

# DEBRA THANA S.K.S. MAHAVIDYALAYA

(Autonomous)

Debra, Paschim Medinipur, West Bengal



Department Of Physics

*Proposed Curriculum & Syllabus (draft)*

*(w.e.f. Academic Year 2024-2025)*

*Based on*  
**Curriculum & Credit Framework for Undergraduate  
Programmes (CCFUP), 2024 & NEP, 2020**

# Selection of Disciplines/Subjects during Admission:

## 1. 4-YEAR BACHELOR OF SCIENCE (HONOURS) WITH PHYSICS:

### i) MAJOR IN PHYSICS:

- a) Major- Physics
- b) Minor - Any other 2 subjects

### ii) MAJOR IN OTHER SUBJECT WITH MINOR IN PHYSICS:

- a) Major- Other subject
- b) Minor – Physics and another subject

PHYSICS: Minor 1 / Minor 2
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## 2. 3-YEAR BACHELOR OF PHYSICAL SCIENCE WITH PHYSICS (MULTIDISCIPLINARY STUDIES) :

- a) Major- 2 subjects (A & B)
- b) Minor -1 subject (C)

PHYSICS: A/B/C
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## Curriculum &amp; Credit Structure of 4-Year Bachelor Degree Programme B.A./B.Sc./B.Com. (Hons./ Hons. with Research) in Single Major

SEMESTER	Major - MJ (Core Discipline)	Minor Disciplines- MI (Discipline- I & II)	Ability Enhancement Courses -AEC	Skill Enhancement- SEC	Summer Internship	Multidisciplin ary Courses	Value Added Courses - VAC	Dissertation/ Project/ Entrepreneurship	Total Credit / No. of courses
	Major - 20 (4 Credits)	Minor- 8 (4 Credits)	AEC -4 (2 Credits)	SEC- 3 (3 Credits)	Int./Proj./ Comm. Ser. -2 (4 Credits)	MDC-3 (3 Credits)	VAC -2 (4 Credits)	Dissertation/ Project/ Entp. 2	
I	Major-1	Minor -1 (Discipline-1)	English Communication-1	SEC-1		MDC-1	VAC-1 (ENVS)		20 /6
II	Major -2	Minor-2 (Discipline-II)	MIL (Bengali/Hindi) -1	SEC-2	Community Service (Add.)	MDC-2	VAC-2		20/ 6
YEAR-1	(2x4) 8	(2x4) 8	(2x2) 4	(3x2) 6	(+4)	(3x2) 6	(2x4) 8	-	40 (+4) 44
<b>Exit option with Undergraduate Certificate (in the Major Discipline) securing 44credits with Community Service (Additional 4 credits)</b>									
III	Major -3 Major -4	Minor-3 (Discipline-1)	English Communication-2	SEC-3		MDC-3			20/ 6
IV	Major 5 Major 6 Major 7	Minor4 (Discipline-11)	MIL (Bengali/Hindi) -2		Internship / Apprenticeship (Major Disc.)				22/ 6
YEAR-2	(7x4) 28	(4x4) 16	(4x2) 8	(3x3) 9	4 (+4) 8	(3x3) 9	(2x4) 8	-	86
<b>Students on Exit shall be awarded Undergraduate Diploma (in the Major Discipline) securing 86 credits</b>									
V	Major 8, 9, 10 Major (Elect.) -1	Minor- 5 (Discipline-1)							20/ 5
VI	Major -11, 12, 13 Major (Elect.) -2	Minor-6 (Discipline-11)							20/ 5
YEAR-3	(15x4) 60	(6x4) 24	(4x2) 8	(3x3) 9	4 (+4) 8	(3x3) 9	(2x4) 8	-	126
<b>Students on Exit shall be awarded 3-Year Bachelor Degree (in the Major Discipline) after securing 126 Credits</b>									
VII	Major -14, 15, Major (Elect.) -3*	Minor-7 (Discipline-1)						Project-1 (4 Credit)	20/ 5
VIII	Major -16 Major (Elect.) -4*	Minor-8 (Discipline-11)						Project-2 (8 Credit)	20/ 4 (5*)
YEAR-4	(20x4) 80	(8x4) 32	(4x2) 8	(3x3) 9	4 (+4)=8	(3x3) 9	(2x4) 8	(4+8) 12	166 /43
<b>Students shall be awarded Bachelor Degree (Hons. with Research) in the Major Discipline securing 166 credits</b>									
<i>*Students not opting Research shall complete Three (03) additional papers (Major Electives-5 in Sem.-VII and Major Electives-6, 7 in Sem.-VIII One (01) Major Discipline &amp; Two (02) Minor Disciplines-(1 &amp; 2) Disciplines to be selected from given Subject bunch/group</i>									

