ASSAM SCIENCE AND TECHNOLOGY UNIVERSITY

Course Structure and Syllabus for the B.Sc. (Applied Physics) Programme

3rd SEMESTER

(JULY-DECEMBER)

Sl. No.	Sub Code	Subject	Hrs / Week			Credits
			L	T	P	C
Theory						
1	BAP161301	Introduction to Computing and Programming in C	3	2	0	4
2	BAP161302	Numerical Methods	2	2	0	3
3	BCS161305	Environmental Studies	4	0	0	4
4	BAP161303	Quantum Mechanics	2	2	0	3
5	BAP161304	Atomic Physics	2	2	0	3
6	BAP161306	Signals and Systems	2	2	0	3
Practical						
7	BAP161314	Dissertation (Atomic Physics)	0	0	4	2
8	BAP161316	Physics Lab VI (Signals & Systems)	0	0	4	2
9	BAP161311	Lab in C programming	0	0	2	1
Total			15	10	10	**25**
Total Contact Hours = 35						
Total credits = 25						

Subject Code: BAP161301

Subject: Introduction to Computing and Programming in C

L-T-P: 3-2-0 **Credit - 4**

Modules	Topics	Course Content	Hours
1	Fundamentals	Major components of a digital computer (A brief introduction of CPU, main memory, secondary memory devices and I/O devices), keyboard, monitor, mouse, printers, secondary storage devices (floppy disks, hard disks and optical disks), backup system and why it is needed ? Bootstrapping a computer. Representation of numbers and characters in computer. ASCII, EDCDIC and Gray codes. Interpreter, assembler, linker and loader, definition and concept of algorithm, flowchart.	10
2	Number System	Binary, hexadecimal, octal, BCD and conversions of number systems. Representations of signed integers, sign and magnitude, 1's complement and 2's complement representation, arithmetic operations using 2's complement representation and conditions for overflow/underflow and its detection	6
3	Introduction to C	Elementary data types, variables, constants and identifiers. Integer, character floating point and string constants. variable declarations. Syntax and semantics. Reserved word. Initialization of variable during declarations Constant data types. Expression in C, precedence and associativity of C operators, unary, binary and ternary operators. C arithmetic operators, assignment operators, relational operators, logical operators and bit –wise operators. L-value and R-value. Side effects of operators. Expression statement. Conditional Statement-if, if-else, switch Iterative Statement-white, do-while, for Other Statement –break, continue, goto, return, null Statement, block Statement.	8
4	Function	Function declaration. Calling a function. Parameters –Call by value, Call by reference and its absence in C. Recursion and how it works. Cast and sizeof operator. Automatic type Conversion. Simple programs like programs to compute an arithmetic expression, unit conversion, the sum of a series, GCD, factorial, fibonacci number,generation of prime numbers, reversing digits of an integer, finding the square root of a number, prime factors of an integer, base conversion of numbers, test if three points form a triangle and classify triangles as right angled, isosceles, equilateral etc., roots of a quadratic equation, generation of simple patterns of characters on screen.	8

5	Arrays and Pointers	Storage classes : Automatic, External, Static, Register. Scope and lifetime of variables. Arrays and pointers and corresponding operators. Pointer arithmetic. Programs using arrays and pointers like sum, average, minimum, maximum of an array of numbers. Add and delete an element of an array. Merge two sorted arrays. String manipulation programs like addition, subtraction, multiplication and their combinations. Sum of rows, columns, and diagonal elements of a matrix. Transpose of a matrix. Linear search, binary search. Selection sort and bubble sort.	8
6	Structures and Files	Structure – declaration and use. Structure member resolution and structure pointer member resolution operators.Programs to show the use of structure. Standard C library.Files in C— opening, closing, reading and writing of files. Seeking forward and backward. Simple examples of file handling programs.	8
		Total	48

Reference Books:

1. Rajaraman, Fundamentals of Computers, Prentice Hall of India.
2. Venugopal & Prasad, Mastering C, TMH
3. Yashwant Kanetkar, Let us C, BPB Publications.

