B.Sc. PHYSICS
SYLLABUS
(Common core syllabus under CBCS)

With effect from the academic year: 2025-2026 and onwards

Accredited with 'A^{+}' by NAAC

DEPARTMENT OF PHYSICS
KAKATIYA UNIVERSITY
WARANGAL-506009,
TELANGANA

Annexure-I (Credits)

Proposed CBCS Structure from 2025-2026 for Under Graduate Course

Courses		Papers	Total Credits	Credits for each paper/ Semester					
				B.Sc					
				I	II	III	IV	V	VI
Core Courses (DSC)	Major-1	6	30	5	5	5	5	5	5
	Major-2	6	30	5	5	5	5	5	5
	Minor-1	4	20	5	5	5	5	---	----
MIL/AEC (First language)	English	4	20	5	5	5	5	---	----
Second Language (Telugu, Hindi, Urdu etc.,)		4	20	5	5	5	5	---	----
Multi Disciplinary Course	MDC-1	1	4	---	----	---	----	4	----
SEC 1,2		2	4	---	----	---	----	2	2
SEC 3,4		2	4	---	----	---	----	2	2
Value added course (VAC)	VAC 1,2	2	6	---	----	---	----	3	3
Internships	Internship/Project	1	4	---	----	---	----	---	4
Total Credits in each semester		----	142	25	25	25	25	21	21
Total Credits in UG		---	142						

B.Sc. PHYSICS SYLLABUS

SCHEME OF INSTRUCTIONS UNDER CBCS (w.e.f. 2025-26 academic year onwards)

Year	Semester	Title of the Paper [Theory and Practical]	Instructions Hrs/week	Number of Credits	Total Credits	Marks
1st Year	I Sem	Paper – I: Mechanics and Oscillations	4	4	5	100
		Practicals – I: Mechanics and Oscillations Lab	2	1		25
	II Sem	Paper – II: Thermal Physics	4	4	5	100
		Practicals – II: Thermal Physics lab	2	1		25
2nd Year	III Sem	Paper – III: Electromagnetic Theory	4	4	5	100
		Practicals – III : Electromagnetic Theory Lab	2	1		25
	IV Sem	Paper – IV : Optics	4	4	5	100
		Practicals – IV : Optics lab	2	1		25
3rd Year	V Sem	Paper –V : Modern Physics	4	4	5	100
		Practicals – V: Modern Physics lab	2	1		25
		Multi Disciplinary Courses (MDC-1):				
		Radiation Physics	4	4	4	100
		Skill Enhancement Courses (SEC):				
		SEC-1: Communications Skills/Professional Development Skills/ Entrepreneurship & Starts up	2	2	2	50
		SEC-3: Fundamentals of AI Tools/Ability Skills (Competitive Mathematics)	2	2	2	50
		Value Added Course (VAC)				
		VAC-1-Paper-1: Environmental Science (EVS)/ Cyber Security & Cyber laws	3	3	3	75

	VI Sem	Paper – VI : Solid State Physics & Solid State Devices	4	4	5	100
		Practicals VI : Solid State Physics & Solid State Devices lab	2	1		25
		Skill Enhancement Courses (SEC):				
		SEC-2: Professional Development Skills /Communications Skills/Entrepreneurship & Starts up	2	2	2	50
		SEC-4: Biomedical instrumentation	2	2	2	50
		Value Added Course (VAC)				
		VAC-2--Paper-2: Cyber Security & Cyber laws/Environmenta Science (EVS)	3	3	3	75
		Project work /Internship:				
		(Innovative Products making Skill (IPMS))	4	4	4	100

Total Credits: 52

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Under Graduate Courses (Under CBCS 2025–2026 onwards)

B.Sc (PHYSICS) II Year, SEMESTER-III
PAPER-III: ELECTROMAGNETIC THEORY

w.e.f academic year (2025-26) (CBCS)

Total: 56 Hrs (4hrs/week)

UNIT-I

Electrostatics: (8 hrs)

Electric Field, Concept of electric field lines and electric flux, Gauss's law (Integral and differential forms), application of Gauss's law-linear and plane, spherical charge distributions, Conservative nature of electric field 'E', Irrotational field, Electric potential: Concept of electric potential, relation between electric potential and electric field, potential energy of a system of charges, Energy density in an electric field, Calculation of potential from electric field for a spherical charge distribution.

