BANKURA UNIVERSITY

(West Bengal Act XIX of 2013- Bankura University Act, 2013)

Main Campus, Bankura Block-II, P.O.: Purandarpur, Dist.: Bankura, Pin- 722155, West Bengal

Office of the Secretary

Faculty Council for Undergraduate Studies

Ref: BKU/FCUG/167/2026 Date: 19/06/2026

NOTIFICATION

As directed, the undersigned is pleased to inform all concerned that Bankura University has initiated the process to implement New Curriculum and Credit Framework for Undergraduate Programme, UGC 2022 (as per NEP 2020) for 4-years Undergraduate programme with Mathematics as Major, Minor etc. from the academic session 2023-2024. The syllabus as framed / drafted and partially implemented deserves to be analysed after receiving feedback from different stakeholders. As an important corollary to the process, a workshop will be organized on the date mentioned herewith to get the feedback from the stakeholders. Present Students, Alumni, Guardians, Academicians and other stakeholders related to the specific programme/course are requested for their kind participation in the workshop and to present their views/ observations, etc. The stakeholders may go through the draft syllabus attached herewith and convey their observations to the office of the undersigned on ugsecretaryoffice@bankurauniv.ac.in within seven days from the date of publication of this notice.

Date: 02.07.2026
Time: 12 noon
Google Meet joining link : https://meet.google.com/rkh-vstb-sru

Sd/-
Dr. Arindam Chakraborty
Secretary
Faculty Council for Undergraduate Studies

Ref: BKU/FCUG/167(6)/2026 Date: 19/06/2026

1. Registrar (Addl. Charge), Bankura University.
2. Dean (Officiating), Faculty Council of P.G. Studies in Arts, Science etc. Bankura University.
3. Chairperson / Convenor, Undergraduate Board of Studies in Mathematics, Bankura University with request for necessary action.
4. System Administrator, Bankura University with request to upload this in website.
5. Secretary, Hon'ble Vice Chancellor, Bankura University.
6. Guard File.

Sd/-
Dr. Arindam Chakraborty
Secretary
Faculty Council for Undergraduate Studies

BKU Proposed Syllabus for UG Mathematics

Semester – VII

STRUCTURE IN MATHEMATICS (HONOURS. /HONS. WITH RESEARCH)

Course Code	Course Title	Credit	Marks			No. of Hours		
			I.A.	ESE	Total	Lec.	Tu.	Pr.
S/MTH/ 701/MJC-17	Advanced Real Analysis	04	10	40	50	03	01	00
S/MTH/ 702/MJC-18	Group theory-II and Ring theory-II	04	10	40	50	03	01	00
S/MTH/ 703/MJC-19	Integral Transforms and Integral Equations	04	10	40	50	03	01	00
S/MTH/ 704/MJC-20	Advanced Mechanics	04	10	40	50	03	01	00
S/MTH/ 705/MN - 7	Statics and Dynamics	04	10	40	50	03	01	00
Total in Semester - VII		**20**	**50**	**200**	**250**	**15**	**05**	**00**

MJC 17 – Advanced Real Analysis

Advanced Real Analysis

4 Credits

Course Objectives: The main objective of this course is to introduce measurable sets, measurable functions and study their various properties. The concept of Lebesgue integration as a generalization of Riemann integration will be introduced and cultivated here.

Course Specific Outcomes: After completion of this course a student would have

- a clear idea of Functions of Bounded Variation
- a basic concept of Riemann-Stieltjes integrals
- a vast knowledge of measurable sets, measurable functions.
- a clear concept of Lebesgue integration,
- an idea how to construct non-measurable sets.

Total Lectures: **50** (10+10+15+15) (**Marks** – 50)

Unit 1

Functions of Bounded Variation and their properties, variation function.
Riemann-Stieltjes integration, Necessary and sufficient conditions of RS integrability, Some basic theorems. RS Integral as limit of a sum, RS integral to Riemann integration, mean value theorem, and Integration by parts and their applications.

Unit 2

Lebesgue outer measure, measurable sets and their properties, Cantor's Set, Borel sets, existence of non-measurable sets, Lebesgue measure.

Unit 3

Measurable functions and their properties, continuity and measurability, monotonocity and measurability, sequence of measurable functions, operation on collection of measurable functions, pointwise limit of a sequence of measurable functions, measurability of Supremum and Infimum, Egoroff's theorem, Applications of Lusin Theorem.

Unit 4

Simple and Step Functions, Lebesgue integral of simple and step functions, Lebesgue integral of a bounded function over a set of finite measure, Lebesgue integral of non-negative function, Fatou's Lemma, Monotone Convergence Theorem and its consequences.
The General Lebesgue integral: Definition and examples, Dominated Convergence Theorem (statement only), Bounded Convergence Theorem (statement only).

