

Lecture Plan / lesson Plan of CC 1 (Geometry , Vector , Calculus)

Semester - I (MTMA CBCS)

Instructor Name : Snehendu Mandal

Class	topic	Related links	Faculty approach	Student activity	Learning outcomes
Class 1	- Hyperbolic functions, - higher order derivatives	https://youtu.be/BLkz5LGWihw?si=ulrPluJNZorpeB0f	Explains Board work	Listens	Understanding
Class 2	- Leibnitz rule and its applications to problems of type $\exp(ax+b) \sin x$, $\exp(ax+b) \cos x$ $\exp(ax+b) \cos(cx+d)$	https://youtube.com/playlist?list=PLU6SqDYcYsflsER5aEx21e8CSolZhb-Rd&si=vBrElWj-vqS76Tal	Explains Board Work with examples	Listens & write	Understanding
Class 3	$(ax+b)^n \sin x$, $(ax+b)^n \cos x$ $\sin(ax+b)$, $\cos(ax+b)$, $\log(ax+b) \cdot \sin x$ $\log(ax+b) \cdot \cos(cx+d)$	https://youtube.com/playlist?list=PLU6SqDYcYsflsER5aEx21e8CSolZhb-Rd&si=vBrElWj-vqS76Tal	Explains Board work	Listen & write	Understanding
Class 4	- Curvature - Radius of Curvature of Cartesian , Polar , & Parametric Curves	https://youtu.be/f37Q_vjfn0k?si=erVD1exccCmz8hqe	Explains Board Work with examples	Listens & write Understanding	Understanding & analyze
Class 5	- Theorems & applications on Curvature - Examales , Problems	https://youtu.be/f37Q_vjfn0k?si=erVD1exccCmz8hqe	Explains Board Work with examples	Listens & write Understanding	Understanding & analyze
Class 6	Concavity , Convexity ,	https://youtu.be/H9xxLXYSrCw?si=-U7F3T-droPM0SVR	Explains Board Work with examples	Listens & write Understanding	Understanding & analyze

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	and points of inflection				
Class 7	- Theorems on convexity , Concavity , & Infexion - Examples & Problems	https://youtu.be/H9xxLXYSrCw?si=-U7F3T-droPM0SVR	Explains Board Work with examples	Listens & write Understanding	Understanding & analyze
Class 8	- Envelopes, - Results & Properties on Envelops - Problems	https://youtu.be/H9xxLXYSrCw?si=-U7F3T-droPM0SVR	Explains Board work	Listens & write	Understanding & analyze
Class 9	- Rectilinear asymptotes (Cartesian & parametric form only - Theorems & applictions	https://youtube.com/playlist?list=PLU6SqdYcYsfIJRl8mo2Rv1MpdvmVD0YyI&si=l0A1It0hJxAQ6zBt	Explains Board work	Listens & write Understanding	Understanding & analyze
Class 10	- Curve tracing in Cartesian coordinates & also in Parmetric Coordinates - Examples & Results - Problems	https://youtu.be/CioY8ElsjO4?si=xHXY7NJq0fpXAYmW	Explains Board Work with examples	Listen & write Understanding	Develop Skills
Class 11	- Tracing in polar coordinates of standard curves, - Examples & Results - Problems on Polar Curves	https://youtu.be/zLQE8tO5G90?si=bcyyTSRcHiXXtknz	Explains Board work with examples	Listens Understanding	Develop Skills
Class 12	- L'Hospital's rule, - Applications in business, Economics and Life Sciences.	https://youtu.be/H-TZUMCWgo8?si=JNXpH5G_aagNsMIv	Explains Board Work with examples	Listens & write	Understanding & analyze
Class 13	- Applications - Various types	https://youtu.be/H-TZUMCWgo8?si=JNXpH5G_aagNsMIv	Explains Board Work with examples	Listens & write	Understanding & analyze

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	Exercises				
Class 14	- Reduction formulae, - derivations and illustrations of reduction formulae of the type $\int \sin^n x \, dx$, $\int \cos^n x \, dx$ $\int \tan^n x \, dx$ $\int \cot^n x \, dx$	https://youtube.com/playlist?list=PLdhH6IJ5Nz1fbUCBCcYEuAOX1g_gGzBwU&si=pAGB1umK3HVLfR68	Explains Board work	Listen & write	Develop Skills
Class 15	- Reduction formulae, - derivations and illustrations of of the type $\int \sin^n x \cos^m x \, dx$ $\int \sin^n x \cos^m x \, dx$ $\int \sin^m x \cos^n x \, dx$	https://youtu.be/r_WY5oVlsm4?si=CqCx6P0CIpoiaO0	Explains Board Work with examples	Listens	Understanding & analyze
Class 16	- Reduction formulae - illustrations of of the type $\int \sec^n x \, dx$ $\int \operatorname{cosec}^n x \, dx$ $\int \log x^n \, dx$	https://youtube.com/playlist?list=PLZrDw1dA7WxFI0WQV_kx8rqa7AU3F18JCT&si=EI5ObLHYwjoEsuwd	Explains Board work with examples	Listens & write	Understanding & analyze
Class 17	Exercises / Test on Reduction formulae, L' H Rule , Asymptotes , Curvature	https://youtu.be/zLQE8tO5G90?si=bcyyTSRcHiXXtknz	Explains	Listens & write	Understanding & analyze
Class 18	- Parametric equations, - Parametrizing a Curve	https://youtu.be/YsAiAiRxHU4?si=k8aJV_Q2hg0Gb9xa	Explains Board Work with examples	Listen & write	Understanding & analyze
Class 19	Exercises on on Higher Order Derivatives , Concavity , Convexity , & Point of Inflexion	https://youtu.be/zLQE8tO5G90?si=bcyyTSRcHiXXtknz	Explains	understanding Problem solving	Understanding & analyze

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Class 20	- Area under a curve, - Area of a Cartesian & Polar Curves & Parametric Curves	https://youtube.com/playlist?list=PLU6SqdYcYsfJV8Lf4KFA0U8kGeJ2NGWV&si=O96QrBx8g0uEIQMm	Explains Board Work with examples	Listens & write	Understanding & analyze
Class 21	- Area and volume of surface of revolution. - Various Problems	https://youtube.com/playlist?list=PLjReJAzC4wUiKAobb-pTeGmOINJN43VEm&si=FDcBL-t9WF_z68hw	Explains Board work	Listen & write	Understanding & analyze
Class 22	Unit-2 : Geometry - Rotation of axes and - second degree equations, - classification of conics using the Discriminant	https://youtu.be/jECFUcmrxxU?si=7IClvYjsdOQpLZqZ	Explains Board Work with examples	Listens & write	Understanding & analyze
Class 23	- Tangent and normal, - Theorems & Results - Various Problems	https://youtube.com/playlist?list=PLmxCweM-UENzIafKidGeicxmkB1xu7LjT&si=sq_vY4IwcwNCOlBJ	Explains Board work	Listens & write	Understanding
Class 24	- Polar equations of conics. - Polar equations of Curves - Theorems & Results - Various Problems	https://youtu.be/j4EamStB4xA?si=8PL3xtINcxQ--bPx	Board Work with examples	Listens & write	Understanding & analyze
Class 25	- Equation of Plane : General form, - Intercept and Normal forms. - The sides of a plane.	https://youtu.be/g2513dd5HJU?si=NvHRJ2eR0JYEHoi	Explains Board Work with examples	Listen & write	Develop Skills
Class 26	Signed distance of a point from a plane.	https://youtu.be/g2513dd5HJU?si=oXDYbwLxVyfjS-WE	Explains Board work	Listens & write	Understanding & analyze

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	Equation of a plane passing through the intersection of two planes.				
Class 27	- Angle between two intersecting planes. - Parallelism and perpendicularity of two planes.	https://youtu.be/g2513dd5HJU?si=oXDYbwLxVyfjS-WE	Explains Board Work with examples	Listens & write	Understanding & analyze
Class 28	- Straight lines in 3D: Equation (Symmetric & Parametric form). - Direction ratio and direction cosines - Canonical equation of the line of intersection of two intersecting planes	https://youtu.be/j4EamStB4xA?si=rJB9lCFXZ4O2CHqZ	Explains Board Work with examples	Listen & write Understanding	Problem solving Develop Skills
Class 29	Exercises on 3D geometry	https://youtu.be/ZBvxrHggBRs?si=m-gsnPrjOJuld27	Explains Board Work with examples	Problem solving	Understanding & analyze Problem solving
Class 30	- Angle between two lines. - Distance of a point from a line. - Condition of coplanarity of two lines.	https://youtu.be/j4EamStB4xA?si=8PL3xtlNcxQ--bPx	Explains Board Work with examples	Understanding Listen & write	Develop Skills
Class 31	- Equation of skew lines. - Shortest distance between two skew lines.	https://youtu.be/j4EamStB4xA?si=8PL3xtlNcxQ--bPx	Explains Board Work with examples	Problem solving Listen & write	Develop skill
Class 32	- Spheres. - Theorems & properties - Examples & Problems	https://youtu.be/ZBvxrHggBRs?si=m-gsnPrjOJuld27	Explains Board Work	Listen & write	Develop skill
Class 33	Cylindrical surfaces.	https://youtu.be/tLzCP3R9_W4?si=xYyMIRxri74LVTxo	Board Work with examples	Understanding Listen & write	Understanding & analyze Develop Problem solving

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	- Theorems & properties - Examples & Problems				Skills
Class 34	- Central conicoids - Examples & Problems - Theorems & properties	https://youtu.be/tLzCP3R9_W4?si=xYyMIRxri74LVTxo	Board Work with examples	Understanding Listen & write	Understanding & analyze Develop Problem solving Skills
Class 35	Exercises / on 3D Geometry	https://youtu.be/j4EamStB4xA?si=rJB9lCFXZ4O2CHqZ	Board Work with examples	Understanding Listen & write	Problem solving Develop Skills
Class 36	- Paraboloids, - Examples & Properties - theorems	https://youtu.be/tLzCP3R9_W4?si=xYyMIRxri74LVTxo	Explains Board Work	Problem solving Listen & write	Problem solving Develop Skills
Class 37	- Ellipsoids - Examples & Properties - Theorems & problems	https://youtu.be/tLzCP3R9_W4?si=xYyMIRxri74LVTxo	Explains Board Work with examples	Understanding Listen & write	Develop Skills Listen & write
Class 38	- Hyperboloids - Examples & Properties - Theorems & problems	https://youtu.be/tLzCP3R9_W4?si=xYyMIRxri74LVTxo	Explains Board Work with examples	Understanding Listen & write	Develop Skills Listen & write
Class 39	- plane sections of conicoids - Examples & Properties	https://youtu.be/tLzCP3R9_W4?si=xYyMIRxri74LVTxo	Board Work with examples	Understanding	Problem solving Develop Skills
Class 40	- Generating lines - Classification - Examples & Problems - Theorems & Properties	https://youtu.be/tLzCP3R9_W4?si=xYyMIRxri74LVTxo	Board Work with examples	Understanding	Problem solving Develop Skills
Class 41	- Classification of quadrics - Illustrations of	https://youtube.com/playlist?list=PLtVf2Dbr0DF6n8YYzTxo8Geg6nw2QFqtq&si=v0Lvjt	Explains Board Work with examples	Listens & write	Understanding & analyze