Dielectrics: (6 hrs)

Dielectric properties of matter, Electric field in matter, polarization, polarization charge, electric susceptibility & dielectric constant, capacitors (Parallel, Spherical, Cylindrical plates) filled with dielectrics, Displacement vector D, Gauss Law in dielectrics, Relation of E, P & D.

UNIT-II

Magnetostatics: (14 hrs)

Concept of magnetic field 'B' and magnetic flux, Biot-Savart's law, B' due to a straight current carrying conductor, Force on a point charge in a magnetic field, properties of magnetic induction (B), curl and divergence of B, solenoidal field, Integral form of Ampere's law, Applications of Ampere's law- field due to current carrying straight conductor, circular coil and solenoidal, Energy stored in magnetic field., Magnetic energy in terms of current and inductance, Magnetic force between two current carrying conductors, Magnetic field intensity, Ballistic Galvanometer, Torque on a current loop in a uniform magnetic field, working principle of Ballistic Galvanometer, current and charge sensitivity, electromagnetic damping, critical damping resistance.

UNIT-III:

Electromagnetic Induction and Electromagnetic waves: (14 hrs)

Faraday's laws of induction (differential and integral form), Lenz's law, self and mutual Induction, Continuity equation, modification of Ampere's law, displacement current, Maxwell equations, Maxwell's equations in vacuum and dielectric medium, boundary conditions, Poynting's theorem, plane wave equation, transverse nature of EM waves, velocity of light in vacuum and in medium.

UNIT-IV:

Varying and alternating currents: (8 hrs)

Introduction, time constants in a LR and CR circuits (Growth and decay of currents), Growth and decay of currents in LCR circuits - Critical damping, Alternating current, relation between current and voltage in pure R,C and L-vector diagrams - Power in ac circuits, LCR series and parallel resonant circuit, frequency,Q-factor, AC & DC motors-single phase, three phase (basics only). RC low pass, High pass filters.

Network Theorems (6 hrs)

Passive elements, power sources, Active elements, Network models: T and π Transformations, Superposition theorem, Thevenin's theorem, Norton's theorem. Reciprocity theorem and Maximum power transfer theorem (problems).

NOTE: *Problems should be solved at the end of every chapter of all units.*

Reference/Suggested Books:

1) **Fundamentals of electricity and magnetism** by Arthur F.Kip (McGraw-Hill,1968)

2) **Electricity and magnetism** by J.H.Fewkes & JohnYarwood.Vol.I (Oxford Univ.Press, 1991).

3) Introduction to Electrodynamics,3rd edition, by DavidJ.Griffiths,(Benjamin Cummings,1998).

4)Electricity and magnetism by Edward M.Purcell (McGraw-HillEducation,1986)

5)Electricity and magnetism.by DC Tayal (Himalaya Publishing House,1988)

6) Electromagnetics by Joseph A.Edminister 2nd ed., (NewDelhi:TataMcGrawHill, 2006).

7) II year Physics by Telugu Academy, Telangana

B.Sc (Physics) -II year, Semester – III
Paper-III: Electromagnetic Theory practical lab

No. of hours per week: 2

1) To verify the Thevenin's Theorem
2) To verify Norton's Theorem
3) To verify Superposition Theorem
4) To verify maximum power transfer theorem
5) To determine a small resistance by Carey Foster's bridge.
6) To determine the (a) current sensitivity, (b) charge sensitivity, and (c) CDR of a B.G.
7) To determine high resistance by leakage method.
8) To determine coefficient of Mutual inductance by absolute method.
9) Determine the Band width, quality factor and resonance frequency of a Parallel LCR Circuit.
10) To determine self inductance of coil by Anderson's bridge using AC
11) Determine the Band width, quality factor and resonance frequency of a Series LCR Circuit.
12) Determine the time constant of L-R circuit.
13) Determine the time constant of RC circuit.
14) Determination of internal resistance of a cell by using potentiometer.
15) To determine the ratio of two capacitances by De Sauty's bridge.

Note: *Minimum of **Eight** experiments should be performed. Maximum of 15 students per batch and maximum of three students per experiment should be allotted in the regular practical class of three hours per week.*

Suggested Books:

1) B.L.Worsnop and H.T.Flint Advanced Practical Physics, Asia Publishing House, New Delhi
2) InduPrakash and Ramakrishna, A Text Book of Practical Physics, KitabMahal

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Under Graduate Courses (Under CBCS 2025–2026 onwards)

B.Sc PHYSICS II Year, SEMESTER – IV

PAPER–IV: OPTICS

w.e.f academic year (2025-26) (CBCS)

Total: 56 Hrs (4hrs/week)

UNIT-I:

Interference: (2 hrs)

Principle of super position-coherence-temporal coherence and spatial coherence-conditions for Interference of light.

