



AMAL COLLEGE
OF ADVANCED STUDIES

LEARNING OUTCOMES-BASED CURRICULUM FRAMEWORK FOR UNDERGRADUATE EDUCATION

B.Sc. Mathematics and Physics

DEPARTMENT OF MATHEMATICS AND PHYSICS



AMAL COLLEGE OF ADVANCED STUDIES

Myladi, Eranhimangad Po, Nilambur – 679329

Aided by Govt. of Kerala & affiliated to the University of Calicut NAAC Accredited with A Grade (3.11 CGPA)

Website: www.amalcollege.ac.in | Email: principal@amalcollege.ac.in Phone: 04931207055

PREFACE

We are pleased to present the Learning Outcome Based Curriculum Framework for the Bachelor of Mathematics and Physics program offered by the Department of Mathematics and Physics at Amal College of Advanced Studies, Nilambur. This document embodies our institution's vision and mission, guiding us toward academic excellence and reaffirming our commitment to providing comprehensive and forward-looking education. Amal College's vision seeks to establish an advanced learning center that nurtures personal transformation, social empowerment, and excellence. Our mission centers on delivering quality education, shaping responsible citizens, fostering research and innovation, and equipping students with essential life skills. These core principles influence the development of this curriculum.

This curriculum outlines the B. Sc. program, its aims, graduate attributes, Program Learning Outcomes, course-level learning outcomes, CLO-PLO Mapping, teaching and learning methodologies, and assessment techniques. It reflects our commitment to providing transformative education that aligns with the needs of today's world. This framework will guide our faculty and students as we continue our educational journey.

We express our appreciation to all those who contributed to its development.

Warm regards,

Dr. Zacaria TV

Principal

Amal College of Advanced Studies, Nilambur

18/05/2022

VISION AND MISSION OF THE COLLEGE

VISION

The vision of Amal College is to establish an innovative learning institution that catalyses personal transformation, leads community upliftment, and motivates individuals to attain the highest levels of excellence.

MISSION

- **Education Excellence:** We are committed to delivering high-quality education in a nurturing and inclusive environment.
- **Responsible Citizens:** Our goal is to prepare our youth to become responsible citizens with a deep sense of patriotism.
- **Research and Innovation:** We encourage and support research and innovation to nurture students as contributors to our nation.
- **Global Competency:** We strive to establish collaborative partnerships with high-standard institutions, enhancing the global competitiveness of both our institution and our scholars.
- **Life Skills:** We empower our students with essential life skills that not only transform their own lives but also uplift their communities.
- **Community Empowerment:** We are dedicated to promoting social and educational empowerment in our community through extension and outreach programs.
- **Inclusion and Sustainability:** We are committed to fostering sustainable development and advocating for inclusiveness of all sections of the society.

**PROGRAMME LEARNING OUTCOME B.SC. MATHEMATICS AND
PHYSICS PROGRAMME****PROGRAMME LEARNING OUTCOMES**

- PLO1:** Interpret the basic concepts of fundamentals of mechanics, properties of matter and electrodynamics
- PLO2:** Analyse the theoretical basis of quantum mechanics, relativistic physics, nuclear physics, optics, spectroscopy, solid state physics, astrophysics, statistical physics, photonics and thermodynamics
- PLO3:** Investigate and apply the concepts of electronics in the designing of different analog and digital circuits
- PLO4:** Understand the basics of computer programming and numerical analysis
- PLO5:** Apply and verify theoretical concepts through laboratory experiments
- PLO6:** Understand fundamental ideas of limit, continuity and differentiability and also to some basic theorems of differential calculus.
- PLO7:** Understand the notion of partial derivative, their computation and interpretation and also formulate the idea of limit and continuity for functions of several variables.
- PLO8:** Formulate mathematical models in the form of ordinary differential equations to suggest possible solutions of the day to day problems arising in physical, chemical and biological disciplines.
- PLO9:** Understand the mathematical concepts and applications in the field of algebra, analysis, graph theory, computational techniques and optimization.
- PLO10:** Develops the problem-solving skill.
- PLO11:** Understand the concept of graph theory and its applications

MTS 1B21: BASIC CALCULUS

Course Code	MTS 1B21
Course Title	BASIC CALCULUS
Credits	4
Hours/Weeks	5
Category	Core Course
Semester	Semester 1
Regulation	2020 Onwards

COURSE LEARNING OUTCOMES

CLO1: The fundamental ideas of limit, continuity and differentiability and also to some basic theorems of differential calculus

CLO2: Analyse the close connection between the two branches of Calculus.

CLO-PLO MAPPING

	PLO 1	PLO 2	PLO 3	PLO 4	PLO 5	PLO 6	PLO7	PLO8	PLO 9	PLO 10	PLO 11
CLO 1						2					
CLO 2										1	

All the courses together must cover all the POs (and PSOs). For a course we map the COs to POs through the CO-PO matrix and to PSOs through the CO-PSO matrix as shown below. The various correlation levels are: “1” – Slight (Low) Correlation “2” – Moderate (Medium) Correlation “3” – Substantial (High) Correlation “-” indicates there is no correlation.