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	graphing standard quadric surfaces like cone , Cylinder , ellipsoid.	j3SugalpMK			
Class 42	- Tangent and normals of conicoids. - Examples & Problems - Theorems	https://youtube.com/playlist?list=PLtVf2Dbr0DF6n8YYzTxo8Geq6nw2QFqtq&si=v0Lvjtj3SugalpMK	Explains Board Work with examples	Listen & write	Understanding & analyze
Class 43	- Triple product, vector equations - Theorems & properties	https://youtu.be/0HvfuK5wS30?si=HAMFQuq80mFQ3Ltx	Explains Board Work	understanding	Problem solving Develop Skills
Class 44	- Applications to Geometry and Mechanics - Application of Vector equations in Geometry	https://youtu.be/0HvfuK5wS30?si=HAMFQuq80mFQ3Ltx	Explains Board Work with examples	Understanding Listen & write	Develop Skills Listen & write
Class 45	- Concurrent forces in a plane - Theory of couples, system of parallel forces.	https://youtu.be/Pk79QNMqlg4?si=P6ZwClq3loc1cXaz	Explains Board Work with examples	understanding	Problem solving Develop Skills
Class 46	- Introduction to vector functions - Scalar functions & vector functions - Examples & Problems	https://youtu.be/FfJtVvQtqTM?si=kjrjXAJvhWZUxwFl	Board Work with examples	Listen & write	Understanding & analyze
Class 47	- Vector Valued functions of a scalar variable - Vector valued functions of a vector variable .	https://youtu.be/FfJtVvQtqTM?si=kjrjXAJvhWZUxwFl	Explains Board Work with examples	Understanding Listen & write	Develop Skills Listen & write
Class 48	- Operations with vector-valued functions, - limits and continuity of	https://youtu.be/FfJtVvQtqTM?si=kjrjXAJvhWZUxwFl	Explains Board Work with examples	Understanding	Develop Skills Listen & write

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	vector functions				
Class 49	- Differentiation of vector functions of a scalar variable & of a vector variable . - Examples & Problems	https://youtu.be/FfJtVvQtqTM?si=kjrjXAJvhWZUxwFl	Board Work with examples	Listens & write	Understanding & analyze

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LECTURE PLAN & RELATED LINKS

Subject: MTMA

Paper: CC-2(Algebra)

Semester: I (B.Sc. Mathematics Honours)

Credit: 6

Instructor: Mrs. Rini Maiti

Class	Content	Related Links	Faculty Approach	Student Activity	Learning Outcome
Class 1	• Introduction of complex numbers • Geometrical representation of complex numbers	https://youtu.be/kHrTfRtcecE?si=zLr6vgYmJEnSuEuz	Explains and narrates with suitable board work	Listens and writes	Understand
Class 2	• Conjugate of a complex number • Modulus of a complex numbers • Examples	https://youtu.be/kHrTfRtcecE?si=zLr6vgYmJEnSuEuz https://youtu.be/SZKWwixOI9A?si=z0Esagmeux7k4Hvu	Explains and narrates with suitable board work	Listens and writes	Understand
Class 3	• Polar representation of complex numbers • Corresponding examples	https://youtu.be/hOtIOWyT2qg?si=-313ANRiHaV6_RRd	Explains and narrates with suitable board work	Listens and writes	Understand and apply on some problems
Class 4	• n-th roots of unity • Corresponding examples	https://youtu.be/KecsAValwr4?si=24VvnNGkLebry3jH https://youtu.be/6X8Mae-5EAM?si=YtVuaEjVE8i3VVli	Explains and narrates with suitable board work	Listens and writes, and solve problems	Understand and analyze
Class 5	• De Moivre's theorem for rational indices and its applications	https://youtu.be/oaxlM3gWVck?si=9ENS-jXQB64XOjWj	Explains and narrates with suitable board work	Listens and writes, and solve problems	Understand and analyze
Class 6	• Exponential function of complex variable • Properties of Exponential function • Corresponding examples	https://youtu.be/Dz_MS KA b-t4?si=tnSaLlfMnBghPIM7 https://youtu.be/m1Jby5TPKDs?si=5rAUUvnJC4ewhCmY	Explains and narrates with suitable board work	Listens and writes and solve problems	Understand and apply on some problems

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Class 7	- Logarithmic function of complex variable - Properties of Logarithmic function - Some examples	https://youtu.be/hZsYXvqdxRU?si=jOzK2leuPF2_c5t2	Explains and narrates with suitable board work	Listens and writes	Understand and apply on some problems
Class 8	- Trigonometric functions of complex variable - Properties of Trigonometric functions - Corresponding examples	https://www.youtube.com/live/HwpMowwqVdk?si=3fyyOgwcVu57Moym	Explains and narrates with suitable board work	Listens and writes	Understand and apply on some problems
Class 9	- Hyperbolic functions of complex variable - Properties of Hyperbolic functions - Corresponding examples	https://youtu.be/ZNcx9rrwkjA?si=a9zlhqjcMdwvYjtL	Explains and narrates with suitable board work	Listens, writes and comprehends	Understand and apply on some problems
Class 10	Fundamental theorem of classical algebra & its application	https://youtu.be/4LFE-1m2RrQ?si=SkJl4fd12ivxUS0V	Explains and narrates with suitable board work	Listens and writes	Understand
Class 11	Rolle's theorem & its application	https://youtu.be/ztki8awbo9o?si=laa83vkSaHEJDaiU	Explains and narrates with suitable board work	Listens and writes	Understand
Class 12	- Relation between roots and coefficients - Some applications	https://youtu.be/FAPShLAdkto?si=eWz1HxxeGRldzf-V https://youtu.be/FAPShLAdkto?si=ZBg2JJq-EmNHqhZF	Explains and narrates with suitable board work	Listens and writes	Understand and apply on some problems
Class 13	- Transformation of equation - Some applications	https://youtu.be/Sz8_ZA7nQAo?si=nm3hsl9F52XxnnWs https://youtu.be/NdvI67GKf-s?si=ujGjK-CZ4ps2hLZD	Explains and narrates with suitable board work	Listens and writes	Understand and apply on some problems

Class 14	• Descartes rule of signs • Corresponding examples	https://youtu.be/9EEDfNpSVhY?si=lkwdZtJO6xe6iiL	Explains and narrates with suitable board work	Listens and writes	Understand and apply on some problems
Class 15	• Sturm's theorem • Corresponding examples	https://youtu.be/nQTeWTaeink?si=VYNM0fZM8aydxEL	Explains and narrates with suitable board work	Listens and writes	Understand and apply on some problems
Class 16	• Cubic equation (solution by Cardan's method) • Corresponding examples	https://youtu.be/mxtCRZeJLCw?si=O5G4R-BQE6yfZpGe	Explains and narrates with suitable board work	Listens and writes	Understand and apply on some problems
Class 17	• Biquadratic equation (solution by Ferrari's method) • Corresponding examples	https://youtu.be/4tXrBALMzmI?si=3madHO61h3j7rsV3	Explains and narrates with suitable board work	Listens and writes	Understand and apply on some problems
Class 18	• Introduction of Inequality • Some Standard Inequality	https://youtu.be/R-YCtM3kecl?si=jToBpo9SQR4JuIEu https://youtu.be/uy0y3CbZSSs?si=r9A6ULOAs6IfqZAL	Explains and narrates with suitable board work	Listens and writes	Understand and apply on some problems
Class 19	• Cauchy-Schwartz inequality & it's application	https://youtu.be/bOuWqlidePM?si=a6vqP1f_6XyQBF4H	Explains and narrates with suitable board work	Listens and writes	Understand and apply on some problems
Class 20	• The inequality involving $AM \geq GM$ • Corresponding examples	https://youtu.be/b5Vlj3Wo3fg?si=GVMxnial13D3svUx	Explains and narrates with suitable board work	Listens and writes	Understand
Class 21	• The inequality involving $GM \geq HM$ • Corresponding examples	https://youtu.be/YWgXKQedwbw?si=PBL4AItv6AQAFaS9	Explains and narrates with suitable board work	Listens and writes	Understand and apply on some problems
Class 22	• The inequality involving $AM \geq GM \geq HM$ • Corresponding examples	https://youtu.be/6SI4r1no83E?si=j55fk8f_xqoU5g6u https://youtu.be/NNmK26bPhBk?si=Qq5JESOiqtMP6nZ	Explains and narrates with suitable board work	Listens and writes	Understand and apply on some problems

Class 23	- Linear difference equations with constant coefficients (up to 2nd order) - Corresponding examples	https://youtu.be/GrK5B2SQmrc?si=n3JWl3WHZTC-JJh7	Explains and narrates with suitable board work	Listens and writes	Understand and apply on some problems
Class 24	Some important rules for solving Linear difference equations with constant coefficients	https://youtu.be/GrK5B2SQmrc?si=n3JWl3WHZTC-JJh7	Explains and narrates with suitable board work	Listens and writes	Understand and apply on some problems
Class 25	Different type problems on Linear difference equations with constant coefficients	https://youtu.be/GrK5B2SQmrc?si=n3JWl3WHZTC-JJh7	Explains and narrates with suitable board work	Listens and writes	Understand and apply on some problems
Class 26	- Introduction of Relation - Reflexive Relation - Some examples	https://youtu.be/4Caxyh0zt_o?si=k_uag9uBYJguBHCE	Explains and narrates with suitable board work	Listens and writes	Understand and apply on some problems
Class 27	- Symmetric Relation - Transitive Relation - Equivalence relation - Some examples	https://youtu.be/unvT3HDa6Rw?si=lNogwdO0k0ABteFG	Explains and narrates with suitable board work	Listens and writes	Understand and apply on some problems
Class 28	- Equivalence classes - Formation of equivalence classes from equivalence relation - Corresponding Examples	https://youtu.be/TbCk79SoCYw?si=JwRSNQYd804Y9h2P https://youtu.be/CmZzSao_f8g?si=Kr_t2tantQKrFB	Explains and narrates with suitable board work	Listens and writes	Understand and apply on some problems
Class 29	- Partition - An equivalence relation yields a partition	https://youtu.be/hrumNRQwTV8?si=VdMqLJsfdYL8jrHj https://youtu.be/TbCk79SoCYw?si=y6pV9P8xPQsuu_7j	Explains and narrates with suitable board work	Listens and writes	Understand
Class 30	- Partial order relation - Poset - Some examples of poset	https://youtu.be/qC2reWAo2mc?si=fCV85jGhnxf8wbTq	Explains and narrates with suitable board work	Listens and writes	Understand

