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						

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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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KAKATIYA UNIVERSITY-WARANGAL-TELANGANA

Under Graduate Courses (Under CBCS 2025–2026 onwards)

B.Sc (PHYSICS) - I Year, SEMESTER – I

Paper–I: Mechanics and Oscillations

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

Total: 56 Hrs (4hrs/week)

UNIT–I

Vector Analysis: (7 hrs)

Scalar and Vector fields, Gradient of a Scalar field, Divergence and Curl of a Vector field and their physical significance and related problems. Vector integration, Line, Surface and Volume integrals. Applications of Stokes', Gauss's and Green's theorems.

Rigid body Dynamics: (7 hrs)

Definition of Rigid body, rotational kinematic relations, equation of motion for a rotating body, angular momentum and inertial tensor. Euler's equations, precession of a top, Gyroscope.

UNIT–II

Central Forces: (7 hrs)

Central forces-definition and examples, conservative nature of central forces, conservative force as a negative gradient of potential energy, equation of motion under a central force, gravitational potential and gravitational field, motion under inverse square law, derivation of Kepler's laws.

Special theory of Relativity: (7 hrs)

Galilean relativity, absolute frames, Michelson-Morley experiment, Postulates of special theory of relativity. Lorentz transformation equations, time dilation, length contraction, addition of velocities, mass-energy relation, Concept of four vector formalism.

UNIT – III

Oscillations: (14 hrs)

Simple harmonic oscillator and solution of the differential equation-Physical characteristics of

SHM, torsion pendulum measurements of rigidity modulus, compound pendulum, measurement of 'g', Damped harmonic oscillator, solution of the differential equation of damped oscillator, Energy considerations, logarithmic decrement, relaxation time, quality factor, differential equation of forced oscillator and its solution, amplitude resonance, velocity resonance.

UNIT–IV

Waves: (14 hrs)

Fundamentals of Waves -Transverse wave propagation along a stretched string, general solution of wave equation and its significance, modes of vibration of stretched string clamped at ends, overtones, energy transport, transverse impedance.

Longitudinal vibrations in bars- wave equation and its general solution, Special cases: i) Bar fixed at both ends, ii) Bar fixed at the midpoint, iii) Bar free at both ends, iv) Bar fixed at one end, Transverse vibrations in a bar - wave equation and its general solution.

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

Reference/Suggested Books

1) **Mechanics** by C.Kittel,W.Knight,M.A.Ruderman-Berkeley Physics Course.Vol.1, *Tata-Mc Grawhill Company Edition2008*.

2) Fundamentals of Physics.Halliday/Resnick/Walker *Wiley India Edition2007*.

3) **Theory of relativity - Resnick**

4) First Year Physics-*Telugu Academy*, Telangana

5) Introduction to Physics for Scientists and Engineers. F.J. Ruche. *McGraw Hill*.

6) Fundamentals of Physics by Alan Giambattistaetal *Tata-Mc Graw Hill Company* Edition, 2008.

7) University Physics byYoung and Freeman,*Pearson Education,Edition2005*.

8) Sears and Zemansky's University Physics by Hugh D.Young, Roger A.Freedman *Pearson Education Eleventh Edition*.

9) An introduction to Mechanics by Daniel Kleppner & Robert Kolenkow. *The McGraw Hill Companies*.

10) Mechanics by Hans & Puri. *TMH Publications*.

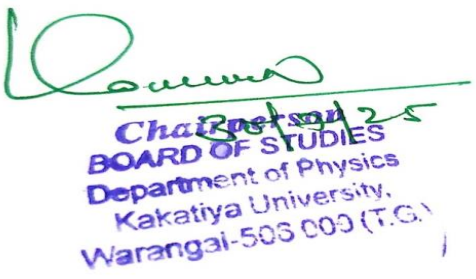
11) **Engineering Physics**. R.K.Gaur & S.L. Gupta. *Dhanpat Rai Publications*.

12) The Feymman Lectures in Physics, Vol.-1, R P Feymman, R B Lighton and MSands, BI Publications,

13) **Mechanics** by P.K.Srivastava-NewAge International.

14) **Mathematical Physics** by SatyaPrakash- Sultan Chand & Sons.

15) Vector Analysis by Murray R.Spiegel-2nd edition-Schaum's Outlines,Mc GrawHill Education



B.Sc (Physics) -I year, Semester - I
Paper–I: Mechanics & Oscillations Practical lab

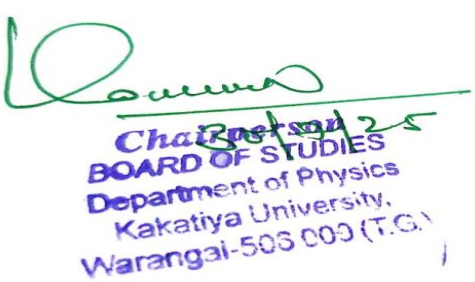
No. of hours per week: 2

1) Simple pendulum – Measurement of errors
2) Study of a compound pendulum-determination of 'g'and 'k'.
3) Determination of Young modulus by uniform bending of a wooden/ metal bar method.
4) Determination of moment of inertia of a flywheel.
5) Determination of rigidity modulus by torsion pendulum.
6) Determine of Viscosity of a fluid by poissuele method.
7) Determination of oscillations of a given spring constant and frequency by using combination of springs-series and parallel.
8) Study of Oscillations under bifilar suspension-Verification of axis theorems.
9) Determine surface tension of a liquid through capillary rise method.
10) Determine surface tension of a liquid by any other method.
11) Verification of laws of a stretched string using Sonometer. (Three Laws).
12) Calculation of slope and intercept of a Y= mX +C graph by theoretical method (simple pendulum experiment)
13) Determination of frequency of a Bar-Melde's experiment
14) Experimental analysis of gyroscope using simulation.
15) Verification of Stokes, Gauss-Divergence and Green's theorem using simulation.

