પરિપત્ર:

ભક્તકવિ નરસિંહ મહેતા યુનિવર્સિટીની સાયન્સ વિદ્યાશાખાનાં અભ્યાસક્રમ ચલાવતી તમામ સંલગ્ન કોલેજોનાં આચાર્યશ્રીઓને સવિનય જણાવવાનું કે સાયન્સ વિદ્યાશાખા હેઠળનો NEP-૨૦૨૦ અંતર્ગત ફિઝીક્સ વિષય સેમેસ્ટર-૫નો અભ્યાસક્રમ આ સાથે સામેલ છે.

માનનીય કુલપતિશ્રીની મંજુરી અનુસાર સદર અભ્યાસક્રમ શૈક્ષણિક વર્ષ જુન,૨૦૨૫ થી અમલવારી કરવાની રહે છે. સાયન્સ વિદ્યાશાખાનાં અભ્યાસક્રમ ચલાવતી તમામ સંલગ્ન કોલેજો ધ્વારા તેની અમલવારી કરવા જણાવવામાં આવે છે.

નોંધ: બીકેએનએમયુ/ એકેડેમિક/૨૧૨/૨૦૨૫ તા.૨૬/૦૫/૨૦૨૫નાં પરિપત્રમાં ફિઝીક્સ અભ્યાસ સમિતિનાં ચેરમેન દ્વારા અત્રેની યુનિવર્સિટીને મળેલ ઈમેઈલ મુજબ અભ્યાસક્રમમાં ફેરફાર કરવામાં આવેલ છે.

Bhakta Kavi Narsinh Mehta University Junagadh.

ખાસ ફરજ પરના અધિકારી
(એકેડેમિક)

ક્રમાંક/બીકેએનએમયુ/ એકેડેમિક/૫૦૫/૨૦૨૫
ભક્તકવિ નરસિંહ મહેતા યુનિવર્સિટી,
સરકારી પોલીટેકનિક કેમ્પસ,
ભક્તકવિ નરસિંહ મહેતા યુનિવર્સિટી રોડ,
ખડીયા, જૂનાગઢ-૩૬૨૨૬૩
તા.૦૪/૦૮/૨૦૨૫

પ્રતિ,

- ભક્તકવિ નરસિંહ મહેતા યુનિવર્સિટી સંલગ્ન સાયન્સ વિદ્યાશાખાનાં અભ્યાસક્રમો ચલાવતી તમામ કોલેજોના આચાર્યશ્રીઓ તરફ....

નકલ સાદર રવાનાઃ-

- માન.કુલપતિશ્રી/ કુલસચિવશ્રીનાં અંગત સચિવશ્રી.
- પરીક્ષા નિયામકશ્રી, ભક્તકવિ નરસિંહ મહેતા યુનિવર્સિટી, જુનાગઢ

નકલ રવાના જાણ તથા યોગ્ય કાર્યવાહી અર્થેઃ

- સીસ્ટમ મેનેજરશ્રી, આઇ.ટી.સેલ વિભાગ (વેબસાઇટ ઉપર પ્રસિદ્ધ થવા અર્થે.)

BHAKTA KAVI NARSINH MEHTA UNIVERSITY

JUNAGADH

BOARD OF STUDIES

FACULTY OF SCIENCE

SYLLABUS FOR PHYSICS (HONOURS)

PROGRAMME (SEMESTER- V)

EFFECTIVE FROM JUNE, 2025

BHAKTA KAVI NARSINH MEHTA UNIVERSITY
Syllabus of B.Sc. (Honors) as per NEP-2020
Faculty of Science
Effective from June 2025
Subject: Physics
SEMESTER-V

SUMMARY OF THE SYLLABUS

Sem No.	Sr. No.	Category of Course	Course Title	Course Level	Credit	Teaching Hrs.	SEE Marks	CCE Marks	Total Marks	Exam Duration
Sem-5	1	Major-11	MAJPHY511	5.5	4	60	50	50	100	2 hours
	2	Major-12	MAJPHY512	5.5	4	60	50	50	100	2 hours
	3	Major-13	MAJPHY513 (P)	5.5	4	120	50	50	100	4 hours
	4	Minor-4	MINPHY504	5.5	4	60	50	50	100	2 hours
	5	Minor-5	MINPHY505 (P)	5.5	4	120	50	50	100	4 hours
				Total	**22**					