References

- Axler, Sheldon, *Measure, integration & real analysis*. Springer Nature, 2020.
- Folland, Gerald B., *Real Analysis: Modern Techniques and Their Applications*. 2nd ed., Wiley, 1999.
- Rudin, Walter.,*Real and Complex Analysis*. 3rd ed., McGraw-Hill, 1987.
- Goldberg, Richard R., *Methods of real analysis*. Oxford and IBH Publishing, 1970.
- Schilling, Rolf W., *Measure and Integral: An Introduction to Real Analysis*. 3rd ed., American Mathematical Society, 2017.
- Stein, Elias M., and Rami Shakarchi, *Lebesgue Integration on Euclidean Space*. Princeton University Press, 1971.
- Bruckner, Andrew M., et al., *Introduction to Real Analysis and Measure Theory*. 2nd ed., American Mathematical Society, 2014.
- Royden, H. L., and P. M. Fitzpatrick. *Real Analysis*. 4th ed., Pearson, 2010.
- Tao, Terence. *An Introduction to Measure Theory*. Graduate Studies in Mathematics, vol. 126, American Mathematical Society, 2011.
- Bartle, Robert G., *The Elements of Integration and Lebesgue Measure*. Wiley, 1995.
- de Barra, G., *Measure Theory and Integration*. World Scientific, 2014.
- Rudin, Walter, *Real Analysis and Foundations*. 2nd ed., McGraw-Hill, 1991.

MJC 18 – Group theory-II and Ring theory-II

Group theory-II and Ring theory-II

4 Credits

Course Objectives: The main objective of this course is to give a deep insight of abstract algebra. This course also covers some advanced area of group theory and basic introduction to module theory and field extension.

Course Specific Outcomes: After completion of this course a student would have

- a vast knowledge of group theory
- basic understanding of module theory
- Introductory ideas of field extension.

Total Lectures: **50**(10+10+15+15) (**Marks** – 50)

Unit 1

Automorphism, inner automorphism, automorphism groups, automorphism groups of finite and infinite cyclic groups, applications of factor groups to automorphism groups, Characteristic subgroups, Commutator subgroup and its properties.

Unit 2

Properties of external direct products, the group of units modulo n as an external direct product, internal direct products, Fundamental Theorem of finite abelian groups, invariant factors, elementary divisors.

Unit 3

Group actions, Orbits, stabilizers and kernels. Generalized Cayley's theorem, extended Cayley's theorem, Index theorem. Burnside theorem, Groups acting on themselves by conjugation, Class equation, p-groups, Cauchy's theorem, Converse of Lagrange's theorem for finite Abelian groups, Sylow theorems and some of its applications, non simplicity tests.

Unit 4

Polynomial rings, division algorithm and consequences in polynomial rings, results regarding various domains in polynomial rings, Irreducibility in polynomial rings, Eisenstein criterion.
Ring embedding and quotient field.

Unit 5

Fields as quotients of a Polynomial ring with the help of an irreducible elements. Prime subfield. Extension of fields, simple extensions, algebraic and transcendental extensions. Construction of finite fields with p^n elements.

References

- Dummit, David S., and Richard M. Foote, Abstract Algebra. Wiley, 3rd ed., 2004.
- Malik, S. K., J. N. Mordeson, and M. K. Sen, Fundamentals of Abstract Algebra. McGraw-Hill, 2003.
- Herstein, I. N., Topics in Algebra. Wiley, 2nd ed., 1975.
- J. A. Gallian,*Contemporary Abstract Algebra*, Cengage Learning, 2016.
- Adhikari, MahimaRanjan, and AvishekAdhikari, *Basic modern algebra with applications*. Springer India, 2014.
- Carter, Nathan, *Visual group theory*. Vol. 32. American Mathematical Soc., 2021.

MJC19 – Integral Transforms and Integral Equations

Integral Transforms and Integral Equations

4 Credits

Course Objectives: The main objective of this course is to give an understanding of the fundamental concepts and analytical techniques of integral transformations and integral equations. Develop skills for solving integral equations and its connection with differential equations. This course also focuses on their applications to different fields.

Course Specific Outcomes: After successful completion of the course, students will be able to:

- Classify Integral Equations
- Solve Integral Equations
- Convert differential equations into integral equations and solve them effectively.
- Apply Laplace Transform &Fourier Transform to ordinary differential equations.
- Understand and apply convolution theorem in solving integral equations & transform problems.