Class 31	• Introduction of Mapping • Into mapping • Onto mapping • Corresponding examples	https://youtu.be/6ZS2j7kXOh8?si=ZU4O7c8vXR9NLb_S https://youtu.be/UCcaU7a5P-o?si=VQm47f5xi8rSyutx	Explains and narrates with suitable board work	Listens and writes	Understand and apply on some problems
Class 32	• Injective Mapping • Surjective Mapping • Bijective Mapping • Corresponding examples	https://youtu.be/bZred_Ksz2k?si=fhry8M4zJ-huU7wT https://youtu.be/zv2ONqtOK7g?si=8wqw7B4nj3rltpVN	Explains and narrates with suitable board work	Listens and writes	Understand and apply on some problems
Class 33	• Composition of mapping • Relation between composition of mappings • Some important theorems on composition of mappings	https://youtu.be/P_jn1Lvw0s4?si=mfXxdIU0M42puH1n https://youtu.be/7FJ08NILBuA?si=WZ0Q3jUCAPhLi5-H	Explains and narrates with suitable board work	Listens and writes	Understand & analyze
Class 34	• Invertible mapping • Examples • Theorems on invertible mapping	https://youtu.be/7FJ08NILBuA?si=mNM3flo7nLmHJWJB https://youtu.be/5C65rlr6H9U?si=XL7wqBhVb83GD2tK	Explains and narrates with suitable board work	Listens and writes	Understand & analyze
Class 35	• Direct images & inverse images • Meaning and properties of $f^{-1}(B)$, for any mapping $f: X \rightarrow Y$ and $B \subseteq Y$.	https://youtu.be/RnQpWXdzfVM?si=Zr8mjYs5PDx6DhYl https://youtu.be/8ip_IyEweRA?si=INJ3Dcc35LTQ0SYR	Explains and narrates with suitable board work	Listens and writes	Understand
Class 36	• Well-ordering property of positive integers • 1st Principle of Mathematical induction • Some applications	https://youtu.be/a5DKkt5RKog?si=QiVFEAMNp6ph3q4z https://youtu.be/6gUyXDCAhRA?si=kvCH4vcNy1ZNylDs https://youtu.be/1lDfp1j9yzA?si=hp7eNHUaRXkvjg7s	Explains and narrates with suitable board work	Listens and writes	Understand & apply on some problems

Class 37	• 2nd Principle of Mathematical induction • Some applications	https://youtu.be/1lDfp1j9yzA?si=FpRu6CbqN8G C5VuG	Explains and narrates with suitable board work	Listens and writes	Understand & apply on some problems
Class 38	• Division algorithm • It's application	https://youtu.be/Mg5gYoWFESU?si=7y4W5Qd8x4AbjUm-	Explains and narrates with suitable board work	Listens and writes	Understand & apply on some problems
Class 39	• Di-visibility • Some important theorems on divisibility	https://youtu.be/yHwneN6zJmU?si=zF-f7NRYw5VEvEmr	Explains and narrates with suitable board work	Listens, writes and comprehends	Understand and analyze
Class 40	• GCD of two integers • Some important theorems on GCD	https://youtu.be/61sph5R5Juw?si=hPq7LgXnSu35hDX C	Explains and narrates with suitable board work	Listens, writes and comprehends	Understand and analyze
Class 41	• Euclidean algorithm • It's application	https://youtu.be/VD4IZbp2k9c?si= VOTNFsh4Z hFkHsD	Explains and narrates with suitable board work	Listens, writes and comprehends	Understand and analyze
Class 42	• Prime numbers and their properties	https://www.youtube.com/live/7fpjss9KMXy?si= KWAIJEbfwe0Fwxo https://youtu.be/NPtpvWn6-gA?si=mFuFuK_ouR7pan2F	Explains and narrates with suitable board work	Listens, writes and comprehends	Understand and analyze
Class 43	• Congruence relation between integers • Some problems on congruence relation	https://youtu.be/cj-Im1Dg37Q?si=kEcC1CZASpLloz0X	Explains and narrates with suitable board work	Listens, writes and comprehends	Understand and apply on some problems
Class 44	• Chinese remainder theorem. • Some examples	https://youtu.be/CSjFOGh9gkk?si=nRXOMVJkvNacCEO5 https://youtu.be/CxCYP9okPm4?si=40MvFxEOqBIFE8r2	Explains and narrates with suitable board work	Listens, writes and comprehends	Understand and apply on some problems
Class 45	• Fundamental Theorem of Arithmetic & it's application	https://youtu.be/5ltOfUUb-7U?si=i1Y0tIvhxvHNw6RQ	Explains and narrates with suitable board work	Listens, writes and comprehends	Understand and apply on some problems
Class 46	• Arithmetic functions • Some arithmetic functions such as φ, τ, σ and their properties	https://youtu.be/E6S2_22CLWI?si=Xd-N1gQT5wioxJOF	Explains and narrates with suitable board work	Listens, writes and comprehends	Understand and analyze

Class 47	- Rank of a matrix - Determination of rank of a matrix	https://youtu.be/ccahV-ukK2o?si=lG5dZU55Xh_4cleg https://youtu.be/ccahV-ukK2o?si=4azAteAY_O-MxSTO	Explains and narrates with suitable board work	Listens, writes and comprehends	Understand and apply on some problems
Class 48	- Row reduction and echelon forms - Some examples - Fully reduced normal form	https://youtu.be/eS3l3jmoN08?si=D4ZyyZWBU3OMN4xf https://youtu.be/p5rBJ5CKCg?si=Bom8ZxyxDL3Ujzxq	Explains and narrates with suitable board work	Listens, writes and comprehends	Understand and apply on some problems
Class 49	- Elementary matrices - Inverse of a matrix - Characterizations of invertible matrices.	https://youtu.be/aYDDglDOk-8?si=cZNyNmLdabBjxe9 https://youtu.be/7H3JFH3lJB0?si=WV3aKiWoFK0Qge4F	Explains and narrates with suitable board work	Listens, writes and comprehends	Understand and apply on some problems
Class 50	- Systems of linear equations - Consistent System - Inconsistent system - Corresponding examples	https://www.youtube.com/live/xCv3061gBKo?si=8YRNtJcLswEgco68 https://youtu.be/sSjB7ccnM_I?si=8GqBJ54D7BCQyCXJ	Explains and narrates with suitable board work	Listens, writes and comprehends	Understand and apply on some problems
Class 51	- Homogeneous system - Examples - Method of solution of homogeneous system	https://youtu.be/7a9Yawt1O50?si=x9mbNNC3AKTe7BIN https://youtu.be/JYZUESXNfMI?si=UG9pQuJE7L5TU34M	Explains and narrates with suitable board work	Listens, writes and comprehends	Understand and apply on some problems
Class 52	Some theorems on homogeneous system	https://youtu.be/7a9Yawt1O50?si=x9mbNNC3AKTe7BIN	Explains and narrates with suitable board work	Listens, writes and comprehends	Understand and analyze

Class 53	- Non-homogeneous system - Examples - Augmented matrix - Method of solution of homogeneous system	https://youtu.be/iwkFNEWqzgc?si=jpiuoKNvwzpxHHaJ https://youtu.be/cfO7lvXp9zg?si=BcMwMvs1n5WoKZuD	Explains and narrates with suitable board work	Listens, writes and comprehends	Understand and apply on some problems
Class 54	- Vector equations - Solution of the matrix equation $AX = B$	https://youtu.be/LuDazQ_201g?si=0GaYQotXUzGE-RaP https://youtu.be/B9Z2e9LSuNw?si=RsR_KYQgQrPgkvvA	Explains and narrates with suitable board work	Listens, writes and comprehends	Understand and apply on some problems
Class 55	- Solution sets of linear systems, - Applications of linear systems	https://youtu.be/7a9Yawt1O50?si=oBYjMP4BSxIrcSgj	Explains and narrates with suitable board work	Listens, writes and comprehends	Understand and apply on some problems
Class 56	Discussion of University questions		Explains and narrates with suitable board work	Listens, writes and comprehends	Understand, analyze and correlate with different type of problems
Class 57	Discussion of University questions		Explains and narrates with suitable board work	Listens, writes and comprehends	Understand, analyze and correlate with different type of problems
Class 58	Discussion of University questions		Explains and narrates with suitable board work	Listens, writes and comprehends	Understand, analyze and correlate with different type of problems
Class 59	Discussion of University questions		Explains and narrates with suitable board work	Listens, writes and comprehends	Understand, analyze and correlate with different type of problems

Class 60	• Discussion of University questions		Explains and narrates with suitable board work	Listens, writes and comprehends	Understand, analyze and correlate with different type of problems
Class 61	• Discussion of University questions		Explains and narrates with suitable board work	Listens, writes and comprehends	Understand, analyze and correlate with different type of problems



Shyampur Siddheswari Mahavidyalaya

AJODHYA, SHYAMPUR, HOWRAH,

PIN-711312, WB

LECTURE PLAN & RELATED LINKS

Subject: MTMA

Paper: CC-3 (Real Analysis)

Semester: II (B.Sc. Mathematics Honours)

Credit: 6

Instructor: Mrs. Rini Maiti

Class	Content	Related Links	Faculty Approach	Student Activity	Learning Outcome
Class 1	- Intuitive idea of real numbers - Mathematical operations and usual order of real numbers revisited with their properties (closure, commutative, associative, identity, inverse, distributive)	https://youtu.be/YXIOft6314?si=aHIaLd84FNdrkN5K https://youtu.be/4HLBaf7wLVw?si=fh0XTSggGG_6UAXZ	Explains and narrates with suitable board work	Listens and writes	Understand
Class 2	- Idea of countable sets - Enumerable sets - Un-countable sets - Corresponding examples	https://www.youtube.com/live/wGTCJmEdpg?si=rWPf5uyeUWriSpOs	Explains and narrates with suitable board work	Listens and writes	Understand and analyze
Class 3	- Uncountability of $\mathbb{R}$ - Uncountability of $[a, b]$ - Countability of $\mathbb{Q}$	https://youtu.be/rJrTHDh8HtE?si=s4EzNDXW8yYnZAMw https://youtu.be/Xs4AT28STt0?si=BXTybqU_UmXmL5RI	Explains and narrates with suitable board work	Listens and writes	Understand and analyze
Class 4	Some important Theorems on enumerable set	https://youtu.be/v_sOk8CkZY?si=tQG8p9-0SjQjp2Pt https://youtu.be/0zzrgtGNKU0?si=HMLlugXdrBrsoTeP	Explains and narrates with suitable board work	Listens and writes	Understand and analyze

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Class 5	• Concept of bounded and unbounded sets in $\mathbb{R}$ • Corresponding examples • L.U.B. (supremum) & G.L.B. (infimum) of a set and their properties	https://youtu.be/KICfq-qtod0?si=ZgawGJt5pptwsKAv https://www.youtube.com/live/HZcpINB-jD8?si=T3RrkIO7PP8iM_sh	Explains and narrates with suitable board work	Listens and writes	Understand and apply on some problems
Class 6	• L.U.B. axiom or order completeness axiom • Archimedean property of $\mathbb{R}$ • Deduction of Archimedean property of $\mathbb{R}$	https://youtu.be/NetDXRGqbng?si=yHn8hSgEdYbhgyAX https://youtu.be/qfxZM32IH0M?si=o5yD3Z Zavq6F7S3V https://youtu.be/MwcpnxnBnh0U?si=j3n2Hhf9xBu gvnTk	Explains and narrates with suitable board work	Listens and writes	Understand and analyze
Class 7	• Density of rational (and Irrational) numbers in $\mathbb{R}$ • Arithmetical Continuum • Linear Continuum	https://youtu.be/MwcpnxnBnh0U?si=pwCwn_H-9--tY1hV https://youtu.be/WWQbHUE3T8o?si=GW2WHSwJA5qhgn-l	Explains and narrates with suitable board work	Listens and writes	Understand and analyze
Class 8	• Concept of Intervals • Neighbourhood of a point • Some theorems on Neighbourhood of a point	https://youtu.be/8-aLsE0SxoM?si=cGMwSxN7AT6RKouH https://youtu.be/4qTDc50Q4O8?si=7i8bYohYFgeH5Jug https://youtu.be/j_St8XMfEwQ?si=3i6_DwRov472MHaz	Explains and narrates with suitable board work	Listens and writes	Understand
Class 9	• Interior point • Open set • Some examples of open sets • Union, intersection of open sets	https://youtu.be/j_St8XMfEwQ?si=T8EqVxlvRIhRPAEI https://youtu.be/zCpoh_FFvVQ?si=z3RQB1THg-2Y57Kw https://youtu.be/LPesm7Wpgc0?si=Vb1j0qZ5Wut5vTl_1	Explains and narrates with suitable board work	Listens and writes	Understand and analyze