Subject Code : BAP161302

Subject: Numerical Methods

L-T-P: 2-2-0 **Credit - 3**

Modules	Topics	Course Content	Hours
1	**Approximation in numerical computation**	Truncation and rounding errors, fixed and floating point arithmetic. Propagation and errors.	**6**
2	**Interpolation**	Basic concepts of Interpolation, Basic concepts of divided difference, Newton forward/backward interpolation. Lagrange's and Newton's divided difference Interpolation.	**6**
3	**Numerical Integration**	Trapezoidal rule, Simpson's1/3 rule. Simpson's 3/8 rule. Expression for corresponding error terms.	**6**
4	**Numerical solution of linear equation**	Gauss elimination method, matrix inversion, LU factorization method, Gauss Siedel method.	**6**
5	**Numerical solution of algebraic and Transcendental equation**	Bisection method, Regula-Falsi method , Newton-Raphson method	**6**
6	**Numerical solution Ordinary differential equations**	Euler's method, Runge-Kutta method, Predictor-Connector methods and Finite Difference method	**6**
		Total	**36**

Reference Books:

1. Numerical methods, Sukhendu Dey, Shishir Gupta, McGraw Hill Education (India) private Limited.
2. Numerical Algorithms E. V. Krishnamoorthy, S.K. Sen
3. Computer programming and Numerical Analysis by N. Dutta, University Press
4. Numerical Mathematical Analysis By J.B. Scarborough Oxford

Subject Code: BCS161305
Subject: Environmental Studies

L-T-P: 4-0-0 **Credit - 4**

Module	Topics	Course Content	Hours
1	**Concepts Of Environmental Science**	Environment – Definition, Scope and Importance, Levels of Organizations in environment.	2
2	**Ecosystem**	Concept of an ecosystem. Structure and function of an ecosystem. Biosphere- Origin and Distribution on land, in water and in air. Producers, consumers and decomposers. Energy flow in the ecosystem. Ecological Succession Food chains, food webs and ecological pyramids. Introduction, types, characteristics, structure of- Forest ecosystem, Grassland ecosystem, Desert ecosystem and Aquatic ecosystem Broad nature of chemical composition of plants and animals.	6
3	**Natural Resources**	Renewable and Non-renewable Resources, Forest resources: Use and over-exploitation, deforestation, Timber extraction, mining, dams and their effects on forest and tribal people. Water Resources: Use and over- utilization of surface and ground water, floods, drought, conflicts over water, dams- benefits and problems. Mineral Resources: Use and exploitation, environmental effects of extracting and using mineral resources, case studies. Food and Land Resources: World food problems, agriculture and overgrazing, modern agriculture, case studies. Energy resources: Growing energy needs, renewable and non renewable energy sources, use of alternative energy sources, Case studies. Land resources: land degradation, landslides, soil erosion and desertification. Natural resources conservation.	8
4	**Biodiversity And Its Conservation**	Introduction – Definition: genetic, species and ecosystem diversity. Biographical classification of India. Value of biodiversity Biodiversity at global, National and local levels. India as a mega-diversity nation, Hot- sports of biodiversity, Threats to biodiversity: habitat loss, poaching of wildlife, man-wildlife conflicts, biotic and abiotic stresses. Strategies for conservation: In-situ and Ex-situ conservation of biodiversity.	8
5	**Environmental Pollution**	Definition, Cause, effects and control measures of- Air pollution , Water pollution, Soil Pollution, Marine pollution, Noise pollution, Thermal pollution, Nuclear hazards, Management of pollution- Rural/Urban/ Industrial Waste management, case study of any one type, e.g., power(thermal/nuclear), Solid / Liquid Waste Management: Causes, effects and control measures of urban and industrial wastes. Role of an individual in prevention of pollution.	8

		Pollution case studies. Disaster management: floods, earthquake, cyclone and landslides.	
6	**Social Issues And Environment**	From Unsustainable to Sustainable development. Problems relating to urban environment- Population Pressure, water scarcity, industrialization. Water conservation, rain water harvesting, watershed management. Environmental ethics: issues and possible solutions. Climate change- Reasons, effects (global warming, ozone layer depletion, acid rain) with one case study. Consumerism and waste products. Legal Issues- Environment Protection Act, Air (Prevention and Control of Pollution) Act, Water (Prevention and Control of Pollution) Act, Wildlife Protection Act, Forest Conservation Act, Issues involved in enforcement of environmental legislation. Public Awareness. Environmental ethics, Environmental monitoring covering Monitoring identification of environment	7
7	**Human Population And The Environment**	Population growth, variation among nations. Population explosion- Family Welfare Program. Environment and human health. Human rights. Value Education. HIV/AIDS. Women and Child Welfare. Case Studies.	6
8	**Field Work**	Visit to a local area to document environmental assets- river/forest/ grassland/hill/ mountain. Visit to local polluted site- Urban/ Rural/ Agricultural area. Study of simple ecosystem- pond. River, hill slopes, etc.	3
		Total	48

