple harmonic oscillator (energy levels and spectra), theory of rotational-vibrational spectra of molecule, Fluorescence and Phosphorescence. Numerical Problems. [11 hours]

Raman Effect, Stokes and Anti-stokes lines, quantum theory of Raman Effect, experimental study of Raman effect, applications of Raman effect. Numerical problems. [05 hours]

References

1. An Introduction to Astrophysics; Baidyanath Basu, Tanuka Chattopadhyay, Sudhindra Nath Biswas; PHI Learning
2. The Structure of the Universe; Jayant Vishnu Narlikar; Oxford University Press
3. Astrophysics: A New Approach; S. K. Saha; Narosa Publishing House

4. What Are the Stars?; Ganesan Srinivasan; Universities Press
5. Introduction to Cosmology; Jayant Vishnu Narlikar; Jones and Bartlett Publishers
6. An Introduction to Modern Astrophysics; Bradley W. Carroll & Dale A. Ostlie; Cambridge University Press
7. Molecular Structure and Spectroscopy; G. Aruldas; Prentice Hall of India
8. Spectroscopy (Atomic and Molecular); Gurdeep R. Chatwal & Sham K. Anand; Himalaya Publishing House
9. Molecular Spectroscopy; V. K. Jain; Narosa Publishing House
10. Fundamentals of Molecular Spectroscopy; C. N. Banwell & E. M. Mc Cash; McGraw Hill Education

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DSC lab: Syllabus for B.Sc. Physics

Semester VI

Course Title: DSC -Lab: Relativity and Solid State Physics lab	
Hours of Teaching/Week: 04 (Practical)	
Total Contact Hours: 64 Hours (Practical)	Formative Assessment Marks: 10 (Practical)
Exam Duration: 03 Hours (Practical)	Semester-End Examination Marks: 40 (Practical)

Course Outcomes (COs)	
CO1	Gaining practical knowledge in conducting experiments to determine fundamental physical constants, semiconductor properties, thermal and electrical characteristics of materials, and optical properties using standard laboratory instruments and experimental techniques
CO2	Analyze and interpret experimental data using appropriate mathematical models and graphical methods, including X-ray diffraction techniques, to evaluate material properties such as lattice parameters, particle size, Hall coefficient, mobility, and Fermi energy, while estimating experimental uncertainties.

DSC-Lab: Relativity and Solid State Physics lab

List of Experiment **Credit : L:T:P**
(Minimum EIGHT experiments must be completed)

Sl.No.	Experiments
Unit -1	
1	To determine Planck's constant using Photocell.
2	To determine Planck's constant using LED
3	Determination of Dielectric Constant of polar liquid.
4	Energy gap of semiconductor.
5	Temperature coefficient of resistance of a Thermistor.
6	Specific Heat of Solid by Electrical Method
Unit -2	
7	Analysis of powder X-ray diffraction spectra(calculation of lattice parameter)..
8	Hall Effect in semiconductor: determination of mobility, hall coefficient
9	Determination of particle size from XRD pattern using Debye-Scherrer formula.
10	Determination of particle size from XRD pattern using Williamson Hall Plot.
11	Analysis of single crystal X-ray diffraction spectra(I v/s 2θ).
12	Fermi Energy of Copper.

Continuous Formative Evaluation / Internal Assessment (DSC/DSE)

Total marks for each course shall be based on continuous assessments and semester end examinations. The pattern is 20:80 for DSC and for Practical Examination 10:40 for IA and Semester End Examination respectively. The pattern is 10:40 for DSE IA and Semester End Examination.

	THEORY DSC	THEORY DSE	PRACTICAL DSC & CSP
Total Marks	100 Marks	50 Marks	50 Marks
Continuous Assessment – 1 (C1)	10 Marks	05 Marks	05 Marks
Continuous Assessment – 2 (C2)	10 Marks	05 Marks	05 Marks
Semester End Examination (C3)	80 Marks	40 Marks	40 Marks

Evaluation Process of IA Marks shall be as follows:

- The first component (C1) of assessment is for 10% marks. This shall be based on test, assignment, seminar, case study, field work, project work etc. This assessment and score process should be completed after completing 50% of syllabus of the course and within 45 working days of semester program.
- The second component (C2) of assessment is for 10% marks. This shall be based on test, assignment, seminar, case study, field work, internship/industrial practicum/project work, quiz etc. This assessment and score process should be based on completion of remaining 50% of syllabus of the course of the semester.
- During the 17th – 19th week of the semester, a semester end examination shall be conducted by the college for each course. This forms the third and final component of assessment (C3) and the maximum marks for the final component will be 80%.
- In case of a student who has failed to attend the C1 or C2 on a scheduled date, it shall be deemed that the student has dropped the test. However, in case of a

student who could not take the test on scheduled date due to genuine reasons, such a candidate may appeal to the Principal. The Principal in consultation with the concerned teacher shall decide about the genuineness of the case and decide to conduct special test to such candidate on the date fixed by the concerned teacher, but before commencement of the concerned semester end examinations.