Class 10	Some theorems on open sets	https://youtu.be/qhGvjRxAVO4?si=AGmcd91uTbeeAUY3 https://youtu.be/rC3UiPjIv7A?si=KjIV3vcIcVLFYLsW	Explains and narrates with suitable board work	Listens and writes	Understand and analyze
Class 11	- Limit point and isolated point of a set - Corresponding examples	https://youtu.be/A7rKT0gwP4c?si=lSdrRysxLgDerenV	Explains and narrates with suitable board work	Listens and writes	Understand and analyze
Class 12	- Bolzano-Weirstrass theorem for sets - Existence of limit point of every uncountable set as a consequence of Bolzano-Weirstrass theorem	https://youtu.be/5IBLIFlMWNy?si=golYaXIZCuDv6lv1	Explains and narrates with suitable board work	Listens, writes and comprehends	Understand and analyze
Class 13	- Derived set - Examples - Some important theorems on derived sets	https://youtu.be/oY-dPfComCg?si=LOfnNfANwhOFCkHH	Explains and narrates with suitable board work	Listens, writes and comprehends	Understand and analyze
Class 14	- Closed set - Corresponding examples - Complement of open set and closed set	https://youtu.be/A7rKT0gwP4c?si=N_jhBSz2glyTCrjU https://youtu.be/xuEmXrZS_TU?si=052gyt-hQrWmODPk https://youtu.be/10kgC9-a7k8?si=wyjL73nr0OZMCXHf	Explains and narrates with suitable board work	Listens and writes	Understand
Class 15	Union and intersection of closed sets as a consequence	https://youtu.be/5z9eSW2lKEw?si=VzgtDs27225EdUgX	Explains and narrates with suitable board work	Listens and writes and comprehends	Understand and analyze
Class 16	- Adherent point - Closure of a set - Some theorems on closure of a set	https://youtu.be/cjNlxq5vic0?si=IC-ZF65yUUgz-FUH	Explains and narrates with suitable board work	Listens and writes and comprehends	Understand and analyze

Class 17	No nonempty proper subset of $\mathbb{R}$ is both open and closed	https://youtu.be/AikrOJ96IjE?si=Vgg9FqqvvRifrQsM	Explains and narrates with suitable board work	Listens and writes and comprehends	Understand and analyze
Class 18	- Dense set in $\mathbb{R}$ as a set having non-empty intersection with every open intervals $\mathbb{Q}$ and $\mathbb{R}$ are dense in $\mathbb{R}$	https://youtu.be/Cj5HF7cQrJc?si=LYiSerHccCDXmkw8	Explains and narrates with suitable board work	Listens and writes	Understand and analyze
Class 19	- Real sequence - Range of a sequence - Bounded sequence - Unbounded sequence - Examples	https://youtu.be/rSZ_kg2vSaY?si=mv2Yr8mlkNC6oih4 https://youtu.be/BxOOXIoief0?si=JZQLtSDviATwc13Q https://youtu.be/AOfShD3mJt0?si=4r5OPaRspFf-UCNQ	Explains and narrates with suitable board work	Listens and writes	Understand and apply on some problems
Class 20	- Convergence and non-convergence - Examples	https://youtu.be/AOfShD3mJt0?si=JFF8oExApH1zlexm	Explains and narrates with suitable board work	Listens and writes	Understand and apply on some problems
Class 21	- Boundedness of convergent sequence - Limit of a sequence - Uniqueness of limit	https://youtu.be/xxcM_fNUydo?si=0cpZte1ygmDbqKL7 https://youtu.be/A4LhIhI6tg4?si=kDk8hbGC41Gs-0_r	Explains and narrates with suitable board work	Listens and writes	Understand and apply on some problems
Class 22	- Algebra of limits - It's application	https://youtu.be/pbg1hFC8_Ow?si=NOEQgl1CBzAa6gQK	Explains and narrates with suitable board work	Listens and writes	Understand and apply on some problems
Class 23	- Relation between the limit point of a set and the limit of a convergent sequence of distinct elements. - Some examples	https://youtu.be/xxcM_fNUydo?si=sJHVzk1NKUrqZAtZ	Explains and narrates with suitable board work	Listens and writes and comprehends	Understand and apply on some problems

Class 24	• Mono- tone sequences and their convergence • Corresponding examples	https://youtu.be/jH-wGZt-FMo?si=F6LqlerXU4uDrrxu	Explains and narrates with suitable board work	Listens and writes	Understand and apply on some problems
Class 25	• Sandwich theorem • Corresponding example	https://youtu.be/KyCn0xdtb7Y?si=Sex-bLrDBbIun5Y7 https://youtu.be/pT3a3ImDZC8?si=QNJRp-cCJzhY_A0a	Explains and narrates with suitable board work	Listens and writes	Understand and analyze and apply on some problems
Class 26	• Nested interval theorem • Examples	https://youtu.be/pT3a3ImDZC8?si=sXF3ruQJ7Q5itxpm	Explains and narrates with suitable board work	Listens and writes	Understand and analyze
Class 27	• Limit of some important sequences • Applications of these limits	https://youtu.be/YXS3dVl0VVVo?si=2CsBMF4LNJvvOrAx	Explains and narrates with suitable board work	Listens and writes	Understand and apply on some problems
Class 28	• Cauchy's first limit theorem • Applications of this theorem	https://youtu.be/c7JKhBarTUg?si=ruOldD7cuHBEtikz https://youtu.be/L7cFTokjX-g?si=j5IPYYKFxOImPl1t	Explains and narrates with suitable board work	Listens and writes and comprehends	Understand and apply on some problems
Class 29	• Cauchy's first and second limit theorems • Applications of this theorem	https://youtu.be/c7JKhBarTUg?si=gEmD8ZZ8MNSedjKQ https://youtu.be/L7cFTokjX-g?si=wwZDYUboLJuB-TZK	Explains and narrates with suitable board work	Listens and writes and comprehends	Understand and apply on some problems
Class 30	• Subsequence • Some important theorems on subsequence	https://youtu.be/JCWJLjcH9b8?si=7HP8jwUTJvEfQFO9 https://youtu.be/_zNXfb-rETw?si=uKx1s9MlHQ3QRI9O	Explains and narrates with suitable board work	Listens and writes	Understand and apply on some problems
Class 31	• Complementary subsequence • Subsequential limits • Examples	https://youtu.be/vr9vAGSPPRw?si=jUyjPEY1VqQqVr7Y https://youtu.be/4WDPPhfihCw?si=C6KZhOdpZRVfEJx5	Explains and narrates with suitable board work	Listens and writes	Understand and apply on some problems

Class 32	- lim sup as the L.U.B. and lim inf as the G.L.B of a set containing all the subsequential limits - Corresponding examples	https://www.youtube.com/live/mAGyuU8lbns?si=BAFYGzIA682w80hf	Explains and narrates with suitable board work	Listens and writes	Understand and apply on some problems
Class 33	- Alternative definition of limsup and liminf of a sequence using inequality or as $\limsup x_n = \inf \sup \{x_n, x_{n+1}, \dots\}$ and $\liminf x_n = \sup \inf \{x_n, x_{n+1}, \dots\}$ - Equivalence between these definitions is assumed	https://www.youtube.com/live/mAGyuU8lbns?si=I3SvHc0jd838ty8P https://youtu.be/JwN8dHkbcLc?si=uF346IBRhGM-e-q	Explains and narrates with suitable board work	Listens and writes	Understand and analyze
Class 34	- A bounded sequence x_n is convergent if and only if $\limsup x_n = \liminf x_n$ - Every sequence has a monotone subsequence	https://youtu.be/TpjDeBA_tOKQ?si=eN4GHE4FhQa8bc8C https://youtu.be/0M8CkXmZtt4?si=qBrbqAJtcPEvg8IJ	Explains and narrates with suitable board work	Listens and writes	Understand
Class 35	Bolzano-Weirstrass theorem for sequence	https://youtu.be/0M8CkXmZtt4?si=vfXxt1x0RSI7pF7n	Explains and narrates with suitable board work	Listens and writes	Understand
Class 36	- Cauchy's convergence criterion - Cauchy sequence - Corresponding examples	https://youtu.be/QJhMybeOcZE?si=9-RGZ-uQ8JjDCjjY https://youtu.be/xCT5F90sq4?si=T0Ou1CmrblQM7_Z	Explains and narrates with suitable board work	Listens and writes and comprehends	Understand and apply on some problems
Class 37	Some theorems on Cauchy sequence	https://youtu.be/MQHwPgSjB2w?si=5OCwSjLOWW6hBRRe	Explains and narrates with suitable board work	Listens and writes	Understand & analyze
Class 38	Some problems on Cauchy sequence	https://youtu.be/xCT5F90sq4?si=V9hAd52TZBj8d9jg	Explains and narrates with suitable board work	Listens and writes	Understand & analyze

Class 39	- Infinite series - Examples of infinite series - Partial sums of infinite series	https://youtu.be/dGP80DTkiVI?si=e901GCrsH5LyP1wkv https://youtu.be/L-JqHo4-W4k?si=1nQjYeYWxlS21Qn9	Explains and narrates with suitable board work	Listens and writes	Understand & analyze
Class 40	- Geometric Series - Harmonic series	https://youtu.be/slcZddyha8?si=gAjaNK5z-3Wm5ZW https://youtu.be/Jfp94nCSjrE?si=KCzUxHV7ONXIVFlp	Explains and narrates with suitable board work	Listens and writes	Understand & analyze
Class 41	- Convergence and non-convergence of infinite series - Cauchy's principle of convergence	https://youtu.be/vfg1mmsSMmm?si=dKg2jwF_cJR2fkSr https://youtu.be/WE6NATp_P7k?si=fagROyj7FnBulZKk	Explains and narrates with suitable board work	Listens and writes	Understand & analyze
Class 42	- Series of positive terms - Introduction & removal of brackets - Re-arrangement of terms	https://youtu.be/woGZzKwaf-Y?si=cnE2nCxn03kdFM	Explains and narrates with suitable board work	Listens and writes	Understand & analyze
Class 43	- Tests for convergence : comparison test, limit comparison test - Corresponding examples	https://youtu.be/S-qzRWJOlf8?si=fAyJnYYLQBIXDALb https://youtu.be/lVgjTZMO05I?si=4Ump_VFQhh_uVjc	Explains and narrates with suitable board work	Listens and writes	Understand and apply on some problems
Class 44	- D'Alembert's ratio test - Corresponding examples	https://youtu.be/inoybBJWsV4?si=uO9RtfewmcVV9a9 https://youtu.be/tF4vDQ6X7Kg?si=uZMgIOrlnfeaO3bd	Explains and narrates with suitable board work	Listens and writes	Understand & apply on some problems
Class 45	- Cauchy's n-th root test - Corresponding examples	https://youtu.be/156wAYwXjfk?si=LrO6uRcjoOiw0vb	Explains and narrates with suitable board work	Listens and writes	Understand & apply on some problems
Class 46	- General form of root test - General form of ratio test - Corresponding examples	https://youtu.be/we9xfBR8SwQ?si=Sa_2MdBhu4ZRnO2q	Explains and narrates with suitable board work	Listens and writes	Understand & apply on some problems