PHY 1B21: MECHANICS 1

Course Code	PHY 1B21
Course Title	MECHANICS 1
Credits	2
Hours/Weeks	2
Category	Core Course
Semester	Semester 1
Regulation	2020 Onwards

COURSE LEARNING OUTCOMES

CLO1: Understand and apply the basic concepts of Newtonian Mechanics to Physical Systems

CLO2: Understand and apply the basic idea of work energy theorem to physics

CLO3: Understand and apply the rotational dynamics of rigid bodies

CLO-PLO MAPPING

	PLO 1	PLO 2	PLO 3	PLO 4	PLO 5	PLO 6	PLO 7	PLO 8	PLO 9	PLO 10	PLO 11
CLO1	2										
CLO2	3										
CLO3	3										

All the courses together must cover all the POs (and PSOs). For a course we map the COs to POs through the CO-PO matrix and to PSOs through the CO-PSO matrix as shown below.

The various correlation levels are: “1” – Slight (Low) Correlation “2” – Moderate (Medium) Correlation “3” – Substantial (High) Correlation “-” indicates there is no correlation.

MTS 2B22: ADVANCED CALCULUS

Course Code	MTS 2B22
Course Title	ADVANCED CALCULUS
Credits	4
Hours/Weeks	5
Category	Core Course
Semester	Semester 2
Regulation	2020 Onwards

COURSE LEARNING OUTCOMES

CL1: Understand several contexts of appearance of multivariable functions and their representation using graph and contour diagrams.

CL2: Formulate and work on the idea of limit and continuity for functions of several variables.

CL3: Understand the notion of partial derivative, their computation and interpretation.

CL4: Get the idea of directional derivative, its evaluation, interpretation, and relationship with partial derivatives

CLO-PLO MAPPING

	PL O1	PL O2	PLO 3	PLO 4	PLO 5	PLO 6	PLO7	PLO8	PLO 9	PL10	PLO11
CLO1										1	
CLO2						2					
CLO3							2				
CLO4							1				

All the courses together must cover all the POs (and PSOs). For a course we map the COs to POs through the CO-PO matrix and to PSOs through the CO-PSO matrix as shown below. The various correlation levels are: “1” – Slight (Low) Correlation “2” – Moderate (Medium) Correlation “3” – Substantial (High) Correlation “-” indicates there is no correlation

PHY 2B22: MECHANICS 2

Course Code	PHY 2B22
Course Title	MECHANICS II
Credits	2
Hours/Weeks	2
Category	Core Course
Semester	Semester 2
Regulation	2020 Onwards

COURSE LEARNING OUTCOMES

CLO1: Understand the features of non-inertial systems and fictitious forces

CLO2: Understand and analyse the features of central forces with respect to planetary forces

CLO3: Understand the basic ideas of Harmonic oscillator

CLO4: Understand and analyse the basic concepts of wave motion

CLO-PLO MAPPING

	PLO 1	PLO 2	PLO 3	PLO 4	PLO 5	PLO 6	PLO7	PLO8	PLO9	PLO10	PLO11
CLO 1	3									1	
CLO 2	3									2	
CLO 3	3									1	
CLO 4	2									1	

All the courses together must cover all the POs (and PSOs). For a course we map the COs to POs through the CO-PO matrix and to PSOs through the CO-PSO matrix as shown below. The various correlation levels are: “1” – Slight (Low) Correlation “2” – Moderate (Medium) Correlation “3” – Substantial (High) Correlation “-” indicates there is no correlation.

PHY2 B23: PRACTICAL I

Course Code	PHY2 B23
Course Title	PRACTICAL I
Credits	2
Hours/Weeks	4
Category	Practical
Semester	Semester 2
Regulation	2020 Onwards

COURSE LEARNING OUTCOMES

CLO1: Apply and illustrate the concepts of properties of matter through experiments

CLO2: Apply and illustrate the concepts of electricity and magnetism through experiments

CLO3: Apply and illustrate the concepts of optics through experiments

CLO4: Apply and illustrate the principles of electronics through experiments

CLO-PLO MAPPING

	PLO 1	PL O2	PL O3	PL O4	PL O5	PL O6	PLO 7	PLO8	PL O9	PLO 10	PLO 11
CLO 1					3					3	
CLO 2					2					3	
CLO 3					2					2	
CLO 4					1					1	

All the courses together must cover all the POs (and PSOs). For a course we map the COs to POs through the CO-PO matrix and to PSOs through the CO-PSO matrix as shown below. The various correlation levels are: “1” – Slight (Low) Correlation “2” – Moderate (Medium) Correlation “3” – Substantial (High) Correlation “-” indicates there is no correlation

PHY 3B24: ELECTRODYNAMICS

Course Code	PHY 3B24
Course Title	Electrodynamics
Credits	4
Hours/Weeks	3
Category	Core Course
Semester	Semester 3
Regulation	2020 Onwards