- e) For assignments, case study analysis etc., of the students should bring their own answer scripts (A4 size), graph sheets etc., required for such tests/assignments and these be sealed/signed by the concerned department at the time of conducting tests/assignment/project work etc.
- f) The outline for continuous assessment activities for Component-I (C1) and Component-II (C2) of a course shall be as under:

	DSC			DSE		
	C1 marks	C2 marks	Total marks	C1 marks	C2 marks	Total marks
Session Test	10	--	10	05	--	05
Seminar/Presentation /Assignment/Activity/ Case Study/Field Work/Project Work/Quiz etc.	--	10	10	--	05	05
Total	10	10	20	05	05	10

- g) Conduct of Test, Seminar, Case study/Assignment etc., can be either in C1 or in C2 component as decided by the college and concerned department/teacher.
- h) The teachers concerned shall conduct test/seminar/case study etc., The students should be informed about the modalities well in advance. The evaluated courses assignments during component I (C1) and component II (C2) of assessment are immediately provided to the candidates after obtaining acknowledgement in the register by the concerned teacher(s) and maintained by the Department. Before commencement of the semester end examination, the evaluated test, assignment etc., of C1 and C2 shall be obtained back to maintain them till the announcement of the results of the examination of the concerned semester.
- i) The marks of the internal assessment shall be published on the notice board of the department/college for information of the students.

- j) The internal assessment marks shall be communicated to the CoE at least 10 days before the commencement of the semester end examinations and the CoE shall have access to the records of such periodical assessments.
- k) The student is eligible to appear for C3 examination, only if he has scored 30% in C1 & C2 put together.
- l) Internal assessment marks may be recorded separately. A candidate who has failed or rejected the result, shall retain the internal assessment marks.

Scheme of Valuation for Practical Examinations

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 during C1 and C2. For C3, the record has to be certified by the Head of the Department.

- The student is evaluated for 10 marks in C1 and C2 as per the following scheme:
Experiment: 08, Record: 02.

The marks scored are then normalised for 5.

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

Component	Marks
Experiment	35
Viva	05
Total	40

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

Heading	Marks
Write up: Observations, Formula with proper units and explanation, relevant tabular column, diagrams/circuit diagrams, nature of curves, if there are any and calculations from it.	08
Setting up the apparatus/circuit connection	05
Taking reading and tabulating	10
Calculation with or without graph	10
Accuracy of result	02
Total	35

**DSC THEORY QUESTION PAPER PATTERN FOR
III , V and VI SEMESTER**

Max Marks: 80

Exam duration: 03 hours

Part A

Long answer questions from unit-I: Answer 2 out of 3 2×8=16

Part B

Long answer questions from unit-II: Answer 2 out of 3 2×8=16

Part C

Long answer questions from unit-III: Answer 2 out of 3 2×8=16

Part D

Numerical problems: One questions from each Unit 3×4=12

Part E

Short answer questions: 04 questions from each Unit to be given,
10 to be answered. 10×2=20

**DSE THEORY QUESTION PAPER PATTERN FOR
III AND IV SEMESTER**

Max Marks: 40

Exam duration: 02 hours

Part A

Long answer questions from unit-I: Answer 3 out of 4 3×5=15

Part B

Long answer questions from unit-II: Answer 3 out of 4 3×5=15

Part C

Short answer questions: 03 questions from each Unit to be given,
5 to be answered. 5×2=10

**DSC THEORY QUESTION PAPER PATTERN FOR
III , V and VI SEMESTER**

Max Marks: 80

Exam duration: 03 hours

PART – A

I. Answer any Two of the following **2 x 8 = 16**

1	(03 long answer questions with two or three subquestions. To be asked from UNIT-I).
2	
3	

PART – B

II. Answer any Two of the following **2 x 8 = 16**

4	(03 long answer questions with two or three subquestions. To be asked from UNIT-II).
5	
6	

PART – C

III. Answer any Two of the following **2 x 8 = 16**

7	(03 long answer questions with two or three subquestions. To be asked from UNIT-III).
8	
9	

PART – D

IV. Answer all questions **3 x 4 = 12**

10	Numerical problem from unit-I
11	Numerical problem from unit-II
12	Numerical problem from unit-III

PART – E

V. Answer any TEN of the following **10 x 2 = 20**

13	a,b,c,d	Questions from unit-I
	e,f,g,h	Questions from unit-II

	i,j,k,l	Questions from unit-III
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Scheme of Valuation for CSP

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

- The student is evaluated for 10 marks in C1 and C2 as per the following scheme:
Experiment: 08, Record: 02.

The marks scored is then normalised for 5.

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

Component	Marks
Experiment	35
Viva	05
Total	40

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

Heading	Marks
Write up: Observations, Formula with proper units and explanation, relevant tabular column, diagrams/circuit diagrams, nature of curves, if there are any and calculations from it.	08
Setting up the apparatus/circuit connection	05
Taking reading and tabulating	10
Calculation with or without graph	10
Accuracy of result	02
Total	35