## Curriculum and Credit Structure of 3-Year Bachelor Degree Programme B.A./B.Sc./B.Com. in Multidisciplinary Studies

SEMESTER	Major - MJ (Disciplines- A & B)	Minor Disciplines- MI (Discipline- C)	Ability Enhancement Courses -AEC	Skill Enhancement- SEC	Summer Internship	Multidisciplinary Courses	Value Added Courses - VAC	Dissertation/ Project/ Entrepreneurship	Total Credit / No. of courses
	Major - 15 (4 Credits)	Minor Disc.- 6 (4 Credits)	AEC -4 (2 Credits)	SEC- 3 (3 Credits)	Int./Proj./ Comm. Ser. -2 (4 Credits)	MDC-3 (3 Credits)	VAC -2 (4 Credits)	Dissertation/ Project/ Entp. 2	
I	Major -A1	Minor -C1	English Communication-1	SEC-1		MDC-1	VAC-1 (ENVS)		20 /6
II	Major -B1	Minor-C2	MIL (Bengali/Hindi) -1	SEC-2	Community Service (Add.)	MDC-2	VAC-2		20/ 6
YEAR-1	(2x4) 8	(2x4) 8	(2x2) 4	(3x2) 6	(+4)	(3x2) 6	(2x4) 8	-	40 (+4) 44
Exit option with Undergraduate Certificate ( Multidisciplinary field of study ) securing 44credits with Community Service (Additional 4 credits)									
III	Major -A2 Major -A3	Minor-C3	English Communication-2	SEC-3		MDC-3			20/ 6
IV	Major -B2 Major -B3 Major (Elect.) -1	Minor-C4	MIL (Bengali/Hindi) -2		Internship / Apprenticeship (any Discipline)				22/ 6
YEAR-2	(7x4) 28	(4x4) 16	(4x2) 8	(3x3) 9	4 (+4) 8	(3x3) 9	(2x4) 8	-	86
Students on Exit shall be awarded Undergraduate Diploma (in Multidisciplinary field of study ) securing 86 credits									
V	Major-A4, A5, A6 Major (Elect.) -2	Minor- C5							20/ 5
VI	Major-B4, B5, B6 Major (Elect.) -3	Minor-C6							20/ 5
YEAR-3	(15x4) 60	(6x4) 24	(4x2) 8	(3x3) 9	4 (+4) 8	(3x3) 9	(2x4) 8	-	126
Students shall be awarded Bachelor Degree in Multidisciplinary field of studies securing 126 credits									
<i>A, B &amp; C – Three (03) Disciplines/ Subjects to be selected from Subject bunch/group of respective Multidisciplinary studies</i>									