Class 47	- Cauchy's condensation test - It's application	https://youtu.be/4NHpLDy1Ljc?si=2IQXzww1EGoZMQQP	Explains and narrates with suitable board work	Listens and writes	Understand & apply on some problems
Class 48	- Raabe's test - General form of Raabe's test - Application of these theorems	https://youtu.be/4NHpLDy1Ljc?si=2IQXzww1EGoZMQQP	Explains and narrates with suitable board work	Listens and writes	Understand & apply on some problems
Class 49	- Logarithmic test - It's application	https://youtu.be/ff6b6u_jDjQ?si=pjuBDx06MFZ_z-MG	Explains and narrates with suitable board work	Listens and writes	Understand & apply on some problems
Class 50	- Kummer's test - Some applications of these tests	https://youtu.be/0jB_tm8m1iI?si=1KtqP7IE1qAA smNs https://youtu.be/YXEVQ6C4-T8?si=9iGu3Unx9zU3YV2q	Explains and narrates with suitable board work	Listens, writes and comprehends	Understand and analyze apply on some problems
Class 51	- Gauss's test (statements only) - Alternative form of Gauss's test	https://youtu.be/qlZTp83SwOQ?si=HdBTEIDcV3gdA84A	Explains and narrates with suitable board work	Listens and writes	Understand & apply on some problems
Class 52	- Abel's theorem - It's application	https://youtu.be/xw1Ale0KFLY?si=na90NFroDz3B-wil	Explains and narrates with suitable board work	Listens and writes	Understand & apply on some problems
Class 53	- Series of arbitrary terms - Absolutely convergent series is convergent	https://youtu.be/EX6zkLpHlec?si=75k6rr9xnA7h-2IN	Explains and narrates with suitable board work	Listens and writes	Understand & apply on some problems
Class 54	- Alternating series - Examples of Alternating series - Leibniz test - Applications of Leibniz test	https://youtu.be/k0HqVWFm7Y0?si=avQLwUMa9b-2jRca https://youtu.be/r_N79ho8ozI?si=Y1GnrCI8fS-FEMwH	Explains and narrates with suitable board work	Listens, writes and comprehends	Understand and apply on some problems
Class 55	- Abel's test - Dirichlet's test - Application of these tests	https://youtu.be/p1ScnETm53k?si=fU3O7xhdxiBVJZq	Explains and narrates with suitable board work	Listens and writes	Understand & apply on some problems

Class 56	Conditionally convergent series	https://youtu.be/NzI5rSX-26w?si=P6wMo8H0aKrlvKlZ	Explains and narrates with suitable board work	Listens and writes	Understand & apply on some problems
Class 57	Discussion of University Year questions		Explains and narrates with suitable board work	Listens, writes and comprehends	Understand and analyze and correlate with different type of problems
Class 58	Discussion of University Year questions		Explains and narrates with suitable board work	Listens, writes and comprehends	Understand and correlate with different type of problems
Class 59	Discussion of University Year questions		Explains and narrates with suitable board work	Listens, writes and comprehends	Understand and correlate with different type of problems
Class 60	Discussion of University Year questions		Explains and narrates with suitable board work	Listens, writes and comprehends	Understand and correlate with different type of problems
Class 61	Discussion of University Year questions		Explains and narrates with suitable board work	Listens, writes and comprehends	Understand and correlate with different type of problems
Class 62	Discussion of University Year questions		Explains and narrates with suitable board work	Listens, writes and comprehends	Understand and correlate with different type of problems

Class 63	• Discussion of University Year questions		Explains and narrates with suitable board work	Listens, writes and comprehends	Understand and correlate with different type of problems
Class 64	• Discussion of University Year questions		Explains and narrates with suitable board work	Listens, writes and comprehends	Understand and correlate with different type of problems

Lecture Plan of CC4 (Group Theory – I)

Semester - II (MTMA CBCS) Instructor Name : Snehendu Mandal

class	Content	Related Links	Faculty approach	Students activity	Learners outcomes
Class 1	<u>UNIT - 1</u> ➤ Definition of groupoid , semigroup , monoid ➤ Examples of groupoid , monoid , semigroups	https://youtu.be/ihQyZ7bJcRE?si=UnOwUSfFSxpr2ILg	Explains Board work	Listens Write	Understanding & analyze
Class 2	➤ Definition of group ➤ Examples of groups	https://youtube.com/playlist?list=PLU6SqDYcYsfKaQARA0_vnhuXbxmuOQVFF&si=T4VVMorWqj4HV-pf	Explains Board Work with examples	Listens & write	Understanding & analyze
Class 3	➤ Elementary Properties Of Groups	https://youtu.be/wh1D4LWmvvg?si=byY_vBqWEO785RrU	Explains Board Work with examples	Listens & write	Understanding
Class 4	➤ Important Theorems on Groups ➤ Cancellation Law on Groups , Results on Semi Groups ➤ Examples	https://youtu.be/wh1D4LWmvvg?si=byY_vBqWEO785RrU	Explains Board Work with examples	Listens & write	Understanding
Class 5	➤ Groups and Quaternions Groups Q_8 (through matrices) ➤ Examples	https://youtu.be/v-nO5ORvP10?si=chu3mjibml-yigii	Explains Board work	Listen & write	Develop Skills
Class 6	➤ Results & Theorems on Semi groups	https://youtu.be/ihQyZ7bJcRE?si=UnOwUSfFSxpr2ILg	Explains Board Work with examples	Listens & write	Understanding

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Class 7	➤ Cayley Table or Composition Table ➤ Important Results	https://youtu.be/ihQyZ7bJcRE?si=UnOwUSfFSxpr2ILg	Explains Board Work with examples	Listens & write	Understanding Develop Skills
Class 8	➤ Results on Groups through Cayley Table	https://youtu.be/L0N7HbOS_0I?si=acE7O41lbWrGcHEc	Explains Board Work with examples	Listens & write	Develop Skills understanding
Class 9	➤ Dihedral groups (D_n) ➤ Examples ➤ Properties	https://youtu.be/wh1D4LWmvvg?si=byY_vBqWEO785RrU	Explains Board Work with examples	Listens	Develop Skills
Class 10	➤ Some Important Results on Dihedral Groups D_n ➤ Characteristic of Dihedral Groups	https://youtu.be/L0N7HbOS_0I?si=acE7O41lbWrGcHEc	Explains Board Work with examples	Listens	Develop Skills
Class11	➤ Symmetric Groups of Degree N ➤ Examples & Results ➤ Theorems & Problems	https://youtu.be/L0N7HbOS_0I?si=acE7O41lbWrGcHEc	Explains Board work	Listens & write	Understanding & analyze
Class12	➤ Alternating Groups of Degree N ➤ Examples & Results ➤ Theorems & Problems	https://youtu.be/_XY9Sa1ZHeE?si=1yl1NWkUy4BukE_s	Explains Board work	Listens & write	Understanding & analyze
class 13	➤ Klein's 4 Group ➤ Examples & Results ➤ Theorem & Problems	https://youtube.com/playlist?list=PLU6SqdYcYsfKaQARA0_vnhuXbxmuOQVFF&si=T4VVMorWqj4HV-pf	Explains Board work	Listens & write	Understanding & analyze
Class14	➤ Elementary properties of groups ➤ Problems on Various Types Groups	https://youtu.be/_XY9Sa1ZHeE?si=1yl1NWkUy4BukE_s	Explains Board work	Listens & write	Understanding & analyze
Class 15	➤ Order Of an element in a Group ➤ Order of a Group ➤ Order of elements in Finite & Infinite Groups	https://youtu.be/N1z5hnFru4w?si=jwNNrdtW81hYWqtB	Explains Board work	Listens	Understanding

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Class 16	➤ Some Important Results on Order of an Elements & Order of Groups ➤ Examples on Z_n, R^2, R^3, S_n, A_n Etc . etc.	https://youtu.be/N1z5hnFru4w?si=jwNNrdtW81hYWqtB	Explains Board work	Listens	Understanding
Class 17	➤ Examples of Commutative and Non-Commutative groups. ➤ Important Results	https://youtu.be/_XY9Sa1ZHeE?si=1yl1NWkUy4BukE_s	Explains Board work	Listen & write	Develop Skills
Class 18	➤ Exercises on Groups ➤ Important Results ➤ theorems	https://youtu.be/xlAuoQoBgM8?si=ggGmuxy99CLWzXyr	Explains Board work	Listens & write	Understanding & analyze
Class 19	➤ Subgroups and examples of Subgroups ➤ Important Results	https://youtu.be/N1z5hnFru4w?si=jwNNrdtW81hYWqtB	Explains Board Work with examples	Listens	Understanding & analyze
Class20	➤ Subgroups of Finite & Infinite Groups ➤ Important Results	https://youtu.be/xlAuoQoBgM8?si=ggGmuxy99CLWzXyr	Explains Board work	Listens & write	Understanding & analyze
Class 21	➤ Necessary and Sufficient condition for a nonempty subset of a group to be a subgroup ➤ Application	https://youtu.be/xlAuoQoBgM8?si=ggGmuxy99CLWzXyr	Explains Board work	Listens & write	Understanding & analyze
Class 22	➤ The Group HK, where H & K are two different Subgroups of a Group G ➤ Order of the Group HK	https://youtu.be/_XY9Sa1ZHeE?si=1yl1NWkUy4BukE_s	Explains Board work	Listens & write	Understanding & analyze
Class 23	➤ Normalizer, $N(H)$ ➤ Centralizer $C(H)$ ➤ Center of a group $Z(G)$	https://youtu.be/L0N7HbOS_0I?si=acE7O41lbWrGcHEc	Explains Board Work with examples	Listen & write	Understanding & analyze