Text Books/Reference Books:

1. Agarwal, K.C. Environmental Biology, Nidi Publication Ltd., Bikaner,2001
2. Bharucha Erach, Biodiversity of India, Mapin Publishing Pvt. Ltd., Ahmedabad,2002
3. Dr. R.J. Ranjit Daniels and Dr. Jagadish Krishnaswamy – Environmental Studies – 2010 willey India.

Subject Code: BAP161303

Subject: Quantum Mechanics

L-T-P: 2-2-0 **Credit - 3**

Module	Topics	Course Content	Hours
1	**Particle Properties Of Waves**	Electromagnetic waves, black body radiation, ultraviolet catastrophe, Photoelectric effect, nature of light, wave particle duality, Compton Effect & its demonstration. Pair production, photons & gravity.	**6**
2	**Wave Properties Of Particles**	De Broglie waves, waves of probability, phase velocity & group velocity, particle diffraction, Davisson And Germer experiment, Electron Microscope, Uncertainty principle I, Uncertainty principle II, Applying the uncertainty principle, Energy & time uncertainty.	**6**
4	**Wave Mechanics**	Classical mechanics is an approximation of quantum mechanics, wave function, Wave function and its probabilistic interpretation as probability amplitude; Continuity equation, probability density and probability current density J; Normalisation condition and normalised wave function; properties of well-behaved wave function in quantum mechanics. Wave packets, Superposition of waves, phase velocity and group velocity and their relation.	**8**
5	**Introduction to operator formalism**	Introduction to operator formalism, Dynamical variable as operator (position, momentum and Hamiltonian), Eigenvalues and eigen function; Expectation value, Ehrenfest's theorem. Schrodinger wave equation – (i) time dependent and (ii) time independent. Correspondence Principle. Application of Schrodinger's wave equation –(i) one dimensional step potential (ii) one dimensional potential barrier, Reflection and transmission coefficients and tunneling effect, (iii) a particle in a one dimensional potential well of infinite depth (iv) one dimensional harmonic oscillator.	**10**
6	**Hydrogen Atom**	Schrodinger equation for the hydrogen atom, separation of variables, quantum numbers, principal quantum number, orbital quantum number, magnetic quantum number, electron probability density, radiative transitions, selection rules, Zeeman effect, electron spin, exclusion principle,.	**6**
		Total	**36**

Text books/Reference Books:

1. Perspectives of Modern Physics-Beiser A.
2. Introduction to the Quantum Theory- Park D. (1974)
3. Theory and Problems of QUANTUM MECHANICS - Schaum Series
4. Introduction to the Quantum Mechanics-Griffiths D.J.
5. Modern Physics (Ii Edn.)-Kenneth Krane

Subject Code: BAP161304

Subject: Atomic Physics

L-T-P: 2-2-0 **Credit - 3**

Module	Topics	Course Content	Hours
1	Positive Rays	Thomson's mass parabola method; Aston's mass spectrograph, Bainbridge mass spectrograph.	**6**
2	Atomic Model	Rutherford's model of atom , Bohr's theory of hydrogen spectra; energy level diagram; Ritz combination principle; resonance, excitation, critical and ionization potentials; fine structures of the spectral lines; Sommerfeld's extension of the Bohr's theory. Spectra of alkali atoms; Bohr magneton; spinning of electron and vector model, ll-coupling, ss- coupling; quantum numbers; Pauli's exclusion principle; explanation of the periodic classification of the elements; spin- orbit coupling, spectroscopic term and notations, selection rules, Stern-Garlach experiment; LS & JJ coupling, source of radiation in external fields- normal Zeeman effect; anomalous Zeeman effect; Paschen-Back effect; Stark effect;.	**24**
3	X-rays	Origin, Continuous and characteristic X-rays Mosley's law, Compton Effect.	**6**
		Total	**36**