Interference by division of wave front: **(5 hrs)**

Fresnel's biprism-determination of wavelength of light, Determination of thickness of a transparent material using Fresnel's biprism-change of phase on reflection-Lloyd's mirror experiment.

Interference by division of amplitude: (7 hrs)

Oblique incidence of a plane wave on a thin film due to reflected and transmitted light (Cosine law), Colors of thin films - Non-reflecting films, Interference by a plane parallel film illuminated by a point source, Determination of diameter of wire using wedge shaped. Determination of wave length of monochromatic light – Michelson Interferometer-types of fringes-Determination of wavelength of monochromatic light using Newton's rings (both transmitted & reflected light).

UNIT-II

Diffraction: (14 hrs)

Introduction-Distinction between Fresnel and Fraunhofer diffraction, Fraunhofer diffraction-Diffraction due to single slit and circular aperture-Limit of resolution- Fraunhofer diffraction due to double slit-Fraunhofer diffraction pattern with N slits (diffraction grating). Resolving Power of grating-Determination of wave length of light in normal and oblique incidence methods using diffraction grating.

Fresnel diffraction-Fresnel's half period zones-area of the half period zones -zone plate-
Comparison of zone plate with convex lens-Phase reversal zone plate-diffraction at a straight edge difference between interference and diffraction.

UNIT III:

Polarization: (14 hrs)

Introduction, Methods of Polarization, Polarization by reflection, refraction, double refraction, selective absorption , scattering of light-Brewster's law-Malus law-Nicol prism, polarizer and analyzer-Refraction of plane wave incident on negative and positive crystals (Huygen's explanation) - Quarter wave plate, Half wave plate-Babinet's compensator, optical activity, analysis of light by Laurent's half shade polarimeter.

UNIT IV:

Lasers and Holography: (14 hrs)

Lasers: Introduction, Laser principle, Metastable states, Stimulated emission, spontaneous emission, Optical pumping, population inversion and, Three-Level and Four-Level Lasers. Construction and working of Semiconductor Laser, Relationship among Einstein coefficients, Applications of Lasers.

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Holography: Basic Principles of Holography- Recording of amplitude and phase- The recording medium- Reconstruction of original wave front- Image formation by wave front reconstruction. Gaber Hologram- Limitations of Gaber Hologram-Off axis Hologram- Fourier transforms Holograms- Volume Holograms, Applications of Holograms.

NOTE: Problems should be solved at the end of every chapter of all units

Reference/Suggested books:

1) **Optics** by Ajoy Ghatak. *The McGraw-Hill companies.*
2) **Optics** by Subramanian and Brijlal. *S.Chand & Co.*
3) **Fundamentals of Physics** by Halliday/Resnick/Walker.*C.Wiley India Edition 2007.*
4) **Optics and Spectroscopy** by R.Murugeshan and Kiruthiga Siva Prasath .*S.Chand & Co.*
5) **Second Year Physics**–*Telugu Academy, Telangana*
6) **Modern Engineering Physics** by A.S. Vasudeva.*S.Chand & C o. Publications.*
7) **Feyman's Lectures on Physics**Vol.1, 2, 3 & 4.*Narosa Publications.*
8) **Fundamentals of Optics** by Jenkins A.Francis and White E.Harvey, *McGrawHill Inc.*
9) **Physical Optics** K.Ghatak,
10) **Optical and Atomic Physics** by D.P.Khandelwal, (Himalaya Publishing House,Bombay,1988)
11) **Fundamental of Optics** by Jenkins and White: (McGraw-Hill)
12) **Optics** by Smith and Thomson: (John Wiley and sons).

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B.Sc (Physics)-II year, Semester – IV

Paper–IV: Optics practical lab

No. of hours per week: 2

1) Determination of thickness of a wire using wedge method.
2) Determination of wave length of light using Biprism.
3) Determination of Radius of curvature of a given convex lens by forming Newton's rings.
4) Resolving power of grating.
5) Study of optical rotation-polarimeter.
6) Dispersive power of a prism.
7) Determination of wavelength of light using diffraction grating minimum deviation method.
8) Wavelength of light using diffraction grating-normal incidence method.
9) Resolving power of a telescope.
10) Wavelength of Laser light using diffraction grating.
11) Refractive index of a liquid and glass (Boys Method).
12) Pulfrich refractometer – determination of refractive index of liquid.
13) To determine the wavelength of laser source using diffraction of single slit.
14) To determine the wavelength of laser source using diffraction of double slits