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Class 24	➤ Results on Normalizer , Centralizer , & Centre of a Group ➤ Various Problems	https://youtu.be/L0N7HbOS_0I?si=acE7O41lbWrGcHEc	Explains Board work	Listens & write	Understanding & analyze
Class 25	➤ Product of two subgroups ➤ Important Results on Product of Subgroups ➤ Examples	https://youtu.be/N1z5hnFru4w?si=jwNNrdtW81hYWqtB	Explains Board work	Listens	Understanding & analyze
Class 26	Exercises on the whole Unit 1 on Groups	https://youtu.be/L0N7HbOS_0I?si=acE7O41lbWrGcHEc	Explains Board work	Problem Solving	Develop skills
Class 27	UNIT 2 ➤ Properties of cyclic groups, ➤ Examples ➤ Problems	https://youtu.be/yDQhErltWUG?si=7pSbfbVuTtJkzbw7	Board work with examples	Listen & write	Understanding & analyze
Class 28	➤ Classification of subgroups of cyclic groups.	https://youtube.com/playlist?list=PLlj41Lsfa1mYwCYxEwQsV5fXIReCgiao_&si=ywFy9jTearS7hi3P	Board work with examples	Listens	Understanding & analyze
Class 29	➤ Cycle notation for permutations, ➤ Simple problems	https://youtu.be/p-PN3rRaPWM?si=tYE4p3v9XXczv9vr	Board work with examples	Listens understand	Understanding
Class 30	➤ Properties of Permutations, ➤ Even and Odd permutations	https://youtu.be/p-PN3rRaPWM?si=o2juLv_sdfhpHaeH	Board work with examples	Listens & write understand	Develop Skills
Class 31	➤ Alternating group, ➤ Properties of Cosets ➤ Important theorems on Cosets	https://youtu.be/s9AGMCiOnBo?si=7x9VPPglXMCVTHaO	Board work with examples	Listen & write	Understanding & analyze
Class 32	➤ Number of Left & Right Cosets of a Subgroup in a Group ➤ Index Number	https://youtu.be/N1z5hnFru4w?si=jwNNrdtW81hYWqtB	Explains Board work	Listens & write	Understanding & analyze
Class 33	➤ Order of an element, ➤ Order of a group. ➤ Lagrange's theorem	https://youtu.be/QOMJQ1aFws0?si=IBExFMc7DhaEsc1d	Board work with examples	Listens understand	Understanding & analyze

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Class 34	➤ Applications on Order of elements ➤ Applications on Lagrange Theorem	https://youtu.be/N1z5hnFru4w?si=jwNNrdrW81hYWqtB	Explains Board work	Listens & write	Understanding & analyze
Class 35	➤ Consequences of Lagrange theorem including Fermat's Little theorem.	https://youtu.be/zCTOQIHbxKE?si=CSfljmasa3oO7obs	Board work with examples	Listens & write	Problem solving Develop Skills
Class 36	➤ Groups exercises on Cosets , Lagrange Theorem , Order	https://youtu.be/N1z5hnFru4w?si=jwNNrdrW81hYWqtB	Explains discuss	Problem solving	Understanding & analyze
Class 37	➤ Groups exercises on Cyclic groups , Cyclic subgroups , Subgroups	https://youtu.be/N1z5hnFru4w?si=jwNNrdrW81hYWqtB	Explains Board work	Listens & write	Understanding & analyze
Class 38	➤ Normal subgroup and its properties ➤ Examples on Normal Subgroups	https://youtu.be/vYKdh5oQ4Zw?si=eMcmoLroIT93Dylg	Board work with examples	Understanding Problem solving	Develop Skills
Class 39	➤ Various Important Results on Normal Subgroups	https://youtu.be/vYKdh5oQ4Zw?si=eMcmoLroIT93Dylg	Explains Board work	Listens & write Problem solving	Understanding & analyze
Class40	➤ Necessary & Sufficient Condition for a non – empty subset to be a Normal Subgroup	https://youtu.be/bkasWIRpONE?si=0AgifAKRo00 BkLD	Explains Board work	Listens & write Problem solving	Understanding & analyze
Class 41	➤ Conjugate of an element ➤ Conjugate of a Subgroup ➤ Self Conjugate ➤ Examples	https://youtu.be/vYKdh5oQ4Zw?si=CsZDNtWFJEaEak5b	Board work with examples	Listens understand	Develop skill
Class 42	➤ Quotient group. ➤ Important Result on factor Group	https://youtu.be/-h3GsWp6-n0?si=Yxh-8zpEPRIW7zAE	Explains Board work	Listens & write	Understanding & analyze
Class43	➤ Group Homomorphisms ➤ Homomorphisms on Various Types	https://youtu.be/-h3GsWp6-n0?si=Yxh-8zpEPRIW7zAE	Explains Board work with examples	Listens & write	Understanding & analyze

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	of Groups				
Class 43	➤ Properties of Homomorphisms ➤ Examples	https://youtu.be/-h3GsWp6-n0?si=Yxh-8zpEPRIW7zAE	Board work with examples	Listens & write understand	Understanding & analyze
Class 44	➤ Application on Homomorphisms ➤ Exercises on S . K Mapa	https://youtu.be/LON7HbOS_0I?si=acE7O41lbWrGcHEc	Explains Board work with examples	Listens & write	Understanding & analyze
Class 45	➤ One one correspondence between the set of all normal subgroups of a group and the set of all congruences on that group	https://youtu.be/bkasWIRpONE?si=B-imQTr44m2dzBtY	Board work with examples	Listens understand	Understanding & analyze
Class 46	➤ One one correspondence between the set of all normal subgroups of a group and the set of all congruences on that group ➤ Exercises on correspondence theorems	https://youtu.be/bkasWIRpONE?si=0AgifAKRo00_BkLD	Explains Board work with examples	Listens & write understand	Develop Skills
Class 47	➤ Cayley's theorem, ➤ Problems ➤ examples	https://youtu.be/MzS9cwY3aYc?si=exDX2ytejxZl52xX	Board work with examples	Listens understand	Understanding & analyze
Class 48	➤ Properties of Isomorphisms ➤ Examples ➤ Application	https://youtu.be/R_Pu-H_aRvs?si=MtGG0RQKf-TWg7fd	Board work with examples	Listens & write	Understanding & analyze
Class 49	➤ First Isomorphism theorems. ➤ Examples ➤ application	https://youtu.be/NJN6cQsu0_o?si=xabM2eeOIeRTqcbZ	Board work with examples	Listens understand	Develop Skills
Class	➤ Second isomorphism	https://youtu.be/VoS4V6vWvuI?si=Uin1STeff27GA2Iq	Explains Board work	Listens & write	Develop Skills

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50	➤ theorems. ➤ Examples ➤ application		with examples		
Class 51	➤ Third isomorphism theorems. ➤ Examples ➤ application	https://youtu.be/djrAiRRs508?si=dyOsBq4RSo952UC	Board work with examples	Listen & write	Develop skills Understand Problem solving
Class 52	Exercises on isomorphism	https://youtu.be/QOMJQ1aFws0?si=IBExFMc7DhaEsc1d	discussing	Problem solving	Problem solving Develop skills

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Shyampur Siddheswari Mahavidyalaya

AJODHYA, SHYAMPUR, HOWRAH,

PIN-711312, WB

LECTURE PLAN & RELATED LINKS

Subject: MTMA

Paper: CC-5 (Theory of Real Functions)

Semester: III (B.Sc. Mathematics Honours)

Credit: 6

Instructor: Mrs. Rini Maiti

Class	Content	Related Links	Faculty Approach	Student Activity	Learning Outcome
Class 1	- Introduction to limit of a function - Definition of limit of a function ($\epsilon - \delta$ approach) - If c be a limit point of the domain of a function f, then f can have at most one limit point at c - Examples	https://youtu.be/wzT403sa5oE?si=-XEHH1JlTgiw-68u https://youtu.be/NqwieokSeqE?si=hdfdnszr3A9Lc3aq	Explains and narrates with suitable board work	Listens and writes	Understand and apply on some problems
Class 2	- Sequential criterion for limits - Corresponding examples	https://youtu.be/Qjv4-JFn9GE?si=mKIkVwtgu5teRRo0	Explains and narrates with suitable board work	Listens and writes	Understand
Class 3	Algebra of limits for functions	https://youtu.be/013FdbvS5ZA?si=kFQwzSTff8IKiv6c	Explains and narrates with suitable board work	Listens and writes	Understand
Class 4	- Effect of limit on inequality involving functions - Sandwich theorem - Application of Sandwich theorem	https://youtu.be/loWUZTycZ2s?si=EJWqx9F3fb_d07zm	Explains and narrates with suitable board work	Listens and writes, and solve problems	Understand and analyze
Class 5	- Cauchy's principle - Corresponding examples	https://youtu.be/8BQoNY6uPn0?si=qwjLgDHla3DjGjwB	Explains and narrates with suitable board work	Listens and writes, and solve problems	Understand and analyze

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Class 6	- One sided limits - Infinities limits - Corresponding examples	https://youtu.be/dz6TZCkR_E4?si=-VpOzP2jON7wK09Y https://youtu.be/UKo99ik3Fnk?si=Ldzt3TwdD15okQ1g	Explains and narrates with suitable board work	Listens and writes and solve problems	Understand and apply on some problems
Class 7	- Limits at infinity - Infinite limits at infinity - Corresponding examples	https://youtu.be/TIBUH8WJMTc?si=qW3zP2m2n-8eesw4	Explains and narrates with suitable board work	Listens and writes and solve problems	Understand and apply on some problems
Class 8	- Limits of monotone functions - Some examples - Some important theorems	https://youtu.be/x_8ZdK_CJZE?si=aWg_LMvQDVHZENUT	Explains and narrates with suitable board work	Listens and writes	Understand
Class 9	Important limits like $\frac{\sin x}{x}$, $\frac{\log(1+x)}{x}$, $\frac{a^x-1}{x}$ as $x \rightarrow 0$	https://youtu.be/GvSI2ScXdEI?si=m0JxGkZwzr6rBqNG	Explains and narrates with suitable board work	Listens and writes	Understand
Class 10	- Definition of continuity at a point - Continuity of a function on an interval and at an isolated point	https://youtu.be/ygaGJEXqdiY?si=jRYyUyNJM1tkxF8y	Explains and narrates with suitable board work	Listens and writes	Understand
Class 11	- Sequential criteria for continuity - Application of this theorem	https://youtu.be/w4MJyWIEUy4?si=DvO3PuQKvMZvJOei	Explains and narrates with suitable board work	Listens and writes	Understand and analyze
Class 12	Algebra of continuous functions as a consequence of algebra of limits	https://youtu.be/1jMmNfZbadM?si=5li3NIP52gWmVgnm	Explains and narrates with suitable board work	Listens, writes and comprehends	Understand
Class 13	Continuity of some important functions: $\sin x$, $\cos x$, $\tan x$, $\log x$, e^x, $y = x^a$ ($a = 2, 3, \frac{1}{2}, -1$), x	https://youtu.be/jgTFrxQWul?si=uP9WgQeO2420TS-d	Explains and narrates with suitable board work	Listens, writes and comprehends	Understand
Class 14	Continuity of composite function	https://youtu.be/v5nWZMDhMUA?si=mKlvJsocOKdvmoi2	Explains and narrates with suitable board work	Listens, writes and comprehends	Understand