# **DEBRA THANA S.K.S. MAHAVIDYALAYA**



**Proposed Syllabus (Draft) of**

**BACHELOR OF SCIENCE WITH PHYSICS  
(MULTIDISCIPLINARY STUDIES)**

**3-YEAR UNDERGRADUATE PROGRAMME**

**(w.e.f. Academic Year 2024-2025)**

**Based on Curriculum & Credit Framework for  
Undergraduate Programmes (CCFUP), 2024 & NEP, 2020**

**DEBRA THANA S.K.S. MAHAVIDYALAYA**  
**BACHELOR OF SCIENCE IN PHYSICAL SCIENCES with PHYSICS**  
*(under CCFUP, 2024)*

Level	YR.	SEM	Course Type	Course Code	Course Title	Credit	L-T-P	Marks				
								CA	ESE	TOTAL		
B.Sc. in Physical Sc. with Physics	1 <sup>st</sup>	I	<b>SEMESTER-I</b>									
			Major (Disc.-A1)	PHSPMJ101	T: Mathematical Methods and Mechanics (including STR) P: Practical <i>(To be studied by the students taken Physics as Discipline-A)</i>	4	3-0-1	15	60	75		
			SEC	SEC01	<i>To be chosen from SEC-01 of Discipline A/B/C of their Hons. prog. P: Basics of Computer and Graph Plotting</i>	3	0-0-3	10	40	50		
			AEC	AEC01	Communicative English-1 ( <i>common for all programmes</i> )	2	2-0-0	10	40	50		
			MDC	MDC01	Multidisciplinary Course-1 ( <i>to be chosen from the list</i> )	3	3-0-0	10	40	50		
			VAC	VAC01	VAC-01: ENVS ( <i>common for all programmes</i> )	4	2-0-2	50	50	100		
			Minor (Disc.-C1)	PHSMI01/C1	T: Mathematical Physics and Mechanics; P: Practical <i>(To be studied by the students taken Physics as Discipline-C)</i>	4	3-0-1	15	60	75		
		<b>Semester-I Total</b>						<b>20</b>				<b>400</b>
		II	<b>SEMESTER-II</b>									
			Major (Disc.-B1)		T: Mathematical Methods and Mechanics (including STR) P: Practical <i>(Same as like A1 for students taken Physics as Discipline-B )</i>	4	3-0-1	15	60	75		
			SEC	SEC02	<i>To be chosen from SEC-02 of Discipline A/B/C of their Hons. prog. P: Introduction to Python Programming and Graph Plotting.</i>	3	0-0-3	10	40	50		
			AEC	AEC02	MIL-1 ( <i>common for all programmes</i> )	2	2-0-0	10	40	50		
			MDC	MDC02	Multi Disciplinary Course-02 ( <i>to be chosen from the list</i> )	3	3-0-0	10	40	50		
			VAC	VAC02	VAC-02 ( <i>to be chosen from the list</i> )	4	4-0-0	10	40	50		
			Minor (Disc.-C2)	PHSMI02/C2	T: Electricity and Magnetism; P: Practical <i>(To be studied by the students taken Physics as Discipline-C)</i>	4	3-0-1	15	60	75		
Summer Intern.	CS		Community Service	4	0-0-4	-	-	50				
<b>Semester-II Total</b>						<b>24</b>				<b>400</b>		
<b>TOTAL of YEAR-1</b>						<b>44</b>	-	-	-	<b>800</b>		

P MJ= Major Programme (Multidisciplinary), MI = Minor, A/B = Choice of Major Discipline; C= Choice of Minor Discipline; SEC = Skill Enhancement Course, AEC = Ability Enhancement Course, MDC = Multidisciplinary Course, VAC = Value Added Course; CA= Continuous Assessment, ESE= End Semester Examination, T = Theory, P= Practical, L-T-P = Lecture-Tutorial-Practical, MIL = Modern Indian Language, ENVS = Environmental Studies

# **SEMESTER II**

**BACHELOR OF SCIENCE WITH PHYSICS**  
**(MULTIDISCIPLINARY STUDIES)**

**Physics**

**Major B1**

Mathematical Methods and Mechanics:

MJ B1-T: Mathematical Methods and Mechanics:

**Course contents:**

- 1. Differential equations:** Exact and inexact differential, First order linear differential equations with integrating factor, Second order Linear differential equations with constant coefficients. Particular Integral. [4L]
- 2. Vector Calculus:** Properties of vectors under rotations. Scalar product and its invariance under rotations. Scalar triple product and their interpretation in terms of area and volume, respectively. Scalar and Vector fields. Vector differentiation: Gradient of a scalar field and its geometrical interpretation. Divergence and Curl of a vector field. Only statements of Gauss' divergence theorem, Green's theorem and Stokes theorem. [6L]
- 3. Fundamentals of Dynamics:** Reference frames. Inertial frames. Galilean transformations. Galilean invariance. Review of Newton's laws of motion. Dynamics of a system of particles. Centre of mass. Concept of Centre of mass frame. Non-inertial frames and fictitious forces. [5L]
- 4. Gravitation and central force motion:** Gravitational potential Energy. Potential and field due to a spherical shell and solid sphere. Motion of a particle in a central force field (motion is in a plane, angular momentum is conserved, areal velocity is constant). [5L]
- 5. Rotational Dynamics:** Perpendicular and parallel axes theorems, radius of gyration, calculation of moment of inertia for rectangular, cylindrical, and spherical bodies, pure rolling of a body on an inclined plane. [5L]
- 6. Motion under central forces:** Two-body problem, reduction to one-body problem, reduced mass; definition and nature (conservative nature, spherically symmetric potential) of central force, features of motion under central force field, differential equation of orbit; energy expression, simple derivations of nature of force from equation of orbit and vice versa. [6L]
- 7. General properties of matter:** Relation between Elastic constants, Torsion of a cylinder or wire, surface tension and surface energy, angle of contact, capillarity and Juris's law, excess pressure and application to soap bubble, molecular theory of surface tension, ripple method, Viscosity, Reynold's number, Poiseuille's Equation for flow of a liquid through a Capillary Tube, Stroke's law in a high viscous liquid. [6L]



**8. Special Theory of Relativity:** Constancy of speed of light, postulates of special theory of relativity, Lorentz transformations, length contraction, time dilation, relativistic addition of velocities – illustrations with simple problems. [5L]

**Suggested Readings:**

1. Mathematical Methods in the Physical Sciences, M. L. Boas, 2005, Wiley
2. Mathematical Methods for Physicists, G.B. Arfken, H.J. Weber, F.E. Harris, 2013, 7th Edn., Elsevier
3. Mathematical Methods for Physics and Engineering: A Comprehensive Guide by K. F. Riley, M. P. Hobson, S. J. Bence, Cambridge Univ. Press, 3rd Eds., 2006
4. Vector Analysis and an introduction to Tensor Analysis, S. Lipschutz, D. Spellman, M. R. Spiegel, Schaum's Outline Series, Tata McGraw Hill Education Private Limited, edition 2009
5. Mathematical Physics, A. K. Ghatak, I. C. Goyal, S. J. Chua, Macmillan India Ltd., 2016
6. Fundamentals of Mathematical Physics, A. B. Gupta, Books and Allied (P) Ltd. 2022

Classical Mechanics:

1. Classical Mechanics, N. C. Rana and P. S. Joag, McGraw-Hill Education
2. Classical Mechanics, A. K. Raychaudhuri, Oxford University Press, 1984
3. Feynman Lectures, Vol. I, R. P. Feynman, R. B. Leighton, M. Sands, 2008, Pearson Education
4. Classical Mechanics and General Properties of Matter. S. N. Maiti and D. P. Raychaudhuri, New Age International.
5. Introduction to Classical Mechanics, R. G. Takwale and P.S.Puranik, Tata McGraw-Hill Publishing Company Ltd.
6. Theory and Problems of Theoretical Mechanics, M. R. Spiegel, Mc Grow Hill Education
7. Introduction to Classical Mechanics with problems and solutions, D. Morin, Cambridge University Press
8. Mechanics, Berkeley Physics, vol.1, C.Kittel, W.Knight, et.al. 2007, Tata McGraw-Hill, Physics
9. Mechanics, Resnick, Halliday and Walker 8/e. 2008, Wiley
10. Mechanics, D. S. Mathur, S. Chand and Company Limited, 2000
11. University Physics. F.W. Sears, M.W.Zemansky, H.D Young 13/e, 1986, Addison Wesley
12. Classical Mechanics, J. C.Upadhyay, Himalaya Publishing.
13. Fundamentals of Classical Mechanics, A. B. Gupta, Books & Allied (P) Ltd.