COURSE LEARNING OUTCOMES

CLO1: Understand and analyse the electrostatic properties of physical system

CLO2: Understand the mechanism of electric field in matter

CLO3: Understand and analyse the magnetic properties of physical systems

CLO4: Understand the mechanism of magnetic field in matter

CLO5: Understand the basic concepts of electrodynamics and electromagnetic waves and analyse the properties of electromagnetic waves

CLO-PLO MAPPING

	PL O1	PL O2	PL O3	PL O4	PL O5	PL O6	PLO 7	PLO8	PL O9	PLO 10	PLO 11
CLO1	1										
CLO2	2										
CLO3	1										
CLO4	2										
CLO5	1										

All the courses together must cover all the POs (and PSOs). For a course we map the COs to POs through the CO-PO matrix and to PSOs through the CO-PSO matrix as shown below. The various correlation levels are: “1” – Slight (Low) Correlation “2” – Moderate (Medium) Correlation “3” – Substantial (High) Correlation “-” indicates there is no correlation.

PHY2 B23: PRACTICAL I

Course Code	MTS 3B24
Course Title	Multivariable Calculus
Credits	3
Hours/Weeks	3
Category	Core Course
Semester	Semester 3
Regulation	2020 Onwards

COURSE LEARNING OUTCOMES

CLO1: Extend the notion of integral of a function of single variable to integral of functions of two and three variables

CLO2: Address the practical problem of evaluation of double and triple integral using Fubini's theorem and change of variable formula.

CLO3: Realise the advantage of choosing other coordinate systems such as polar, spherical, cylindrical etc. in the evaluation of double and triple integrals.

CLO4: Learn three major results viz. Green's theorem, Gauss's theorem and Stokes' theorem of multivariable calculus and their use in several areas and directions.

CLO-PLO MAPPING

	PO1	PLO2	PLO3	PLO4	PLO5	PLO6	PLO7	PL O8	PL O9	PLO 10	PL O11
CLO 1						1					
CLO 2						1				2	
CLO 3						1				2	
CLO 4						1					

All the courses together must cover all the POs (and PSOs). For a course we map the COs to POs through the CO-PO matrix and to PSOs through the CO-PSO matrix as shown below. The various correlation levels are: "1" – Slight (Low) Correlation "2" – Moderate (Medium) Correlation "3" – Substantial (High) Correlation "-" indicates there is no correlation.

MTS 3B23: ABSTRACT ALGEBRA

Course Code	MTS 3B23
Course Title	Abstract Algebra
Credits	3
Hours/Weeks	4
Category	Core Course
Semester	Semester 3
Regulation	2020 Onwards

COURSE LEARNING OUTCOMES

CLO1: Learn fundamental properties and mathematical tools such as closure, identity, inverse and generators.

CLO2: Link the fundamental concepts of groups and symmetries of geometrical object.

CLO3: Analyse the consequences of Lagrange's theorem.

CLO-PLO MAPPING

	PLO1	PLO2	PLO3	PLO4	PLO5	PLO6	PLO7	PL O8	PL O9	PL O10	PL O11
CLO1									2	1	
CLO2									2		
CLO3									1	1	

All the courses together must cover all the POs (and PSOs). For a course we map the COs to POs through the CO-PO matrix and to PSOs through the CO-PSO matrix as shown below. The various correlation levels are: "1" – Slight (Low) Correlation "2" – Moderate (Medium) Correlation "3" – Substantial (High) Correlation "-" indicates there is no correlation.

PHY 3B25: THERMODYNAMICS

Course Code	PHY 3B25
Course Title	THERMODYNAMICS
Credits	3
Hours/Weeks	3
Category	Core Course
Semester	Semester 3
Regulation	2020 Onwards

COURSE LEARNING OUTCOMES

CLO1: Understand the zero and first laws of thermodynamics

CLO2: Understand the thermodynamics description of the ideal gas

CLO3: Understand the second law of thermodynamics and its applications

CLO4: Understand the basic ideas of entropy

CLO5: Understand the concepts of thermodynamic potentials and phase transitions

CLO-PLO MAPPING

	PLO 1	PLO 2	PLO 3	PLO 4	PLO 5	PLO 6	PLO7	PLO8	PLO 9	PLO1 0	PLO1 1
CLO 1		3								1	
CLO 2		2								1	
CLO 3		3								2	
CLO 4		2								1	
CLO 5		2								1	

All the courses together must cover all the POs (and PSOs). For a course we map the COs to POs through the CO-PO matrix and to PSOs through the CO-PSO matrix as shown below. The various correlation levels are: “1” – Slight (Low) Correlation “2” – Moderate (Medium) Correlation “3” – Substantial (High) Correlation “-” indicates there is no correlation.