Class 15	• Concept of discontinuity of function • Removable discontinuity • Corresponding examples	https://youtu.be/xAYy-mqxZdc?si=hprZ48JVeC4wJrZL	Explains and narrates with suitable board work	Listens, writes and comprehends	Understand
Class 16	• Concept of oscillation of a function at a point • A function is continuous at x if and only if its oscillation at x is zero	https://youtu.be/kOUgxU_POXU?si=ZhIpKbU-G9J7vp-z	Explains and narrates with suitable board work	Listens, writes and comprehends	Understand
Class 17	• Infinite discontinuity • Infinite oscillatory discontinuity • Jump discontinuity • Corresponding examples	https://youtu.be/u8xeVeeDnQc?si=5ThDg9jG1utmohzW https://youtu.be/wGP7aB2itl8?si=a106cKaz9SAo7M_V	Explains and narrates with suitable board work	Listens, writes and comprehends	Understand
Class 18	• Examples of continuous functions • Continuity of a function at a point does not necessarily imply the continuity in some neighbourhood of that point	https://youtu.be/NVQBZWTkygU?si=JNTTgqLAZ2RhrA5l	Explains and narrates with suitable board work	Listens and writes	Understand
Class 19	• Bounded functions • Neighbourhood properties of continuous functions regarding boundedness and maintenance of same sign	https://youtu.be/hMa38ouMbZ4?si=KhvhBTh8BE-u60lw https://youtu.be/cMixkAAaRxw?si=6pRJQ7cKmph5KYmU	Explains and narrates with suitable board work	Listens and writes	Understand and apply on some problems
Class 20	• Continuous function on $[a, b]$ is bounded and attains its bounds.	https://youtu.be/piz8lto4Z5s?si=ZKrJLCFQIV_EhXLe	Explains and narrates with suitable board work	Listens and writes	Understand
Class 21	• Bolzano theorem • Intermediate value theorem	https://youtu.be/G7EyT8A4FTk?si=V2-TkudaeRR9NG8A	Explains and narrates with suitable board work	Listens and writes	Understand and analyze

Class 22	- Continuous image of a closed & bounded interval is again a closed & bounded interval - Continuous image of an interval is an interval	https://youtu.be/0LOKoE5nv_g?si=3LCvdyB1LF1xK880	Explains and narrates with suitable board work	Listens and writes	Understand and analyze
Class 23	- Step functions. - Piecewise continuity.	https://youtu.be/JrYmEo6hoiU?si=R2cHwESOOI7SfMqi	Explains and narrates with suitable board work	Listens and writes	Understand and apply on some problems
Class 24	- Monotone functions & continuity - Monotone functions can have only jump discontinuity.	https://youtu.be/aZUI9zslNUM?si=XENB3wi9ne3gXGLs https://youtu.be/7XyhfIIREyw?si=zjq47ZQUwj-mMpN4	Explains and narrates with suitable board work	Listens and writes	Understand
Class 25	Monotone functions can have at most countably many points of discontinuity.	https://youtu.be/S1yuLfd uS9Y?si=SimRoD-nNKdKrpQu	Explains and narrates with suitable board work	Listens and writes	Understand and apply on some problems
Class 26	Monotone bijective function from an interval to an interval is continuous and its inverse is also continuous.	https://youtu.be/8GG9Q YGFon0?si=qfGjsAXUajGclqyQ	Explains and narrates with suitable board work	Listens and writes	Understand and apply on some problems
Class 27	- Uniform continuity - Corresponding examples	https://youtu.be/FEfuKwzPZgl?si=mqiy4kEn8yuhK7v5	Explains and narrates with suitable board work	Listens and writes	Understand
Class 28	Functions continuous on a closed and bounded interval is uniformly continuous.	https://youtu.be/jJkF7SYdi2M?si=PMeq9XbahypDQMCa	Explains and narrates with suitable board work	Listens and writes	Understand
Class 29	- A necessary and sufficient condition under which a continuous function on a bounded open interval I will be uniformly continuous on I. - A sufficient condition under which a continuous function on	https://www.youtube.com/live/CFUb2pNHY4U?si=7vDJuj9CrLnEmoRR https://youtu.be/wPvEjgWtV7Q?si=lyKelybHTdFWBC2g	Explains and narrates with suitable board work	Listens and writes	Understand and apply on some problems

	an unbounded open interval I will be uniformly continuous on I (statement only).				
Class 30	Uniform continuity of a function implies boundedness of that function	https://youtu.be/3HTXUCti7Kk?si=AClnHXz55JWjXTX1	Explains and narrates with suitable board work	Listens and writes	Understand
Class 31	Lipschitz condition and uniform continuity.	https://youtu.be/7QJVjzVuKXw?si=DdJoCkuoZojSg2AN	Explains and narrates with suitable board work	Listens and writes	Understand
Class 32	- Differentiability of a function at a point and in an interval - Right hand derivative - Left hand derivative - Corresponding examples	https://youtu.be/xzvl-a7RmPU?si=gSEXUrgC7fj96FUk	Explains and narrates with suitable board work	Listens and writes	Understand
Class 33	- Differentiability of a function implies continuity of that function - Algebra of differentiable functions	https://youtu.be/JfzQBOfs9e8?si=Zw2mrEfTkj5ZLP4K	Explains and narrates with suitable board work	Listens and writes	Understand
Class 34	- Differentiability of composite functions - Some Examples	https://youtu.be/Qj0Hc8KFnjE?si=VtJy1N2q6tnjz2I7	Explains and narrates with suitable board work	Listens and writes	Understand and apply on some problems
Class 35	- Meaning of sign of derivative. - Corresponding examples	https://www.youtube.com/live/wj9xiC7crDA?si=0wJ4GCIW-FOsaKpX	Explains and narrates with suitable board work	Listens and writes	Understand
Class 36	- Darboux theorem, - It's application	https://youtu.be/C4SP6w1jC60?si=-VZD04Y3IqYAaYqJ	Explains and narrates with suitable board work	Listens and writes	Understand and apply on some problems
Class 37	- Rolle's theorem - Geometrical Interpretation of Rolle's theorem - Application of Rolle's theorem	https://youtu.be/IFtjDDB8fzo?si=Qv4s6T7Xl3Z91MKX	Explains and narrates with suitable board work	Listens and writes	Understand and apply on some problems

Class 38	- Derived function cannot have a jump discontinuity - Image of an interval under derived function is an interval	https://youtu.be/WICf0nXuDvk?si=v5cpuM4xDd5fNrko	Explains and narrates with suitable board work	Listens and writes	Understand
Class 39	- Mean value theorem of Lagrange — as an application of Rolle's theorem - Geometrical interpretation of this theorem - Corresponding examples	https://youtu.be/_rLizW7giT4?si=v6VV6e1NmufyDq6Z https://youtu.be/oDHp3i3oeuk?si=nXAFj_DiGmKof-T2	Explains and narrates with suitable board work	Listens and writes	Understand and apply on some problems
Class 40	- Mean value theorem of Cauchy - Geometrical interpretation of this theorem	https://youtu.be/oDHp3i3oeuk?si=oFjjgVXkEs3RyWl	Explains and narrates with suitable board work	Listens and writes	Understand and apply on some problems
Class 41	- Taylor's theorem on closed and bounded interval with Lagrange's and Cauchy's form of remainder deduced from Lagrange's and Cauchy's mean value theorem respectively - Application of Taylor's theorem to inequalities.	https://youtu.be/VJl9x05WC7U?si=Yr3tLjbbZTDyV6TJ https://youtu.be/rk-8KseCZyE?si=U1AUluzbNzYqR7Ji	Explains and narrates with suitable board work	Listens and writes	Understand and apply on some problems
Class 42	Expansion of e^x, $\log(1+x)$, $(1+x)^m$	https://youtu.be/5NsZ9CGIwc8?si=yRQXVVdfuHGYqcIY	Explains and narrates with suitable board work	Listens and writes	Understand
Class 43	Expansion of $\sin x$, $\cos x$ with their range of validity (assuming relevant theorems)	https://youtu.be/OvTSZUZnVog?si=b3yLbhpJY12ODSmK	Explains and narrates with suitable board work	Listens and writes	Understand
Class 44	- Statement of L' Hospital's rule and its consequences - Application of L' Hospital's rule	https://youtu.be/NVE_XrjIX_o?si=bdVgUFEFAGe2seuW https://youtu.be/lznfgDjxhdA?si=Xr2NL3pg719KGq87	Explains and narrates with suitable board work	Listens and writes	Understand and apply on some problems

Class 45	- Point of local extremum (maximum, minimum) of a function in an interval - Sufficient condition for the existence of a local maximum/minimum of a function at a point (statement only)	https://youtu.be/y9M6kmgSnw8?si=iH8rld9S9B5axkb4 https://youtu.be/Sh9NP3ITv7Q?si=LVwWSaouHHQOU2Do	Explains and narrates with suitable board work	Listens and writes	Understand and apply on some problems
Class 46	- Determination of local extremum using first order derivative - Application of the principle of maximum/minimum in geometrical problems	https://youtu.be/5d75uGMIRsS?si=h3uDf8R7ghgi5lwo	Explains and narrates with suitable board work	Listens and writes	Understand
Class 47	- Higher order derivative test for extrema - Corresponding examples	https://youtu.be/HqxZyr8crKI?si=JolLVFRI7G3dxmU	Explains and narrates with suitable board work	Listens and writes	Understand and apply on some problems
Class 48	Discussion of previous year questions of university		Explains and narrates with suitable board work	Listens, writes and comprehends	Understand and correlate with different type of problems
Class 49	Discussion of previous year questions of university		Explains and narrates with suitable board work	Listens, writes and comprehends	Understand and correlate with different type of problems
Class 50	Discussion of previous year questions of university		Explains and narrates with suitable board work	Listens, writes and comprehends	Understand and correlate with different type of problems
Class 51	Discussion of previous year questions of university		Explains and narrates with suitable board work	Listens, writes and comprehends	Understand and correlate with different type of problems

Class 52	• Discussion of previous year questions of university		Explains and narrates with suitable board work	Listens, writes and comprehends	Understand and correlate with different type of problems
Class 53	• Discussion of previous year questions of university		Explains and narrates with suitable board work	Listens, writes and comprehends	Understand and correlate with different type of problems
Class 54	• Discussion of previous year questions of university		Explains and narrates with suitable board work	Listens, writes and comprehends	Understand and correlate with different type of problems
Class 55	• Discussion of previous year questions of university		Explains and narrates with suitable board work	Listens, writes and comprehends	Understand and correlate with different type of problems

Lecture plans of CC 6 (RING THEORY - I & LINEAR Algebra – I)

Semester - III (MTMA CBCS) Instructor Name : Snehendu Mandal

class	Content	Related Links	Faculty approach	Students activity	Learners outcomes
Class 1	➤ Definition and examples of rings, ➤ properties of rings	https://youtube.com/playlist?list=PLU6SqdYcYsfLyL330UDwLrRvNvWbto7DR&si=mQWRlCxFkritEvwY	Explains Board work	Listens & write	Understanding & analyze
Class 2	➤ Examples of rings ➤ Simple problems ➤ Different types of rings	https://youtube.com/playlist?list=PLU6SqdYcYsfLyL330UDwLrRvNvWbto7DR&si=w1g_UhX55M9JitAN	Explains Board Work with examples	Listen & write	Understanding & analyze
Class 3	➤ Subrings, ➤ examples & Theorems ➤ simple problems	https://youtu.be/eyb5csJzmYg?si=gDVhp3NkhinYaKG0	Explains Board work	understanding	Develop Skills
Class 4	➤ Necessary and sufficient condition for a nonempty subset of a ring to be a Subring ➤ Examples ➤ simple problems	https://youtu.be/eyb5csJzmYg?si=gDVhp3NkhinYaKG0	Explains Board work	understanding	Develop Skills
Class 5	➤ Integral domains ➤ examples ➤ problems	https://youtu.be/87QXdOxeVmU?si=4q47avsIx7MUoeHs	Explains Board Work with examples	Listens understand	Develop Skills Problem solving
Class 6	➤ properties of integral Domain ➤ Theorems & Applications	https://youtu.be/87QXdOxeVmU?si=4q47avsIx7MUoeHs	Explains Board work	understanding	Develop Skills
Class 7	➤ fields, ➤ Theorems & Applications ➤ important Results	https://youtu.be/KCSZ4QhOw0I?si=36KKIMuTjViC9vjk	Explains Board work	Listens & write understand	Understanding & analyze
Class 8	➤ Subfields ➤ examples ➤ important Results	https://youtu.be/KCSZ4QhOw0I?si=36KKIMuTjViC9vjk	Explains Board work	understanding	Develop Skills

