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

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

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) Major - 15 (4 Credits)	Minor Disciplines- MI (Discipline- C) Minor Disc.- 6 (4 Credits)	Ability Enhancement Courses -AEC AEC -4 (2 Credits)	Skill Enhancement- SEC SEC- 3 (3 Credits)	Summer Internship Int./Proj./ Comm. Ser. -2 (4 Credits)	Multidisciplinary Courses MDC-3 (3 Credits)	Value Added Courses - VAC VAC -2 (4 Credits)	Dissertation/ Project/ Entrepreneurship Dissertation/ Project/ Entp. 2	Total Credit / No. of courses
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									

A, B & C – Three (03) Disciplines/ Subjects to be selected from Subject bunch/group of respective Multidisciplinary studies

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

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 I

BACHELOR OF SCIENCE WITH PHYSICS

(MULTIDISCIPLINARY STUDIES)

Physics

Major A1

Mathematical Methods and Mechanics:

MJ A1-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 A1-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 1

SEC 1: Basics of Computer and Graph Plotting.

SEC1P: 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 C1

MI – C1: Mathematical Physics and Mechanics:

MI –C1T: Mathematical Physics 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. [5L]

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. [6L]

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. [6L]

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. [7L]

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 Jurin'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, Stoke's law in a high viscous liquid. [7L]

Suggested Readings:

Math. Methods:

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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.

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MI – C1P: Mathematical Physics and Mechanics:

Course Outline:

1. Measurements of length (or diameter) using vernier callipers, screw gauge and travelling microscope.

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6. B.Sc. Practical Physics, C.L. Arora, S Chand and Company Limited

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