PHY 3A11 PYTHON PROGRAMMING

Course Code	PHY 3A11
Course Title	PYTHON PROGRAMMING
Credits	4
Hours/Weeks	5
Category	General Course
Semester	Semester 3
Regulation	2020 Onwards

COURSE LEARNING OUTCOMES

- Co1 Understand the basic concepts of Python language
- Co2 Understand the various operation in Python language
- Co3 Develop computer languages in Python language
- Co4 Understand the basics of object oriented programming using Python

CLO-PLO MAPPING

	PLO 1	PLO 2	PLO 3	PLO 4	PLO 5	PLO 6	PLO7	PLO8	PLO 9	PLO1 0	PLO1 1
CLO 1		3								1	
CLO 2		2								1	
CLO 3		3								2	
CLO 4		2								1	
CL0 5		2								1	

All the courses together must cover all the POs (and PSOs). For a course we map the COs to POs through the CO-PO matrix and to PSOs through the CO-PSO matrix as shown below. The various correlation levels are: “1” – Slight (Low) Correlation “2” – Moderate (Medium) Correlation “3” – Substantial (High) Correlation “-” indicates there is no correlation.

MTS 3A12: BASIC LOGIC, BOOLEAN ALGEBRA AND GRAPH THEORY

Course Code	MTS 3A12
Course Title	BASIC LOGIC, BOOLEAN ALGEBRA AND GRAPH THEORY
Credits	4
Hours/Weeks	5
Category	General Course
Semester	Semester 3
Regulation	2020 Onwards

COURSE LEARNING OUTCOMES

CLO1: Understand the scientific way of decision making using the laws of logic

CLO2: Understand the concept of algebraic structures in Mathematics

CLO3: Define the concept of Boolean algebra as an algebraic structure and list its properties

CLO4: Define a Graph and identify different classes of graphs

CLO5: Understand various applications of Graph theory

CLO-PLO MAPPING

	PLO 1	PLO 2	PLO 3	PLO 4	PLO 5	PLO 6	PLO7	PLO8	PLO 9	PLO1 0	PL O11
CLO1										1	
CLO2									2		
CLO3									1		
CLO4											1
CLO5											2

PHY 4B27: ELECTRONICS (ANALOG & DIGITAL)

Course Code	PHY 4B27
Course Title	ELECTRONICS (ANALOG & DIGITAL)
Credits	3
Hours/Weeks	3
Category	Core Course
Semester	Semester 4
Regulation	2020 Onwards

COURSE LEARNING OUTCOMES

CLO1: Understand the basic principles of rectifiers and dc power supplies

CLO2: Understand the principles of transistor

CLO3: Understand the working and designing of transistor amplifiers and oscillator

CLO4: Understand the basic operation of Op – Amp and its applications

CLO5: Understand the basics of digital electronics

CLO-PLO MAPPING

	PLO 1	PLO 2	PLO 3	PLO 4	PLO 5	PLO 6	PLO7	PLO8	PLO 9	PLO1 0	PLO1 1
CLO1		3								1	
CLO2		3								2	
CLO3		3								2	
CLO4		2								1	
CL05		2								1	

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PHY 4A13: DATA COMMUNICATION AND OPTICAL FIBERS

Course Code	PHY 4A13
Course Title	Data Communication And Optical Fibers
Credits	4
Hours/Weeks	5
Category	General
Semester	Semester 4
Regulation	2020 Onwards

COURSE LEARNING OUTCOMES

CLO1: Understand the basic principles of rectifiers and dc power supplies

CLO2: Understand the principles of transistor

CLO3: Understand the working and designing of transistor amplifiers and oscillator

CLO4: Understand the basic operation of Op – Amp and its applications

CLO5: Understand the basics of digital electronics

CLO-PLO MAPPING

	PLO 1	PLO 2	PLO 3	PLO 4	PLO 5	PLO 6	PLO7	PLO8	PLO 9	PLO 10	PLO 11
CLO 1		3								1	
CLO 2		3								2	
CLO 3		3								2	
CLO 4		2								1	
CL05		2								1	

All the courses together must cover all the POs (and PSOs). For a course we map the COs to POs through the CO-PO matrix and to PSOs through the CO-PSO matrix as shown below. The various correlation levels are: “1” – Slight (Low) Correlation “2” – Moderate (Medium) Correlation “3” – Substantial (High) Correlation “-” indicates there is no correlation

PHY 4B26 STATISTICAL PHYSICS, SOLID STATE PHYSICS, SPECTROSCOPY & PHOTONICS

Course Code	PHY 4B26
Course Title	STATISTICAL PHYSICS, SOLID STATE PHYSICS, SPECTROSCOPY & PHOTONICS
Credits	3
Hours/Weeks	3
Category	Core Course
Semester	Semester 4
Regulation	2020 Onwards

COURSE LEARNING OUTCOMES

- Co1 Understand the basic principles of statistical physics and its applications
- Co2 Understand the basic aspects of crystallography in solid state physics
- Co3 Understand the basic elements of spectroscopy
- Co4 Understand the basics ideas of microwave and infrared spectroscopy
- Co5 Understand the fundamental ideas of photonics.

