VIDYASAGAR UNIVERSITY

Midnapore, West Bengal

PROPOSED CURRICULUM & SYLLABUS (DRAFT) OF

BACHELOR OF SCIENCE WITH PHYSICS

(MULTIDISCIPLINARY STUDIES)

3-YEAR UNDERGRADUATE PROGRAMME

(w.e.f. Academic Year 2023-2024)

Based on

Curriculum & Credit Framework for Undergraduate Programmes

(CCFUP), 2023 & NEP, 2020

VIDYASAGAR UNIVERSITY
BACHELOR OF SCIENCE IN PHYSICSL SCIENCES with PHYSICS
(*under CCFUP, 2023*)

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.***	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)		***To be decided*** ***(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.***	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: Thermal Physics and Statistical Mechanics; 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

MAJOR (MJ)

MJ A1/B1: Mathematical Methods and Mechanics (including STR) Credits 04 (FM: 75)

MJ A1/B1T: Mathematical Methods and Mechanics (including STR) Credits 03 [45L]

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. **[8L]**

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. **[4L]**

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. **[5L]**

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. **[8L]**

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:

Math. Methods-

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 PublishingCompany 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/B1P: Practical **Credits 01**

Course Outline:

1. Measurements of length (or diameter) using verniercallipers, screw gauge and travellingmicroscope.
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 g by Kater's Pendulum.
6. To determine the Moment of Inertia of a Flywheel.
7. To determine the Modulus of Rigidity of a Wire by Maxwell's needle / To determine the Elastic Constants of a Wire by Searle's 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

MINOR (MI)

MI-1/C1: Same as Minor-1 (PHSMI01) of Physics (Hons) programme — **Credits 04**, **Full Marks: 75**

MI-2/C2: Same as Minor-2 (PHSMI02) of Physics (Hons) programme — **Credits 04**, **Full Marks: 75**

SKILL ENHANCEMENT COURSE (SEC)

TO BE CHOSEN FROM THE BUCKET OF SECs OF SELECTED DISCIPLINE A/B/C
(As per A/B/C Hons. Prog. Syllabus)