***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 under graduate 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.KShukla, Anchal Srivastava.



KAKATIYA UNIVERSITY-WARANGAL-TELANGANA

Under Graduate Courses (Under CBCS 2025–2026 onwards)

B.Sc (PHYSICS) I Year, SEMESTER – II

Paper-II: Thermal Physics

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

Total: 56 Hrs (4hrs/week)

UNIT–I

Kinetic theory of gases: (4 hrs)

Introduction-Deduction of Maxwell's law of distribution of molecular speeds, Transport Phenomena-Viscosity of gases-thermal conductivity – diffusion of gases.

Thermodynamics: (8 hrs)

Basics of Thermodynamics-Carnot's engine (qualitative)-Carnot's theorem-Kelvin's and Clausius statements-Thermodynamic scale of temperature-Entropy, physical significance-Change in entropy in reversible and irreversible processes-Entropy and disorder-Entropy of universe -Temperature-Entropy (T-S) diagram - Change of entropy of a perfect gas-change of entropy when ice changes into steam, Application of entropy in waste management.

UNIT–II

Thermodynamic potentials and Maxwell's equations: (8 hrs)

Thermodynamic potentials-Derivation of Maxwell's thermodynamic relations-Clausius-Clayperon's equation-Derivation for ratio of specific heats-Derivation for difference of two specific heats for perfect gas.

Low temperature Physics: (8 hrs)

Joule Kelvin effect-liquefaction of gas using porous plug experiment, Joule expansion-Distinction between adiabatic and Joule Thomson expansion-Expression for Joule Thomson cooling-Liquefaction of helium, Kapitza's method-Adiabatic demagnetization-Production of low temperatures -Principle of refrigeration, vapour compression type, Thermocouple-seebeck effect, Peltier effect and Thomson's effect.

UNIT–III

Quantum theory of radiation: (14 hrs)

Black body-Ferry's black body-distribution of energy in the spectrum of Black body-Wein's displacement law, Wein's law, Rayleigh-Jean's law-Quantum theory of radiation-Planck's law-deduction of Wein's law, Rayleigh-Jeans law, Stefan's law from Planck's law.

Measurement of radiation using pyrometers-Disappearing filament optical pyrometer-experimental determination–Angstrom pyro heliometers-determination of solar constant, effective temperature of sun.

UNIT–IV

Statistical Mechanics: (14 hrs)

Introduction, postulates of statistical mechanics. Phase space, concept of ensembles and some known ensembles, classical and quantum statistics and their differences, concept of probability, Maxwell-Boltzmann's distribution law - Molecular energies in an ideal gas - Maxwell-Boltzmann's velocity distribution law (qualitative), Bose-Einstein Distribution law- application to Photon energy, Fermi-Dirac Distribution law- free electron gas, comparison of three distribution laws.

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

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Reference/Suggested books

1) **Fundamentals of Physics**.byHalliday/Resnick/Walker.*C.Wiley India Edition 2007.*
2) **Second Year Physics** –*Telugu Academy, Telangana*
3) **Modern Physics** by **R.**Murugeshan and Kiruthiga Siva Prasath (For Statstical mechanics) S. Chand & Co.
4) **Modern Physics** by G.Aruldhas and P. Rajagopal, *Eastern Economy Education.*
5) **Statistical Physics** by F.Reif Berkeley Physics Course.Volume-5,*The McGraw-Hill Companies.*
6) **An Introduction to Thermal Physics** by Daniel V. Schroeder.*Pearson Education Low Price Edition*.
7) **Thermodynamics** by R.C. Srivastava, Subit K. Saha & Abhay K. *Jain Eastern Economy Edition.*
8) **Modern Engineering Physics** by A.S.Vasudeva .*S.Chand & Co. Publications.*
9) **Feyman's Lectures on Physics** Vol. 1, 2, 3 & 4.*Narosa Publications.*
10) **Heat and Thermo dynamics**: K.W.Zeemansky.
11) **Introduction to statistical Mechanics**"by B.B. Laud (Macmillan 1981).
12) **Statistical Physics**" by F.Reif., (Mc Graw-Hill,1998)
13) **Statistical Physics"** by K.Haung., (Wiley Eastern 1988)

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B.Sc (Physics) - I year, Semester - II
Paper–II: Thermal Physics Practical lab

No. of hours per week: 2

1) Determination of Co-efficient of thermal conductivity of a bad conductor by Lee's method.
2) Determination of Stefan's constant-Stefan's experiment.
3) Determination of Specific heat of a liquid by using Newton's law of cooling method.
4) Determination of heating efficiency of electrical kettle with varying voltages.
5) Cooling Curve of a metallic body (Null method).
6) Determination of temperature coefficient of resistance using resistance thermometer.
7) Study of conversion of mechanical energy to heat.
8) Determination of Specific heat of a solid (graphite).
9) Thermal expansion of solids
10) Calibration of thermo couple
11) Simulations for T-S diagram

***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 under graduate classes"(Vani Publishing House, New Delhi).
2) S.P.Singh,"Advanced Practical Physics"(Pragati Prakashan, Meerut).
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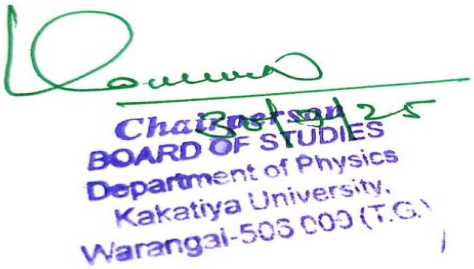

Internal Question paper pattern
Faculty of Science
B.Sc Physics

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)					