CLO-PLO MAPPING

	PLO 1	PLO 2	PLO 3	PLO 4	PLO 5	PLO 6	PLO7	PLO8	PLO 9	PLO1 0	PLO1 1
CLO 1		2									
CLO 2		1									
CLO 3		2									
CLO 4					1						
CLO 5					1						

All the courses together must cover all the POs (and PSOs). For a course we map the COs to POs through the CO-PO matrix and to PSOs through the CO-PSO matrix as shown below. The various correlation levels are: “1” – Slight (Low) Correlation “2” – Moderate (Medium) Correlation “3” – Substantial (High) Correlation “-” indicates there is no correlation.

PHY 5B29 OPTICS

Course Code	PHY 5B29
Course Title	OPTICS
Credits	4
Hours/Weeks	3
Category	Core Course
Semester	Semester 5
Regulation	2020 Onwards

COURSE LEARNING OUTCOMES

Co1 Understand the fundamentals of Fermat's principles and geometrical optics

Co2 Understand and apply the basic ideas of interference of light.

CO3 Understand and apply the basic ideas of diffraction of light.

Co4 Understand the basics ideas of polarization of light.

Co5 Describe the basic principles of holography and fibre optics.

CO-PO MAPPING

	PLO 1	PLO 2	PLO 3	PLO 4	PLO 5	PLO 6	PLO7	PLO8	PLO 9	PLO1 0	PLO1 1
CLO 1		2									
CLO 2		2									
CLO 3					2						
CLO 4		2									
CLO 5		2									

All the courses together must cover all the POs (and PSOs). For a course we map the COs to POs through the CO-PO matrix and to PSOs through the CO-PSO matrix as shown below. The various correlation levels are: "1" – Slight (Low) Correlation "2" – Moderate (Medium) Correlation "3" – Substantial (High) Correlation "-" indicates there is no correlation

PHY 5B 30: QUANTUM MECHANICS

Course Code	PHY 5B 30
Course Title	QUANTUM MECHANICS
Credits	3
Hours/Weeks	3
Category	Elective Course
Semester	Semester 5
Regulation	2020 Onwards

COURSE LEARNING OUTCOMES

CLO1: Understand the particle properties of electromagnetic radiation

CLO2: Describe Rutherford – Bohr model of the atom

CLO3: Understand the wavelike properties of particles

CLO4: Understand and apply the Schrödinger equation to simple physical systems

CLO5: Apply the principles of wave mechanics to the Hydrogen atom

CLO-PLO MAPPING

	PLO 1	PLO 2	PLO 3	PLO 4	PLO 5	PLO 6	PLO7	PLO8	PLO 9	PLO1 0	PLO1 1
CLO 1		2								1	
CLO 2		2								1	
CLO 3		3								2	
CLO 4		3								3	
CL05		3								3	

All the courses together must cover all the POs (and PSOs). For a course we map the COs to POs through the CO-PO matrix and to PSOs through the CO-PSO matrix as shown below. The various correlation levels are: “1” – Slight (Low) Correlation “2” – Moderate (Medium) Correlation “3” – Substantial (High) Correlation “-” indicates there is no correlation

PHY 6B31 NUCLEAR PHYSICS AND PARTICLE PHYSICS

Course Code	PHY 6B31
Course Title	NUCLEAR PHYSICS AND PARTICLE PHYSICS
Credits	4
Hours/Weeks	3
Category	Core Course
Semester	Semester 6
Regulation	2020 Onwards

COURSE LEARNING OUTCOMES

Co1 Understand the basic aspects of nuclear structure and fundamentals of radioactivity.

Co2 Describe the different types of nuclear reactions and their applications

Co3 Understand the principle and working of particle detectors

Co4 Describe the principle and working of particle accelerators

Co5 Understand the basic principles of elementary particle physics

CLO-PLO MAPPING

	PLO 1	PLO 2	PLO 3	PLO 4	PLO 5	PLO 6	PLO7	PLO8	PLO 9	PLO1 0	PLO1 1
CLO1		2									
CLO2		1									
CLO3		1									
CLO4		1									
CLO5		2									

All the courses together must cover all the POs (and PSOs). For a course we map the COs to POs through the CO-PO matrix and to PSOs through the CO-PSO matrix as shown below. The various correlation levels are: “1” – Slight (Low) Correlation “2” – Moderate (Medium) Correlation “3” – Substantial (High) Correlation “-” indicates there is no correlation

MTS 4B25: DIFFERENTIAL EQUATIONS

Course Code	MTS 4B25
Course Title	Differential Equations
Credits	3
Hours/Weeks	4
Category	Core Course
Semester	Semester 4
Regulation	2020 Onwards

COURSE LEARNING OUTCOMES

CLO1: Identify what an ODE is, what it means by its solution, how to classify DEs, and what it means by an IVP and so on.

CLO2: Solve DEs that are in linear, separable and in exact forms and also to analyse the solution

CLO3: Develop the knowledge of solving a differential equation using Laplace method which is especially suitable to deal with problems arising in engineering field

CLO-PLO MAPPING

	PLO 1	PLO 2	PLO 3	PLO 4	PLO 5	PLO 6	PLO7	PLO8	PLO 9	PLO 10	PLO 11
CLO 1								2			
CLO 2								2		1	
CLO 3								2		1	

All the courses together must cover all the POs (and PSOs). For a course we map the COs to POs through the CO-PO matrix and to PSOs through the CO-PSO matrix as shown below. The various correlation levels are: “1” – Slight (Low) Correlation “2” – Moderate (Medium) Correlation “3” – Substantial (High) Correlation “-” indicates there is no correlation.