## **MJ B1-P: Practical :**

### **Course Outline:**

1. Measurements of length (or diameter) using vernier callipers, screw gauge and travelling microscope.
2. To determine  $g$  and velocity for a freely falling body using Digital Timing Technique.
3. To study the Motion of a Spring and calculate (a) Spring Constant (b) Value of  $g$ .
4. To determine  $g$  by Bar Pendulum.
5. To determine the Moment of Inertia of a Flywheel.
6. To determine the Modulus of Rigidity of a Wire by Maxwell's needle.
7. To determine the Elastic Constants of a Wire by Searle's method.
8. To determine the height of a building using a Sextant.
9. To determine the Young's Modulus of a Wire by Optical Lever Method.

### **Suggested Readings:**

1. Advanced Practical Physics for students, B. L. Flint and H. T. Worsnop, 1971, Asia Publishing House.
2. Engineering Practical Physics, S. Panigrahi & B. Mallick, 2015, Cengage Learning India Pvt. Ltd.
3. A Text Book of Practical Physics, Indu Prakash and Ramakrishna, 11th Edition, 2011, Kitab Mahal, New Delhi.
4. Laboratory Manual of Physics, Madhusudan Jana, Books & Allied (P) Ltd., 2022, Kolkata.
5. Practical Physics, G.L. Squires, 2015, 4th Edition, Cambridge University Press
6. B.Sc. Practical Physics, C.L. Arora, S Chand and Company Limited

7. Physics in Laboratory, Mandal, Chowdhury, Das, Das, Santra Publication
8. Advanced Practical Physics Vol 1, B. Ghosh, K. G. Majumder, Sreedhar Publisher
9. Practical Physics, P.R. Sasi Kumar, PHI Learning Private Limited
10. B.Sc. Practical Physics, Harnem Singh, P.S. Hemne, S Chand and Company Limited.

**BACHELOR OF SCIENCE WITH PHYSICS  
(MULTIDISCIPLINARY STUDIES)**

**Physics**

**SKILL ENHANCEMENT COURSE (SEC)**

**SEC 2**

**SEC 2: Basics of Computer and Graph Plotting.**

**SEC2P: Basics of Computer and Graph Plotting.**

**Introduction and Overview:** Introduction to computer and Basic data types Introduction to computer- Characteristics and Basic Applications of Computer, Components of Computer System, Central Processing Unit (CPU), VDU, Keyboard and Mouse, Other input/output Devices, Memory, concepts of Hardware and Software.

**Basic Word Processing:** Introduction to Word Processing, Opening Word Processing Package, Opening and closing documents, Using a Document/Help Wizard, Text Creation and Manipulation, Formatting the Text, Handling Multiple Documents, Table Manipulation, Printing, saving documents in different formats.

**Spreadsheets and Basic Data Analysis:** Spread Sheet, Elements of Electronics Spread Sheet, Application/usage of Electronic Spread Sheet, Manipulation of cells, Formulas and functions; Spread sheets for Small accountings maintaining invoices/budgets, basic practical data analysis works

**Basic Presentations:** Basics- Difference between presentation and document, Using Power Point, Creation of Presentation, Preparation of Slides, Selection of type of Slides, Importing text from word documents, Providing aesthetics- Slide Designs, Slide Manipulation and Slide Show, Presentation of the Slides.

**Introduction to plotting graphs:** Basic 2D and 3D graph plotting - plotting functions and data files, fitting data using gnuplot's fit function, polar and parametric plots, modifying the appearance of graphs, Surface and contour plots, exporting plots.

**Suggested Readings:**

1. C.S. French "Data Processing and Information Technology", BPB Publications 1998
2. P.K Sinha, Computer Fundamentals, BPB Publications, 1992
3. Guy Hart-Davis "The ABCs of Microsoft Office 97 Professional edition", BPB Publications, 1998
4. Karl Schwartz, "Microsoft Windows 98 Training Guide", 1998
5. A first course in Numerical Methods, U.M. Ascher & C. Greif, 2012, PHI Learning.
6. Elementary Numerical Analysis, K.E. Atkinson, 3 rd Edn . , 2007, Wiley India Edition.