BHAKTA KAVI NARSINH MEHTA UNIVERSITY
Syllabus of B.Sc. (Honors) as per NEP-2020
Faculty of Science
Effective from June 2025
Subject: Physics
SEMESTER-V

Course Level	U.G. (5.5)		**Internal Marks**	50
Programme	B.Sc in Physics		**External Marks**	50
Semester	V		**Practical Internal**	0
Category of Course	Major		**Practical External**	0
Course Credit	4		**Prac.External Exam Duration**	0
Teaching Hours	60		**Total**	100
Course Code	MAJPHY511		**Exam Duration**	2 Hrs
Course Title	Mathematical Physics, Classical Mechanics & Quantum Mechanics			

Course Objectives:

- The objective of this course is to provide students with a strong foundational understanding of the mathematical tools and physical principles underlying classical and quantum systems. The course aims to develop proficiency in mathematical methods essential for theoretical physics, like vector calculus and the Fourier series.
- Build a deep conceptual and analytical understanding of Classical Mechanics, focusing on Lagrangian and Hamiltonian formulations. Introduce the fundamental principles of Quantum Mechanics, emphasizing wave functions, operators, and the Schrödinger equation. Prepare students for advanced studies and research in theoretical and applied physics.

Course Learning Outcome: Upon completion of the course, students should be able to:

- Apply mathematical tools such as the Fourier series and vector calculus to solve problems in physics.
- Formulate and analyse classical mechanical systems using Newtonian, Lagrangian, and Hamiltonian approaches.
- Interpret and solve physical problems using conservation laws (energy, momentum, angular momentum) within classical mechanics.
- Understand the foundational principles of quantum mechanics, including the concept of wave-particle duality, quantization, operators, and different types of potentials.

Course Contents:

Unit No.	Syllabi	Teaching Hours
1	**Vector Analysis:** Gradient, The operator Del (∇), The Divergence, The Curl and their significance, Product rules, Integral Calculus – Fundamental theory for Gradient, Fundamental theorem for Divergences - Gauss's theorem, Fundamental theorem for Curls- Stokes theorem, Relations between fundamental theorems	**15**

	Fourier Series: Definition, Evaluation of the Coefficients of Fourier Series, Cosine Series, Sine Series, Dirichlet's Theorem (Statement only), Extension of Interval, Advantages of Fourier series, Properties of Fourier series, Physical Applications of Fourier series analysis (square wave, full wave rectifier, half wave rectifier, triangle wave), Numerical Problems.	
2	**Lagrangian and Hamilton Formulation:** Constraints, Generalized Coordinates, D'Alembert's Principle, Lagrange' Equations Of Motion, Some Applications of Lagrange' Equation of Motion (Linear Harmonic Oscillator, Simple Pendulum, Spherical Pendulum, Atwood Mechine) Cyclic or Ignorable Coordinates, Rayleigh's Dissipation Function, Hamilton's Principle, Equivalence Of Lagrange's And Newton's Equations, Lagrange's Undetermined Multipliers, Applications Of The Lagrangian Method Of Undetermined Multiplies, Hamilton's Equations Of Motion, Some Applications Of The Hamiltonian Formulation (Linear Harmonic Oscillator, Simple Pendulum, Compound Pendulum).	**15**
3	**The Schrodinger equation and Stationary States**: Schrodinger equation: A Free Particle in One Dimension generalization to Three Dimensions, The Operator Correspondence and the Schrodinger equation for a Particle subject to forces, Physical interpretation of psi (Ψ), Normalization and Probability interpretation, Non-Normalizable Wave Functions and Box Normalization, Conservation of Probability, Expectation Values, Ehrenfest's Theorem, Admissibility Conditions on the wave function, Stationary states: The Time Independent Schrodinger equation, A particle in a Square Well Potential.	**15**
4	**General Formalism of Wave Mechanics**: Schrodinger Equation and the Probability Interpretation for an N-Particle System, The Fundamental Postulates of Wave Mechanics, The Adjoint of an Operator, and Self-Adjointness, The Eigenvalue Problem; Degeneracy, Eigenvalues and Eigenfunctions of Self-Adjoint Operators, The Dirac-Delta function.	**15**