TS 4B26: NUMBER THEORY

Course Code	MTS 4B26
Course Title	Number Theory
Credits	3
Hours/Weeks	3
Category	Core Course
Semester	Semester 4
Regulation	2020 Onwards

COURSE LEARNING OUTCOMES

CLO1: Interpret the concepts of divisibility, greatest common common divisor, least common multiple and a few applications.

CLO2: Learn three classical theorems viz. Wilson’s theorem, Fermat’s little theorem and Euler’s theorem and a few important consequence.

CLO3: Formulate and prove conjectures about numeric patterns.

CLO4: Produce rigorous arguments centered on the material of number theory.

CLO-PO MAPPING

	PLO 1	PLO 2	PLO 3	PLO 4	PLO 5	PLO 6	PLO7	PLO8	PLO 9	PLO1 0	PLO1 1
CLO 1									1	1	
CLO 2									1		
CLO 3									2		
CLO 4									1		

All the courses together must cover all the POs (and PSOs). For a course we map the COs to POs through the CO-PO matrix and to PSOs through the CO-PSO matrix as shown below. The various correlation levels are: “1” – Slight (Low) Correlation “2” – Moderate (Medium) Correlation “3” – Substantial (High) Correlation “-” indicates there is no correlation.

MTS 4A14: THEORY OF EQUATIONS AND COMPLEX NUMBERS

Course Code	MTS 4A14
Course Title	THEORY OF EQUATIONS AND COMPLEX NUMBERS
Credits	4
Hours/Weeks	5
Category	General Course
Semester	Semester 4
Regulation	2020 Onwards

COURSE LEARNING OUTCOMES

CLO1: Explain the completeness of a system of real numbers, a least upper bound and a greatest lower bound.

CLO2: Define and utilise the concepts like sequence, subsequence, monotone sequence and Cauchy sequence.

CLO3: Prove some of the classical theorems of real analysis.

CLO-PLO MAPPING

	PLO 1	PLO 2	PLO 3	PLO 4	PLO 5	PLO 6	PLO7	PLO8	PLO 9	PLO1 0	PLO1 1
CLO 1									2		
CLO 2									2		
CLO 3									2		

All the courses together must cover all the POs (and PSOs). For a course we map the COs to POs through the CO-PO matrix and to PSOs through the CO-PSO matrix as shown below. The various correlation levels are: “1” – Slight (Low) Correlation “2” – Moderate (Medium) Correlation “3” – Substantial (High) Correlation “-” indicates there is no correlation.

PHY 5B28: RELATIVISTIC MECHANICS AND ASTROPHYSICS

Course Code	PHY 5B28
Course Title	RELATIVISTIC MECHANICS AND ASTROPHYSICS
Credits	4
Hours/Weeks	2
Category	Core Course
Semester	Semester 5
Regulation	2020 Onwards

COURSE LEARNING OUTCOMES

CLO1: Understand the fundamental ideas of special relativity.

CLO2: Understand the basic concepts of general relativity and cosmology.

CLO3: Understand the basic techniques used in astronomy

CLO4: Describe the evolution and death of stars

CLO5: Describe the structure and classification of galaxies.

CLO-PLO MAPPING

	PLO 1	PLO 2	PLO 3	PLO 4	PLO 5	PLO 6	PLO7	PLO8	PLO 9	PLO 10	PLO 11
CLO1		2									
CLO2		2									
CLO3		1									
CLO4		1									
CLO5		2									

All the courses together must cover all the POs (and PSOs). For a course we map the COs to POs through the CO-PO matrix and to PSOs through the CO-PSO matrix as shown below. The various correlation levels are: “1” – Slight (Low) Correlation “2” – Moderate (Medium) Correlation “3” – Substantial (High) Correlation “-” indicates there is no correlation

MTS 5B27: COMPLEX ANALYSIS

Course Code	MTS 5B27
Course Title	Complex Analysis
Credits	5
Hours/Weeks	5
Category	Core Course
Semester	Semester 5
Regulation	2020 Onwards

COURSE LEARNING OUTCOMES

CLO1: Classify the difference between differentiability and analyticity of a complex function and construct examples.

CLO2: Analyse limits and continuity for complex functions as well as consequences of continuity.

CLO3: Apply the concept and consequences of analyticity and the Cauchy Riemann equations.

CLO4: Evaluate complex contour integrals directly and by the fundamental theorem.

CLO-PLO MAPPING

	PLO 1	PLO 2	PLO 3	PLO 4	PLO 5	PLO 6	PLO 7	PLO 8	PLO 9	PLO1 0	PLO1 1
CLO 1						2					
CLO 2						1				1	
CLO 3						1	1				
CLO 4										2	

All the courses together must cover all the POs (and PSOs). For a course we map the COs to POs through the CO-PO matrix and to PSOs through the CO-PSO matrix as shown below. The various correlation levels are: “1” – Slight (Low) Correlation “2” – Moderate (Medium) Correlation “3” – Substantial (High) Correlation “-” indicates there is no correlation.