Text Books/ Reference Books:

1. Atomic Physics – S. N. Ghosal
2. Atomic & Nuclear Physics - A. B. Gupta & D. Ghosh
3. Atomic Physics – John Yarwood
4. Concept of Modern Physics – A. Beiser

Subject code : BAP161306

Subject: Signals and Systems

L-T-P: 2-2-0 **Credit- 3**

Modules	Topics	Course Content	Hours
1	**Introduction to signals and systems**	Signals and Systems, Examples of signals and systems. Signal types: energy and power signals, continuous and discrete time signals, analog and digital signals, deterministic and random signals. Signal properties: symmetry, periodicity. Elementary signals: unit step, unit impulse, the sinusoid, the complex exponential; representation of signals as vectors. **Systems** linearity, time-invariance, causality, stability; continuous time and discrete time linear time-invariant (LTI) systems: the impulse response and step response.	**12**
2	**Signal representation**	Signal space and orthogonal bases of signal, Fourier series representation; Fourier Transform and properties, Parseval's Theorem. **Discrete-time Fourier Transform (DTFT):** DTFT and properties, Parseval's Theorem; Discrete Fourier Transform (DFT) and properties.	**8**
3	**Laplace transforms for Continuous time signals**	Definition of Laplace transform of continuous time signal, properties, region of convergence, s-Domain analysis of LTI systems, poles and zeros of system functions and signals, stability, Inversion of Laplace's transforms.	**6**
4	**Z-transform**	Definition of Z-transform of discrete time signals. Region of convergence (ROC) : definition and properties. Inversion methods of Z-transforms: Residue theorem, power series expansion method and partial fraction method**.**	**6**
5	**Sampling theorem and its implications**	The sampling theorem; reconstruction of signals from its samples, zero-order hold, first-order hold; aliasing and its effects.	**4**
		Total	**36**

Text Books/Reference Books:

1) Signals & Systems- Oppenheim & Willsky, PHI.
2) A Nagoorkani,"Signals and Systems", McGraw Hill
3) P. Ramesh Babu and R. Anandanatarajan, "Signals and Systems", Scitech Publications.
4) S Ghosh, "Signals and Systems", Pearson Education
5) A.V. Oppenheim, A.S. Willskey and S.H. Nawab," Signal & System", Pearson Education.
6) Sanjay Sharma, "Signal & Systems (with Matlab Programming)", S. K. Kataria &Sons.

Subject code: BAP161316

Subject: Physics Lab-VI (Signals and Systems)

L-T-P: 0-0-4 **Credit - 2**

Unit	Experiments	Hours
1	Different types of continuous signals generation.	**4**
2	Different types of discrete signals generation.	**4**
3	Convolution of signals.	**4**
4	Fourier series representation of continuous time signals.	**4**
5	Fourier transform of continuous time signals.	**4**
6	Sampling and reconstruction of continuous time signals.	**4**
	Total	**24**

Subject Code: BAP161311
Subject: Lab in C Programming

L-T-P: 0-0-2 **Credit - 1**

Modules	Topics	Course Content	Hours
1	**Basics**	1. Program to produce ASCII equivalent of given number 2. Program to find divisor or factorial of a given number.	**2**
2	**String**	Implement different string functions - strcat(), strcpy(), strlen(), strcmp()	**2**
3	**Arrays and Pointers**	1. C program to calculate average using arrays. 2. C program to find largest element of an array. 3. C program to calculate standard deviation. 4. C program to add two matrices. 5. C program to sort elements of an array. 6. C program to access elements of an array using pointer. 7. C program to multiply two matrices.	**4**
4	**Functions**	1. C program to display prime numbers. 2. C program to check prime numbers. 3. C program to find sum of n natural numbers. 4. C program to find H.C.F. 5. C program to convert binary number to decimal. 6. C program to convert decimal number to binary.	**4**
		Total	**12**

Text Books/Reference Books:

1. Computer Programming in C by Godfried.
2. C Programming Language by Kernighan & Ritchie, The (Ansi C Version), PHI.
3. Let us C by YashavantKanetkar, BPB Publications.

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