Suggested Reading:

Text Books:

1. Introduction to electrodynamics by David J Griffiths, Publisher: PHI.
2. Mathematical Physics by Rajput, Publisher: Pragati Prakashan, Meerut.
3. Introduction to Classical Mechanics by Takwale and Puranik. (Tata McGraw-Hill Pub Comp. Delhi).
4. Text Book of Quantum Mechanics by Mathews and Venkateshan, (Tata McGraw-Hill Pub. Comp.

Reference Books:

1. Mathematical Physics by H K Dass & Dr. Rama Verma, Publisher: S.Chand
2. Mathematical Physics by P.K.Chattopadhyay
3. Mathematical Methods in the Physical Sciences by Mary L. Boas: Wiley India, Third Edition
4. Classical Mechanics by Herbert Goldstain
5. Foundation of Classical Mechanics by P.C. Deshmukh: Cambridge University Press
6. Quantum Mechanics by Ajoy Ghatak
7. Quantum Mechanics Concept and Applications by Nouredine Zettili: Wiley Publications

BHAKTA KAVI NARSINH MEHTA UNIVERSITY
Syllabus of B.Sc. (Honors) as per NEP-2020
Faculty of Science
Effective from June 2025
Subject: Physics
SEMESTER-V

Course Level	U.G. (5.5)		**Internal Marks**	50
Programme	B.Sc in Physics		**External Marks**	50
Semester	V		**Practical Internal**	0
Category of Course	Major		**Practical External**	0
Course Credit	4		**Prac.External Exam Duration**	0
Teaching Hours	60		**Total**	100
Course Code	MAJPHY512		**Exam Duration**	2 Hrs
Course Title	Nuclear & Particle Physics			

Course Objectives:

- The objective of this course is to provide students with a fundamental understanding of nuclear physics, including the structure of nuclei, nuclear reactions, radioactivity, and elementary particles. Students will learn key concepts such as nuclear stability, binding energy, fission, fusion, and decay processes, along with their applications in science and technology.

Course Learning Outcomes: Upon completion of the course, students should be able to:

- Describe the structure of nuclei, nuclear models (shell, liquid drop), and properties like binding energy, stability, and angular momentum.
- Understand nuclear fission, nuclear fusion, stellar energy, and plasma confinement methods in controlled thermonuclear reactions.
- Understand radioactive decay and its applications.
- Classify elementary particles, the quark model, and fundamental interactions in particle physics.
- Solve numerical problems related to nuclear physics concepts.
- Recognize the significance of nuclear technology in energy production and scientific research.

Course Contents:

Unit No.	Syllabi	Teaching Hours
1	**General Properties of Nuclei & Nuclear Models:** Rutherford's alpha Scattering Experiment, Rutherford's Atom Model, Constitute of nucleus and their intrinsic properties, qualitative facts about size, mass, Charge, density, Nuclear angular momentum, Nuclear magnetic moment, Classification of Nuclei, Nuclear Stability, binding energy, main features of binding energy versus mass number curve, Shell model: Evidence of Shell Model, liquid drop model, Semi empirical mass formula and significance of various terms. Numerical Problems. **Nuclear Reaction:** Rutherford experiment for artificial transmutation, Q-value of Nuclear reaction, Type of Nuclear reactions, Energy balance in Nuclear reaction, Threshold energy of Endoergic reaction, Nuclear Transmutation, Numerical Problems.	**15**
2	**Nuclear Fission:** Discovery of Nuclear fission, Energy released in fission, Bohr & Wheeler's theory of fission, Chain reaction, Multiplication Factor, Critical Size, Atom bomb, Nuclear reactors, Use of Nuclear Reactor, Power Reactor, Breeder Reactor, Numerical Problems. **Nuclear fusion:** Nuclear fusion, Source of stellar energy, Thermonuclear reactions, Hydrogen Bomb, Controlled thermonuclear reaction, Fusion Reactor, Plasma Confinement – Gravitation Confinement, Magnetic Bottle, Tokamak, Inertial Confinement, Numerical Problems.	**15**
3	**Elementary Particles:** Introduction, The fundamental Interactions, Classification of Elementary Particles, Particles & Antiparticles, Antimatter, Elementary particle Quantum numbers, Conservation laws and symmetry, Quark model, The standard model.	**15**
4	**Radioactivity:** Natural Radioactivity, Properties of alpha, beta and gamma ray, The Law of Radioactive Decay, Half Life, Mean Life, Radioactive Series, Units of Activity, General Rule of Alpha and Beta Decay, Theory of alpha decay- Barrier Penetration, Beta Decay- Continuous beta ray spectrum- Difficulties in understanding it, Neutrino hypothesis and Fermi theory of Beta Decay, Gamma Decay–Gamma Ray emission, Nuclear isomerism, Internal Conversion, Application of Radio isotopes, Determination of the Age of Earth, Carbon Dating, Numerical Problems.	**15**

Suggested Reading:

Text Books:

1. Modern Physics by R.Murugeshan & Kiruthinga Sivaprasatha, Publication: S.Chand & Company Ltd.

Reference Books:

1. Nuclear Physics: An Introduction by S.B. Patel, Publisher: New Age International (P) Limited.
2. Nuclear Physics by D.C.Tayal, Publisher: Himalaya Publishing House.
3. Concept of Nuclear Physics by B.L.Cohen, Publisher: TMG
4. Nuclear Physics by Irving Kaplan. Publisher: Narosa Publishing House.
5. Nuclear Physics in a Nutshell by Carlos A. Bertulani: Princeton University Press

BHAKTA KAVI NARSINH MEHTA UNIVERSITY
Syllabus of B.Sc. (Honors) as per NEP-2020
Faculty of Science
Effective from June 2025
Subject: Physics
SEMESTER-V

Course Level	U.G. (5.5)		**Internal Marks**	0
Programme	B.Sc in Physics		**External Marks**	0
Semester	V		**Practical Internal**	50
Category of Course	Major		**Practical External**	50
Course Credit	4		**Prac.External Exam Duration**	2+2=4 Hrs
Teaching Hours	120		**Total**	100 Marks
Course Code	MAJPHY513 (P)		**Exam Duration**	
Course Title	Physics Practical			

Course Objectives:

- The objective of this course is to train the students in the accurate handling of scientific instruments and the correct methods of data collection. Students will understand the concept of fundamental physics through hands-on practice. With the help of this course analytical skills of students will improve by analyzing experimental data, recognizing patterns, and drawing logical conclusions.

Course Learning Outcomes: Upon completion of the course, students should be able to:

- Apply theoretical knowledge to design and perform physics experiments accurately.
- Demonstrate proficiency in using laboratory instruments and experimental techniques.
- Analyse and interpret experimental data to validate physical laws and principles.
- Develop skills in scientific communication by preparing clear, precise lab reports.
- Identify experimental errors and suggest methods to minimize them for better accuracy.
- Work collaboratively and ethically in a lab environment, promoting teamwork and responsibility.

Course Contents:

Unit	Syllabi	Teaching Hours
List of Experiments	**Part A:** 1. Determine the "g" using Kater's Pendulum 2. Study of Fabry-Perot Etalon 3. Study of Absorption Spectra of Iodine 4. Determine the constant of the Ballistic Galvanometer 5. Determine e/m using the Helical Method 6. Study of h-Parameter of CE-Transistor.	**60**

	7. An electronic voltmeter using an FET. 8. To determine the viscosity of a liquid by the log decrement method. 9. To determine the thermal conductivity of cardboard (a bad conductor) by Lee's Method. 10. To study the elliptical polarization of light using a babinet compensator. **Part B:** 1. Study of Damped Simple Harmonic Motion 2. To determine the capacitance or to compare capacitance by Wien Bridge. 3. Study of Double Refraction in Calcite Prism 4. To determine the radius of curvature of a given lens and the refractive index of glass using the optical lever method. 5. Determine e/m using the Magnetron Method. 6. Study of the Hysteresis Loop of Ferromagnetic Material. 7. Study of the Hartley oscillator 8. Study of Lloyd's Mirror. 9. To determine the Permeability of Free space. 10. Determine the Mutual Induction of coils using Ballistic Galvanometer.	