MTS 5B28: REAL ANALYSIS -1

Course Code	MTS 5B28
Course Title	REAL ANALYSIS - 1
Credits	4
Hours/Weeks	4
Category	Core Course
Semester	Semester 5
Regulation	2020 Onwards

COURSE LEARNING OUTCOMES

CLO1: Explain the completeness of a system of real numbers, a least upper bound and a greatest lower bound.

CLO2: Define and utilise the concepts like sequence, subsequence, monotone sequence and Cauchy sequence.

CLO3: Prove some of the classical theorems of real analysis.

CLO-PLO MAPPING

	PLO 1	PLO 2	PLO 3	PLO 4	PLO 5	PLO 6	PLO 7	PLO8	PLO 9	PLO 10	PLO 11
CLO 1									2		
CLO 2									2		
CLO 3									2		

All the courses together must cover all the POs (and PSOs). For a course we map the COs to POs through the CO-PO matrix and to PSOs through the CO-PSO matrix as shown below. The various correlation levels are: “1” – Slight (Low) Correlation “2” – Moderate (Medium) Correlation “3” – Substantial (High) Correlation “-” indicates there is no correlation.

MTS5 D04: MATHEMATICS FOR DECISION MAKING

Course Code	MTS5 D04
Course Title	MATHEMATICS FOR DECISION MAKING
Credits	3
Hours/Weeks	3
Category	Open Course
Semester	Semester 5
Regulation	2020 Onwards

COURSE LEARNING OUTCOMES

CLO1 : Understand the classifications of data. Student is also introduced to various data collection techniques.

CLO2: Understands concepts like measures of central tendency, measures of variation and measures of position.

CLO3: Understands the standard normal distribution and learns the conversion of normal variable to standard normal variable.

CLO-PLO MAPPING

	PLO 1	PLO 2	PLO 3	PLO 4	PLO 5	PLO 6	PLO 7	PLO8	PLO 9	PLO 10	PLO 11
CLO 1										1	
CLO 2									1		
CLO 3										2	

All the courses together must cover all the POs (and PSOs). For a course we map the COs to POs through the CO-PO matrix and to PSOs through the CO-PSO matrix as shown below. The various correlation levels are: “1” – Slight (Low) Correlation “2” – Moderate (Medium) Correlation “3” – Substantial (High) Correlation “-” indicates there is no correlation

MTS 6B30 REAL ANALYSIS - 2

Course Code	MTS 6B30
Course Title	REAL ANALYSIS - 2
Credits	3
Hours/Weeks	4
Category	Core Course
Semester	Semester 6
Regulation	2020 Onwards

COURSE LEARNING OUTCOMES

CLO1: Develop the notion of Riemann integrability of a function using the idea of tagged partitions and calculate the integral value of some simple functions using the definition.

CLO2: Formulate Cauchy criteria for integrability and a few applications of it. In particular they learn to use Cauchy criteria in proving the non-integrability of certain functions.

CLO3: Prove convergence and divergence of sequences of functions and series

CLO4: Interpret difference between point wise and uniform convergence of sequences and series of functions

CLO-PLO MAPPING

	PLO 1	PLO 2	PLO 3	PLO 4	PLO 5	PLO 6	PLO7	PLO8	PLO 9	PLO 10	PLO 11
CLO 1									2	1	
CLO 2									2		
CLO3									2		
CLO 4									1		

All the courses together must cover all the POs (and PSOs). For a course we map the COs to POs through the CO-PO matrix and to PSOs through the CO-PSO matrix as shown below. The various correlation levels are: “1” – Slight (Low) Correlation “2” – Moderate (Medium) Correlation “3” – Substantial (High) Correlation “-” indicates there is no correlation.

MTS 6B29: LINEAR ALGEBRA

Course Code	MTS 6B29
Course Title	LINEAR ALGEBRA
Credits	5
Hours/Weeks	5
Category	Core Course
Semester	Semester 6
Regulation	2020 Onwards

COURSE LEARNING OUTCOMES

CLO1: Identify the basic ideas of vector algebra, linear dependence and independence.

CLO2: Familiar with the notion of a linear transformation and its matrix.

CLO3: Investigate Inner Product spaces and Gram-Schmidt process of orthogonalization.

CLO-PLO MAPPING

	PLO 1	PLO 2	PLO 3	PLO 4	PLO 5	PLO 6	PLO7	PLO8	PLO 9	PLO1 0	PLO1 1
CLO 1									2		
CLO 2									1	2	
CLO 3									1	2	

All the courses together must cover all the POs (and PSOs). For a course we map the COs to POs through the CO-PO matrix and to PSOs through the CO-PSO matrix as shown below. The various correlation levels are: “1” – Slight (Low) Correlation “2” – Moderate (Medium) Correlation “3” – Substantial (High) Correlation “-” indicates there is no correlation.

