Cooch Behar Panchanan Barma University

Syllabus for Physics

UNDER NEP 2020

Cooch Behar Panchanan Barma University

Cooch Behar, West Bengal

Preamble

University Grants Commission (UGC) introduced, in 2018, a major reform in the higher education sector in India. Accordingly, Learning Outcomes-based Curriculum Framework (LOCF) took the centre-stage to make the curriculum student-centric, interactive and outcome-oriented with well-defined aims and objectives. The Physics Undergraduate Board of Studies of Cooch Behar Panchanan Barma University took the initiative to implement the reforms and frame the syllabus so as to increase the spirit of enquiry, analytical ability and comprehension skills among the students.

Credit Scheme

1^{st} SEM	Cr
Major-1	6
Minor-1	6
MDC-1	3
SEC-1	3
AEC-1	4
	22

2^{nd} SEM	Cr
Major-2	6
Minor-2	6
VAC-1	3
SEC-2	3
INTRN	4
	22

CERTIFICATE	44

3^{rd} SEM	Cr
Major-3	6
Major-4	6
Minor-3	6
SEC-3	3
MDC-2	3
	24

4^{th} SEM	Cr
Major-5	6
Major-6	6
Minor-4	6
AEC-2	4
	22

DIPLOMA	90

5^{th} SEM	Cr
Major-7	6
Major-8	6
Major-9	6
MDC-3	3
	21

6^{th} SEM	Cr
Major-10	6
Major-11	6
Major-12	6
VAC-2	3
	21

DEGREE	132

Paper	Distribution of marks		
	Theory	Lab	Internal
Major	50	25	25
Minor	50	25	25
SEC		35	15
MDC	35		15
AEC	35		15
VAC	35		15

w/o RESEARCH

7^{th} SEM	Cr
Major-13	6
Major-14	6
Minor-5	6
Major-15	6
Major-16	6
	30

8^{th} SEM	Cr
Major-17	6
Major-18	6
Minor-6	6
Major-19	6
	24

DEGREE (HONOURS)	186

w RESEARCH

7^{th} SEM	Cr
Major-13	6
Major-14	6
Minor-5	6
Research-1	6
	24

8^{th} SEM	Cr
Major-15	6
Major-16	6
Minor-6	6
Research-2	6
	24

DEGREE (RESEARCH)	180

SKILL ENHANCEMENT COURSE (PHYSICS)

Semester I

Physics - SEC - 1 : Computational Physics - 1
(Credits: 03)
Lab: 60 Lectures

Report Writing and Presentation Tools

Getting Started with Python Introduction to programming, constants, variables and data types, dynamical typing, operators and expressions, modules, I/O statements, iterables, compound statements, indentation in python, the if-elif-else block, for and while loops, nested compound statements, lists, set, tuples, classes, dictionaries and strings, basic ideas of object oriented programming.

NumPy Arrays; Indexing; Iterating. Creating Arrays : array(), arange(), linspace(), zeros(). Basic Operations : Add, Subtract, Multiply, Divide, and Exponentiation. Vector/Linear Algebra.

MatPlotLib and PyPlot 2D Plot; Interactive Plotting; Plot method; Labels; Log and Polar Plots; Multiple Figures and Curves; Subplots;

Interpolation and Curve Fitting Interpolation Schemes : Nearest Neighbor; Linear; Quadratic; Spline. Least-Squares Fit: Linear and Polynomial.

Roots of equations Real roots of single variable function; iterative approach; qualitative behavior of the function; Closed domain methods (bracketing): Bisection; False position method; Open domain methods: Newton-Raphson, Secant method; Roots of polynomials; Roots of non-linear equations.

Reference Books

[1] Steven C. Chapra and Raymond P. Canale, Numerical Methods for Engineers (8ed), McGraw-Hill.

[2] Rubin H. Landau, Manuel J. Páez and Cristian C. Bordeianu, Computational Physics: Problem Solving with Python (3ed), Wiley.

[3] Alex Gezerlis, Numerical Methods in Physics with Python, Cambridge.

[4] Jaan Kiusalaas, Numerical methods in engineering with Python 3, Cambridge.

Semester II

Physics - SEC - 2 : Computational Physics - 2
(Credits: 03)
Lab: 60 Lectures

Linear algebra Matrix Factorizations: QR Factorization; Gram-Schmidt Orthogonalization; Householder Triangularization; LU and Cholesky factorization; Schur factorization; Direct elimination methods: Gauss elimination (pivoting, scaling); Tri-diagonal systems; Iterative methods: Jacobi iteration; Conjugate Gradients; Eigenvalue problems: Rayleigh Quotient; Arnoldi and Lanczos methods.

Monte Carlo Simulation Random Sequences; Random-Number Generation; Examples : Value of π, Random Walk, Spontaneous Decay.

Differentiation Forward Difference; Central Difference; Backward Difference; Extrapolated Difference; Second Derivatives.

Integration Quadrature as Box Counting; Trapezoid Rule; Simpson's Rule; Gaussian Quadrature; One and Multidimensional Monte Carlo Integration.

Ordinary Differential Equations Initial-Value Problems : Euler's Method; 2^{nd} and 4^{th} Order Runge-Kutta Methods; Simultaneous Differential Equations. Boundary-Value Problems : Shooting Method; Matrix Approach.

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[1] Steven C. Chapra and Raymond P. Canale, Numerical Methods for Engineers (8ed), McGraw-Hill.
[2] Rubin H. Landau, Manuel J. Páez and Cristian C. Bordeianu, Computational Physics: Problem Solving with Python (3ed), Wiley.
[3] Alex Gezerlis, Numerical Methods in Physics with Python, Cambridge.
[4] Jaan Kiusalaas, Numerical methods in engineering with Python 3, Cambridge.

Physics - SEC - 3 : Computational Physics - 3 (Credits: 03)

Each student has to complete a numerical project which gives the student exposure to computer simulation. The student has to submit a report based on his/her studies on the specific topic during the entire semester. It will develop the ability of scientific writing among the students.

The evaluation of the student for this paper will be based on the following criteria:

- 5 marks : Overall attendance.
- 10 marks : Internal assessment based on performance like sincerity, regularity, quality of work done etc.
- 20 marks : Written project report.
- 15 marks : Presentation / viva voce as will be suitable for evaluation (decided by the college).