Suggested Reading:

1. Practical Physics by C.L.Arora (S.Chand)
2. Advanced Practical Physics by Chauhan & Singh. (Pragati Prakashan)
3. B. Saraf et al-Physics through experiments Vol. I & II
4. Electronic Laboratory Primer by Poorna Chandra & Sasikala, (S.Chand)
5. Practical Physics by Chattopadhyay, Rakshit & Saha.

BHAKTA KAVI NARSINH MEHTA UNIVERSITY
Syllabus of B.Sc. (Honors) as per NEP-2020
Faculty of Science
Effective from June 2025
Subject: Physics
SEMESTER-V

Course Level	U.G. (5.5)		**Internal Marks**	50
Programme	B.Sc in Physics		**External Marks**	50
Semester	V		**Practical Internal**	0
Category of Course	Minor		**Practical External**	0
Course Credit	4		**Prac.External Exam Duration**	0
Teaching Hours	60		**Total**	100
Course Code	MINPHY504		**Exam Duration**	2 Hrs
Course Title	**Introduction to Astronomy**			

Course Objectives:

- This course introduces fundamental concepts of astronomy, including celestial observations, telescopes, stellar evolution, and solar phenomena. Students will explore planetary motion, electromagnetic spectrum applications in astronomy, star formation processes, and the life cycles of stars, while gaining practical knowledge of observational techniques and astronomical tools.

Course Learning Outcomes: Upon completion of the course, students should be able to:

- Demonstrate understanding of celestial mechanics, including retrograde motion and sidereal time calculations.
- Describe telescope types, mounting systems, and interferometry in observations.
- Analyse star formation, stellar evolution, and end-stage objects like white dwarfs, supernovae, and black holes.
- Explain solar phenomena like sunspot cycles, coronal activity, and magnetic field generation.

Course Contents:

Unit No.	Syllabi	Teaching Hours
1	**Introduction to Astronomy:** Overview, Scales and Dimensions, Night Sky, Earth, Sun and Solar System, Retrograde Motion of Planets, Sidereal Time, Astronomical Catalogs and Software.	**15**
2	**Observations in Astronomy:** Electromagnetic Wave, Electromagnetic Spectrum, Telescope, Refractor Telescope, Reflecting Telescope, Observations at Visible Frequencies, Theoretical Limit on Resolution, Seeing, Mounting of Telescope, Equatorial Mount, Azimuthal Mount,	**15**

	Interferometry, Observations at Other Frequencies.	
3	**Star Formation and Stellar Evolution:** Early Stage of Star Formation, Fragmentation, Evolution on the Main Sequence, Degenerate Free Electron Gas, Evolution beyond the Main Sequence, Population I and II Stars, White Dwarfs, Neutron Stars, Black Holes, Supernova.	**15**
4	**The Sun:** Solar Atmosphere, Photosphere, Chromosphere, Corona, Dynamo Mechanism for Magnetic Field Enhancement, Sunspots and the Solar Cycle, Some Transient Phenomena.	**15**

Suggested Reading:

Text Books:

1. An Introduction to Astronomy and Astrophysics by Pankaj Jain, CRC Press, Taylor & Francis Group.

Reference Books:

1. Fundamentals of Astronomy by H. Karttunen. Publisher: Springer.
2. Astrophysics, Stars, and Galaxies by K D Abhyankar, Universities Press.
3. Introductory Astronomy and Astrophysics by M. Zeilik and S.A. Gregory, Saunders College Publishing.
4. Astronomy: Fundamentals and Frontiers by Jastrow & Thomson.
5. The Structure of the Universe by Jayant Naralikar.