Total Lectures: **50**(10+10+15+15) (**Marks** – 50)

Unit 1

The Laplace transforms & its inversions: Definitions. Laplace transform of elementary sectionally continuous and exponential ordered functions including its existence, some important properties of Laplace transform of derivatives and integrals. Laplace transforms of some special functions. Definition and Uniqueness theorem of inverse Laplace transform. Laplace Inversion of some elementary functions, some properties of inverse Laplace transform. Inverse Laplace transform of derivatives and integrals, The convolution property. Evaluation of integrals. Application of Laplace Transforms. Ordinary differential equations with constant coefficients, ordinary differential equations with variable coefficient.

Unit 2

Fourier Series and Integrals: Fourier series, Odd and Even functions, half range Fourier sine and cosine series, complex form of Fourier series, Parseval's identity for Fourier Cosine and Sine finite Fourier transforms, the Fourier integral including its complex form, Fourier transforms, including sine and cosine transforms convolution theorem, Parseval's identity for Fourier integrals. Relations between Fourier and Laplace transforms, Solution of simple partial differential equations by means of Fourier transforms.

Unit 3

Linear Integral Equations-Definition and classification, conversion of initial and boundary value problems to an integral equation; Eigen values and Eigen functions; solution of homogenous; Fredholm integral equations second kind with separable kernels; Solution of general Fredholm integral equation of second kind with separable kernels; Solution of Volterra integral equations of second kind with convolution type kernels by Laplace transform Solution of singular integral equations by Fourier transform; Solution of Fredholm and Volterra integral equations of second kind by methods of successive substitutions and successive approximations; Resolvent kernels and its results; Conditions of uniform convergence and uniqueness of series solution.

References

- Integral Transforms and Their Applications (3rd Edition) by L. Debnath and D. Bhatta
- Integral Transforms and Their Applications by Brian Davies
- The Use of Integral Transforms by I.N. Sneddon
- An Introduction to Transform Theory by D.V. Widder
- Introduction to Integral Equations with Applications by Abdul J. Jerri
- Linear Integral Equations by William Vernon Lovitt
- The Classical Theory of Integral Equations: A Concise Treatment by Stephen M. Zemyan
- Integral Equations by B.L. Moiseiwitsch (Dover Books)
- Integral Equations by D.C. Sharma & M.C. Goyal
- Integral Equations and Their Applications by M. Rahman
- Integral Equations and Integral Transforms by S. Banerjee and B.N.Mondal.

MJC 20-Advanced Mechanics

Advanced Mechanics

4 Credits

Course Objectives: After completing this course, the student will:

1. Develop an understanding of the dynamics of systems of particles and the fundamental conservation principles governing mechanical systems.
2. Understand the dynamics of rigid bodies, including moments of inertia, angular momentum, and equations of motion for rigid body systems.
3. Analyze translational and rotational motion of rigid bodies and solve standard problems involving rolling and planar motion.
4. Learn the formulation of mechanical systems using generalized coordinates and constraints within the Lagrangian framework.
5. Understand the theory of small oscillations and its applications to systems with multiple degrees of freedom.
6. Gain an introduction to the Hamiltonian formulation of mechanics and the variational principles underlying classical dynamics.

Course Specific Outcomes: On successful completion of the course, students will be able to:

1. Apply conservation laws of momentum, angular momentum, and energy to analyze the motion of particle systems.
2. Compute moments and products of inertia of standard bodies and analyze rigid body motion about fixed axes and fixed points.
3. Formulate and solve equations of motion for rigid bodies undergoing translational and rotational motion.
4. Model mechanical systems using generalized coordinates and derive equations of motion using Lagrange's equations.
5. Analyze small oscillations of mechanical systems and determine normal modes of vibration.
6. Understand the Hamiltonian formulation of mechanics and interpret mechanical systems in terms of Hamilton's canonical equations and variational principles.

Total Lectures: **50**(10+10+15+15) (**Marks** – 50)

Unit 1

Dynamics of a system of particles: Basic concepts, Centroid, linear momentum, angular momentum, kinetic energy, potential energy, work, power, conservative system of forces; Use of centroid – motion relative to the centroid, angular momentum and kinetic energy relative to the centroid; Conservation principles – linear momentum, angular momentum, total energy; Constraints- basic concepts with examples, D'Alembert Principle.

Unit 2

Introduction to rigid body dynamics: Moments and product of inertia - basic concepts, radius of gyration, parallel and perpendicular axis theorems, a few examples (rod, rectangular plate, circular plate, elliptic plate, sphere, cone, rectangular parallelepiped, cylinder, ellipsoid of revolution etc.); Motion about a point and about fixed axes- angular momentum, inertia matrix, principal axes, principal moments of inertia, kinetic energy, momental ellipsoid, equimomental surface, reaction of the axis of rotation, impulsive forces; General motion of rigid body - translational and rotational motion, kinetic energy and angular momentum (translational and rotational); Two-dimensional motion of rigid body - equation of motion, kinetic energy, angular momentum, Illustrative problems related to Motion of a sphere on horizontal plane, such as, motion of a uniform sphere (solid and hollow) along a perfectly rough plane, motion of a uniform heavy circular cylinder (solid and hollow) along a perfectly rough inclined plane, motion of a uniform heavy solid sphere along an imperfectly rough inclined plane, etc.