PHY 6B32 (EL2): NANOSCIENCE AND TECHNOLOGY

Course Code	PHY 6B32 (EL2)
Course Title	NANOSCIENCE AND TECHNOLOGY
Credits	3
Hours/Weeks	3
Category	Elective Course
Semester	Semester 6
Regulation	2020 Onwards

COURSE LEARNING OUTCOMES

CLO1: Understand the elementary concepts of Nano science

CLO2: Understand the electrical transport mechanisms in nanostructures

CLO3: Understand the applications of quantum mechanics in Nano science

CLO4: Understand the fabrication and characterization techniques of nanomaterial's

CLO5: Enumerate the different applications of nanotechnology

CLO-PLO MAPPING

	PLO 1	PLO 2	PLO 3	PLO 4	PLO 5	PLO 6	PLO7	PLO8	PLO 9	PLO1 0	PLO1 1
CLO 1	1										
CLO 2		2								2	
CLO 3		3								2	
CLO 4	1									1	
CL05					1						

All the courses together must cover all the POs (and PSOs). For a course we map the COs to POs through the CO-PO matrix and to PSOs through the CO-PSO matrix as shown below. The various correlation levels are: "1" – Slight (Low) Correlation "2" – Moderate (Medium) Correlation "3" – Substantial (High) Correlation "-" indicates there is no correlation.

MTS 6B31 (E02): INTRODUCTION TO GEOMETRY

Course Code	MTS 6B31(E02)
Course Title	INTRODUCTION TO GEOMETRY
Credits	3
Hours/Weeks	3
Category	Elective Course
Semester	Semester 6
Regulation	2020 Onwards

COURSE LEARNING OUTCOMES

CLO1 : Understand several basic facts about parabola, hyperbola and ellipse (conics) such as
 Their equation in standard form, focal length properties, and reflection properties,
 Their tangents and normal.

CLO2: Realise the basic difference in identifying two geometric objects in Euclidean and
 Affine geometry tries

CLO3: Understand the concept of cross ratio and calculate it

CLO-PLO MAPPING

	PLO 1	PLO 2	PLO 3	PLO 4	PLO 5	PLO 6	PLO7	PLO8	PLO 9	PLO1 0	PLO1 1
CLO 1										1	
CLO 2											1
CLO 3										2	

All the courses together must cover all the POs (and PSOs). For a course we map the COs to POs through the CO-PO matrix and to PSOs through the CO-PSO matrix as shown below. The various correlation levels are: “1” – Slight (Low) Correlation “2” – Moderate (Medium) Correlation “3” – Substantial (High) Correlation “-” indicates there is no correlation.

PHY 6B33: PRACTICAL II

Course Code	PHY 6B33
Course Title	PRACTICAL II
Credits	2
Hours/Weeks	4
Category	Practical
Semester	Semester 6
Regulation	2020 Onwards

COURSE LEARNING OUTCOMES

CLO1: Apply and illustrate the concepts of properties of matter through experiments

CLO2: Apply and illustrate the concepts of electricity and magnetism through experiments

CLO3: Apply and illustrate the concepts of optics and spectroscopy through experiments

CLO4: Apply and illustrate the principles of heat through experiments

CLO-PLO MAPPING

	PLO 1	PLO 2	PLO 3	PLO 4	PLO 5	PLO 6	PLO7	PLO8	PLO 9	PLO1 0	PLO1 1
CLO 1					1					3	
CLO 2					3					3	
CLO 3					3					2	
CLO 4					2					2	

All the courses together must cover all the POs (and PSOs). For a course we map the COs to POs through the CO-PO matrix and to PSOs through the CO-PSO matrix as shown below. The various correlation levels are: “1” – Slight (Low) Correlation “2” – Moderate (Medium) Correlation “3” – Substantial (High) Correlation “-” indicates there is no correlation.

PHY 6B33: PRACTICAL II

Course Code	PHY 6B34
Course Title	PRACTICAL III
Credits	2
Hours/Weeks	4
Category	Practical
Semester	Semester 6
Regulation	2020 Onwards

COURSE LEARNING OUTCOMES

CLO1: Apply and illustrate the principles of semiconductor diode and transistor through experiment

CLO2: Apply and illustrate the principles of transistor amplifier and oscillator through experiments

CLO3: Apply and illustrate the principles of digital electronics through experiments

CLO4: Analyse and apply computational techniques in Python programming

CLO-PLO MAPPING

	PLO 1	PLO 2	PLO 3	PLO 4	PLO 5	PLO 6	PLO7	PLO8	PLO 9	PLO1 0	PLO1 1
CLO 1					3					1	
CLO 2					3					1	
CLO 3					2					1	
CLO 4					3					1	

All the courses together must cover all the POs (and PSOs). For a course we map the COs to POs through the CO-PO matrix and to PSOs through the CO-PSO matrix as shown below. The various correlation levels are: “1” – Slight (Low) Correlation “2” – Moderate (Medium) Correlation “3” – Substantial (High) Correlation “-” indicates there is no correlation.