Course Level	U.G. (5.5)		**Internal Marks**	0
Programme	B.Sc in Physics		**External Marks**	0
Semester	V		**Practical Internal**	50
Category of Course	Minor		**Practical External**	50
Course Credit	4		**Prac.External Exam Duration**	2+2=4 Hrs
Teaching Hours	120		**Total**	100 Marks
Course Code	MINPHY505 (P)		**Exam Duration**	
Course Title	Physics Practical			

Course Objectives:

- This course helps students understand material properties, electrical circuits, and electronic components through practical experiments. They will measure Young's Modulus, inductance, and capacitance, study amplifiers, oscillators, transformers, and logic gates, and verify theorems using instruments like a CRO. Hands-on training with bridge methods (Owen's, Rayleigh's) will enhance their skills in analyzing circuits and interpreting experimental data.

Course Learning Outcomes: Upon completion of the course, students should be able to:

- Apply theoretical knowledge to measure Young's Modulus, self/mutual inductance, and capacitance using different methods.
- Analyze the behavior of transformers, amplifiers, and oscillators in practical circuits.
- Demonstrate the working of logic gates and verify Boolean theorems.
- Measure frequency, phase, and inductance using CRO and bridge techniques.
- Interpret experimental data to validate physical laws.

Course Contents:

Unit	Syllabi	Teaching Hours
List of Experiments	**Part A:** 1. Young Modulus of the beam by the elevation method 2. Determine the self-induction of coils using Owen's Bridge. 3. Study of Transformer coils using a Bridge rectifier 4. Study of Single-Stage Transformer-Coupled Amplifier	**60**

	5. Study of Series Voltage Regulator using Transistor. 6. Study of RC phase shift Oscillator. 7. Study of Hall Effect. 8. Comparison of Capacities by Mixture Method. **Part B:** 1. To study Diffraction at a Straight edge. 2. Study of Complementary-Symmetry Power Amplifier 3. Study of X-OR Gate. 4. Study of X-NOR Gate. 5. Verification of De Morgan's Theorem. 6. Study of Lissageous figure / Measurement of frequency and phase using CRO. 7. To determine the self-inductance / Mutual Inductance of a given coil by Rayleigh's method. 8. Absolute value of the capacity of a capacitor by B.G.	

Suggested Reading:

1. Practical Physics by C.L.Arora (S.Chand)
2. Advanced Practical Physics by Chauhan & Singh. (Pragati Prakashan)
3. B. Saraf et al-Physics through experiments Vol. I & II
4. Electronic Laboratory Primer by Poorna Chandra & Sasikala, (S.Chand)
5. Practical Physics by Chattopadhyay, Rakshit & Saha.

INTERNAL EVALUATION SCHEME		
NO	**Particulars**	**Marks**
1	**Mid Semester Exam/ Practical Exam (Mandatory)**	**25**
2	Class Test	05
3	Open book exam/test	05
4	Open note exam/test	05
5	Self-test/ Online test	05
6	Essay/Article writing	05
7	Quizzes/Objective test	05
8	Class assignment	05
9	Home assignment	05
10	Reports Writing	05
11	Research/Dissertation	05
12	Case Studies	05
13	Viva/Oral exam	05
14	Group Discussion	05
15	Role Play	05
16	Paper presentation/Seminar	05
17	Language Lab work	05
18	Interview	05
19	Craftwork	05
20	Co-curricular work	05
21	Field Assignment	05
22	Poster Presentation	05
23	Attendance	05
24	Project Work	05
	Total	**50**

Note: Sr.No.1 is mandatory. Select any five from Sr.No.2 to 24. Each contains five marks. Students should secure 18 Marks for passing in internal Exam.

Paper Style

Ques. No.	Particulars	From which Unit	Marks
1	Answer any 2 out of 3 of the following questions.	1	10
2	Answer any 2 out of 3 of the following questions.	2	10
3	Answer any 2 out of 3 of the following questions.	3	10
4	Answer any 2 out of 3 of the following questions.	4	10
5	Answer any 5 out of 8 of the following questions.	From Each Unit	10
		Total Marks	50

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