Note: *Minimum of **Eight** experiments should be performed. Maximum of 15 students per batch and maximum of three students per experiment should be allotted in the regular practical class of three hours per week.*

Suggested Books

1. D.P. Khandelwal, "A laboratory manual for undergraduate classes" (Vani Publishing House, New Delhi).

2. S.P. Singh, "Advanced Practical Physics" (Pragati Prakashan, Meerut).

3. Worsnop and Flint- Advanced Practical physics for students.

4. "Practical Physics" R.K Shukla, Anchal Srivastav

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Internal Question paper pattern
Faculty of Science
B.Sc Physics

Duration: 90 Minutes**]** [Max. Marks: 20

Semester: **Internal: I**

Subject: **Date:**

Paper:

Answer all the Questions

Each question carries equal marks (2 x 10 = 20)

1) Unit – I
2) Unit – I
3) Unit – I
4) Unit – I
5) Unit – I
6) Unit – II
7) Unit – II
8) Unit – II
9) Unit – II
10) Unit – II

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Internal Question paper pattern
Faculty of Science
B.Sc Physics

Duration: 90 Minutes**]** [Max. Marks: 20

Semester: **Internal: II**

Subject: **Date:**

Paper:

Answer all the Questions

Each question carries equal marks (2 x 10 = 20)

1) Unit – III
2) Unit – III
3) Unit – III
4) Unit – III
5) Unit – III
6) Unit – IV
7) Unit – IV
8) Unit – IV
9) Unit – IV
10) Unit – IV

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Question paper pattern

Faculty of Science

B.Sc Physics

Title of the paper:

Paper:

Duration: 3Hrs] [Max. Marks: 80

Section-A: Short Answer Questions **(8 x 4 = 32)**

Answer any EIGHT questions

1) Unit – I
2) Unit – I
3) Unit – I (Problem)
4) Unit – II
5) Unit – II
6) Unit – II (Problem)
7) Unit – III
8) Unit – III
9) Unit – III (Problem)
10) Unit – IV
11) Unit – IV
12) Unit – IV (Problem)

Section B: Essay Answer Questions **(4 x 12 = 48)**

13) (a) Unit – I
OR

(b) Unit – I

14) (a) Unit – II
OR

(b) Unit – II

15) (a) Unit – III

OR

(b) Unit – III

16) (a) Unit – IV

OR

(b) Unit – IV

Annexure – I (Credits)

Proposed CBCS Structure from 2025-26 for Under Graduate Courses

Courses		Papers	Total Credits	Credits for each paper / Semester						Credits for each paper / Semester						Credits for each paper / Semester					
				BA						B.Com.						B.Sc.					
				I	II	III	IV	V	VI	I	II	III	IV	V	VI	I	II	III	IV	V	VI
Core Courses DSC	Major-1	6	30	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5
	Major - 2	6	30	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5
	Minor-1	4	20	5	5	5	5	-	-	5	5	5	5	-	-	5	5	5	5	-	-
MIL/AEC (First Language)	English	4	20	5	5	5	5	-	-	5	5	5	5	-	-	5	5	5	5	-	-
Second Language (Telugu, Hindi, Urdu, etc.)		4	20	5	5	5	5	-	-	5	5	5	5	-	-	5	5	5	5	-	-
Multi-Disciplinary Course	MDC 1	1	4	-	-	-	-	4	-	-	-	-	-	4	-	-	-	-	-	4	-
Sec 1, 2		2	4					2	2					2	2					2	2
Sec 3, 4		2	4					2	2					2	2					2	2
Value added course (VAC)	VAC 1, 2	2	6	-	-	-	-	3	3	-	-	-	-	3	3	-	-	-	-	3	3
Internships	Internship / Project	1	4	-	-	-	-	-	4	-	-	-	-	-	4	-	-	-	-	-	4
Total Credits in each semester			142	25	25	25	25	21	21	25	25	25	25	21	21	25	25	25	25	21	21
Total Credits in UG				142						142						142					
Credits under Non-CGPA (Community engagement and service)		NSS /NCC /sports / Extra curricular	6	Upto 6 (2 in each year)						Upto 6 (2 in each year)						Upto 6 (2 in each year)					
		IKS	4	Upto 4 (2 in each, after I & II years)						Upto 4 (2 in each, after I & II years)						Upto 4 (2 in each, after I & II years)					