Unit 3

Lagrangian Formulation: Generalized co-ordinates, Geometrical equations, Holonomic and non-holonomic systems, Configuration space, Lagrange's equations using D'Alembert's Principle for a holonomic conservative system, Theory of small oscillations: Lagrange's method, normal (principal) co-ordinates and the normal modes of oscillations.

Unit 4

Hamiltonian Formulation: Generalized momentum and the Hamiltonian for a dynamical system, Hamilton's canonical equations of motion, Hamiltonian as a sum of kinetic and potential energies, Phase space and Hamilton's variational principle, the principle of least action.

References

- S. Deo and R. Rahaman, Classical Mechanics: An Introduction, Narosa Publishing House, New Delhi, 2022.
- H. Goldstein, Classical Mechanics, Pearson,2011.
- F. Chorlton, Text Book of Dynamics, CBS Publishers, New Delhi, 1999.
- S. L. Loney, *An Elementary Treatise on the Dynamics of a Particle and of Rigid Bodies*, Radha Publishing House, Calcutta, 1985.
- N. C. Rana and P. S. Joag, *Classical Mechanics*, Tata McGraw Hill Publishing Company Ltd., New Delhi, 1997.
- M. Rahaman, Rigid Dynamics, New Central Book Agency, 7th Edition, 2011.
- B. D. Sharma, B.S. Tyagi, B. Nand, Dynamics Of Rigid Bodies, KEDAR NATH RAM NATH, 2020.

BKU Proposed syllabus for UG Mathematics Minor

Semester VII

MN 7 – Statics and Dynamics

Statics and Dynamics
4 Credits
Course Objectives: The course will enable the students to i) Familiarize with subject matter, which has been the single centre, to which were drawn mathematicians, physicists, astronomers, and engineers together. ii) Understand necessary conditions for the equilibrium of particles acted upon by various forces and learn the principle of virtual work for a system. iii) Determine the centre of gravity of some materialistic systems and discuss the equilibrium of concurrent forces.
Course Specific Outcomes: This course specifically enables to the students i) Deal with the kinematics and kinetics of the rectilinear and planar motions of a particle including the constrained oscillatory motions of particles. ii) Learn that a particle moving under a central force describes a plane curve and know the Kepler's laws of the planetary motions, which were deduced by him long before the mathematical theory given by Newton.
Total Lectures: **50**(10+10+15+15) (**Marks** – 50)
Unit 1
Forces, Various types, Composition and Resolution of forces, Equilibrium of Concurrent forces, Parallel forces, Moment of a force, Couples, Friction, Centre of mass and Centre of gravity, Frictions, Laws of friction, Coefficient of friction and angle of friction.
Unit 2
Virtual work: Principle of Virtual work, Simple problems, Common Catenary: Suspension of strings, Related problems, Stability of a body: Equilibrium, Stable, Unstable, Test of stability: Energy test.
Unit 3
Particle Dynamics: Velocity, Acceleration, Equation of motion, Newton's Laws of motion, Rectilinear motion, Motion in a variable acceleration, Simple Harmonic Motion (SHM), Damped Oscillation, Forced Oscillation, Two dimensional motion – Cartesian and Polar Coordinates, Radial and Cross radial components of velocity and acceleration, Central Force, Equation of motion under central force, Pedal form, Angular momentum, Apse, Apsidal angle, Apsidal distance, Planetary motion, Kepler's Law of motion, Tangential and normal components of velocity and acceleration.

Unit 4

Work, Power, Energy, Kinetic and Potential energy, Conservative force, Conservation of Mechanical energy, Impulse of a force, Impulsive force, Principle of conservation of linear momentum, Collision of elastic bodies: Impact, Coefficient of restitution, Newton's empirical law, Related problems.

References

- S.L. Loney, An Elementary Treatise on the Dynamics of a Particle and of Rigid Bodies. Read Books, 2006.
- P.L. Srivatava, Elementary Dynamics. Ram NarinLal, Beni Prasad Publishers Allahabad, 1964.
- J.L. Synge & B. A. Griffith, Principles of Mechanics. McGraw-Hill, 1949.
- S. Ramsey, Statics. Cambridge University Press, 2009.
- S. Ramsey, Dynamics. Cambridge University Press, 2009.
- R.S. Varma, A Text Book of Statics. Pothishala Pvt. Ltd. Loney, 1962.