# BACHELOR OF SCIENCE WITH PHYSICS

## (MULTIDISCIPLINARY STUDIES)

### Physics

#### Minor C2

##### MI – C2: Electricity and Magnetism:

##### MI –C2T: Electricity and Magnetism:

**Electrostatics:** Electrostatic Field, electric flux, Gauss's theorem of electrostatics. Applications of Gauss theorem - Electric field due to point charge, infinite line of charge, uniformly charged spherical shell and solid sphere, plane charged sheet, charged conductor. Electric potential as line integral of electric field, potential due to a point charge, electric dipole, uniformly charged spherical shell and solid sphere. Calculation of electric field from potential. Capacitance of an isolated spherical conductor. Parallel plate, spherical and cylindrical condenser. Energy per unit volume in electrostatic field. Dielectric medium, Polarisation, Displacement vector. Gauss's theorem in dielectrics. Parallel plate capacitor completely filled with dielectric. [16L]

##### Magnetism:

**Magnetostatics:** Biot-Savart's law & its applications- straight conductor, circular coil, solenoid carrying current. Divergence and curl of magnetic field. Magnetic vector potential. Ampere's circuital law. Magnetic properties of materials: Magnetic intensity, magnetic induction, permeability, magnetic susceptibility. Brief introduction of dia-, para and ferro-magnetic materials. [14L]

**Electromagnetic Induction:** Faraday's laws of electromagnetic induction, Lenz's law, self and mutual inductance, L of single coil, M of two coils. Energy stored in magnetic field. [5L]

**Maxwell's equations and Electromagnetic wave propagation:** Equation of continuity of current, Displacement current, Maxwell's equations, Poynting vector, energy density in electromagnetic field, electromagnetic wave propagation through vacuum and isotropic electric medium, transverse nature of EM waves, polarization. [6L]

##### Suggested Readings:

- Electricity and Magnetism, Edward M. Purcell, 1986, McGraw-Hill Education..
- Electricity and Magnetism, J.H. Fewkes & J. Yarwood. Vol. I, 1991, Oxford Univ. Press.
- Electricity and Magnetism, D C Tayal, 1988, Himalaya Publishing House.
- University Physics, Ronald Lane Reese, 2003, Thomson Brooks/Cole.
- D.J. Griffiths, Introduction to Electrodynamics, 3rd Edn, 1998, Benjamin Cummings.

### **Minor C2 P: Electricity and Magnetism :**

1. To use a Multimeter for measuring (a) Resistances, (b) AC and DC Voltages, (c) DC Current, and (d) checking electrical fuses.
2. To determine the self- inductance of a coil by Anderson's Bridge.
3. To determine an unknown low resistance using Potentiometer.
4. To study the Characteristics of a Series RC Circuit.
5. To study a series LCR circuit and determine its (a) Resonant Frequency, (b) Quality Factor.
6. To study a parallel LCR circuit and determine its (a) Anti-resonant frequency and (b) Quality factor Q.
7. To determine a Low Resistance by Carey Foster's Bridge.
8. To verify the Thevenin and Norton theorem.
9. To verify the Superposition, and Maximum Power Transfer Theorem

### **Suggested Readings:**

- Advanced Practical Physics for students, B.L.Flint & H.T.Worsnop, 1971, Asia Publishing House.
- A Text Book of Practical Physics, Indu Prakash and Ramakrishna, 11th Edition, 2011, Kitab Mahal, New Delhi.
- Engineering Practical Physics, S.Panigrahi & B.Mallick, 2015, Cengage Learning India Pvt. Ltd.
- Advanced level Physics Practicals, Michael Nelson and Jon M. Ogborn, 4<sup>th</sup> Edition, reprinted 1985, Heinemann Educational Publishers