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Class 9	➤ Finite fields ➤ Problems ➤ important Results	https://youtu.be/KCSZ4QhOw0I?si=36KKIMuTjViC9vjk	Explains Board work	understanding	Develop Skills
Class 10	➤ Necessary and sufficient condition for a nonempty subset of a field to be a subfield ➤ examples	https://youtu.be/dX-LxwYVLkc?si=ZUtzO2hKlvHHBDK1	Explains Board work	Listens	Develop Skills Problem solving
Class 11	➤ Characteristic of a ring. ➤ important Results	https://youtu.be/e3riEvoIF6w?si=Rz4V1TLtQKagSs8l	Explains Board work	Listens & write	Understanding & analyze
Class 12	➤ Ideals ➤ Ideal generated by a finite set	https://youtu.be/-RjbKrwJa20?si=j0bECMiiIsNTTKO8	Explains Board work	understanding	Develop Skills
Class 13	➤ properties of ideals ➤ Factor rings, ➤ operations on ideals	https://youtu.be/8plF8xsOOYM?si=z1D2rsQWfB9d3umO	Explains Board Work with examples	Listens & write	Understanding & analyze
Class 14	➤ Prime Ideals ➤ examples ➤ problems ➤ Theorems & Applications	https://youtu.be/-RjbKrwJa20?si=j0bECMiiIsNTTKO8	Explains Board work	Listen & write Problem solving	Develop Skills Problem solving
Class 15	➤ Maximal Ideals ➤ examples ➤ problems ➤ Theorems & Applications	https://youtu.be/-RjbKrwJa20?si=j0bECMiiIsNTTKO8	Explains Board work	understanding	Develop Skills
Class 16	Exercises / Test on Rings	https://youtu.be/_FKVo_9V_Kc?si=jkD8fgn64xScpnSv	Explains Board Work with examples	Understanding Problem solving	Develop Skills Problem solving
Class 17	➤ Important Theorems on Ring Homomorphisms ➤ Ring Homomorphisms ➤ Examples	https://youtube.com/playlist?list=PLrv011ZmIsBdlvrNfiKHcURjZUUzlhNG5&si=5tew4qcU_lyoiCOG	Explains Board work	Listens understand	Understanding & analyze
Class 18	➤ Ring Homomorphisms ➤ properties of ring Homomorphisms ➤ Problems on ring Homomorphisms ➤	https://youtube.com/playlist?list=PLrv011ZmIsBdlvrNfiKHcURjZUUzlhNG5&si=5tew4qcU_lyoiCOG	Explains Board work	understanding	Develop Skills

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Class 19	➤ First isomorphism theorem ➤ Examples ➤ problems	https://youtu.be/bqgnnpjImJ0?si=WcCAFAf7c3EqIwUn	Explains Board work	Listens & write understand	Develop Skills
Class 20	➤ Second Isomorphism theorem ➤ Examples ➤ problems	https://youtu.be/RhjKodX_eH4?si=mjyqGAf2q9nlM-n2	Explains Board work	Listens	Understanding & analyze
Class 21	➤ Third Isomorphism theorem ➤ Examples ➤ problems	https://youtu.be/2sWCVyOmKBA?si=ae0RfArn-SnK_uKb	Explains Board Work with examples	Listens & write	Understanding & analyze
Class 22	➤ Correspondence theorem ➤ congruence on rings	https://youtu.be/_FKVo_9V_Kc?si=jkD8fgn64xScpnSv	Explains Board work	Listens & write	Develop Skills Problem solving
Class 23	➤ one-one correspondence between the set of ideals and the set of all congruences on a ring	https://youtu.be/xY8sN5Wgl4Q?si=k_kjbjx0ewkr5SX-3	Explains Board Work with examples	Listen & write	Develop Skills Problem solving
Class 24	Exercises / Test on Rings	https://youtu.be/bqgnnpjImJ0?si=WcCAFAf7c3EqIwUn	Explains discuss	Understanding Problem solving	Understanding & analyze Develop Skills
Class 25	➤ Factor Rings ➤ Examples ➤ Problems	https://youtu.be/Lm_I4kCFcSc?si=b38G9URshnXGgAPq	Explains Board work	Listens understand	Develop Skills
Class 26	➤ Problems on Quotient Rings ➤ Theorems on Quotient Ring	https://youtube.com/playlist?list=PLHb9mDzwmi3u9yl_5CTFB0wFli7nQ5OEK&si=YaWD2KJrK17m77jv	Explains Board work	Listens & write understand	Understanding & analyze
Class 27	➤ Some Important Results on Isomorphism ➤ Problems on Isomorphism	https://youtu.be/kv0t9sPBxrs?si=8bxTZHnsZk6snUz0	Explains Board work	understanding	Develop Skills
Class 28	➤ Vector spaces ➤ Examples ➤ Properties ➤ Problems	https://youtu.be/1XIT3Y2oyAU?si=SyNKCnc4GDyxMBRx	Explains Board Work with examples	Listens	Understanding & analyze
Class 29	➤ subspaces, ➤ algebra of subspaces ➤ properties	https://youtu.be/y_PHA3szo5s?si=NCAPdjPzgJzkaLhP	Explains Board work	Listens & write	Develop Skills

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Class 30	➤ quotient spaces, ➤ linear combination of vectors, ➤ linear dependence ➤ linear independence	https://youtu.be/vfiwz5T5Qvw?si=gXpsAhwGMMX9kyIp	Explains Board Work with examples	Listens & write	Develop Skills
Class 31	➤ linear span ➤ basis and dimension ➤ examples ➤ problems	https://youtu.be/GhQzSNW45j0?si=QX0wd1k7LiFSr70E	Explains Board work	Listen & write	Understanding
Class 32	➤ dimension of subspaces ➤ examples ➤ problems	https://youtu.be/Pc2dWW3aSrK?si=dh3RR-Op-CENiJWE	Explains Board work	understanding	Develop Skills
Class 33	➤ Subspaces of $\mathbb{R}^n$ ➤ Examples ➤ problems	https://youtu.be/7U_cBQzMgGk?si=QSlsdXBcm8uqw8hl	Explains Board work	Listens understand	Understanding & analyze
Class 34	➤ dimension of subspaces of $\mathbb{R}^n$ ➤ problems	https://youtu.be/kv0t9sPBxrs?si=8bxTZHnsZk6snUz0	Explains Board Work with examples	Listens & write understand	Develop Skills
Class 35	➤ Geometric significance of subspace ➤ Examples ➤ Problems	https://youtu.be/rgxyxcTwwuo?si=MoWdzFPRW4b2a5f	Explains Board work	Listens	Understanding & analyze Develop Skills
Class 36	➤ Linear transformations ➤ Examples ➤ Problems	https://youtu.be/kYB8lZa5AuE?si=05bMmIUPTNX7oXCcs	Explains Board Work with examples	Listens & write	Understanding
Class 37	➤ Null space, range, ➤ rank and nullity of a linear ➤	https://youtu.be/_uTAdf_AsfQ?si=x26B4iQzDDhPPxzu	Explains Board work	understanding	Understanding
Class 38	➤ Linear Transformation ➤ Examples on transformation	https://youtu.be/kv0t9sPBxrs?si=8bxTZHnsZk6snUz0	Explains Board work	understanding	Develop Skills
Class 39	➤ Some Important Results on Linear Transformation ➤ Problems on Linear transformations ➤	https://youtu.be/kv0t9sPBxrs?si=8bxTZHnsZk6snUz0	Explains Board work	understanding	Develop Skills
Class 40	➤ matrix representation of a linear transformation, ➤ change of coordinate matrix	https://youtu.be/CeqNHmkLn2w?si=26idQyY9hLMBasHj	Explains Board work	Listens & write	Develop Skills Problem solving
Class 41	➤ Algebra of linear transformations ➤ Examples	https://youtu.be/4PCktDZJH8E?si=dFYYtQ6RiL2xUnZy	Explains Board Work with	Listen & write	Understanding Develop Skills

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	➤ Problems		examples		
Class 42	➤ Isomorphisms ➤ Examples ➤ Problems	https://youtu.be/8PQPKGKBAhI?si=nYrESwKQql9tQKKm	Explains Board work	understanding	Understanding & analyze
Class 43	➤ Isomorphism theorems ➤	https://youtu.be/0t42IrLaDkw?si=l-gTVjafSjX0OZuq	Explains Board work	Listens understand	Understanding & analyze
Class 44	➤ Invertibility and Isomorphisms. ➤ Examples ➤ Problems	https://youtu.be/KgZR5L9jTJA?si=-evoGaw1KqZGmSEa	Explains Board work	Listens & write understand	Understanding Develop Skills
Class 45	➤ Eigen values, Eigen vectors ➤ Examples ➤ Problems ➤	https://youtu.be/1wjXVdwzgX8?si=gP_iYa0sRGUWQAcu	Explains Board Work with examples	Listens	Understanding & analyze
Class 46	➤ Characteristic equation of a matrix ➤ Matric polynomial	https://youtu.be/1wjXVdwzgX8?si=y pqGJiPy5LiXcDRw	Explains Board work	Listens & write	Develop Skills
Class 47	➤ Cayley-Hamilton theorem and its use in finding the inverse of a matrix, ➤ Problems	https://youtu.be/ZOHMCsdDt0?si=kY5z05usZokjmARQ	Explains Board Work with examples	Listens understand	Develop Skills
Class 48	Exercises on Rings	https://youtu.be/CeqNHmkLn2w?si=26idQyY9hLMBasHj	discussing	Understand Problem solving	Understanding & analyze
Class 49	Exercises on Vector Spaces	https://youtu.be/CeqNHmkLn2w?si=26idQyY9hLMBasHj	Explains discussing	Listens & write Understand Problem solving	Understanding & analyze

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Shyampur Siddheswari Mahavidyalaya

AJODHYA, SHYAMPUR, HOWRAH,

PIN-711312, WB

LECTURE PLAN & RELATED LINKS

Subject: MTMA

Paper: CC-7 (ODE & Multivariate Calculus-I)

Semester: III (B.Sc. Mathematics Honours)

Credit: 6

Instructor: Mrs. Rini Maiti

Class	Content	Related Links	Faculty Approach	Student Activity	Learning Outcome
Class 1	- Introduction to ordinary differential equation - Basic definitions - Order & degree of ordinary differential equation	https://youtu.be/bjJZKTrCBNw?si=sXfBSNV063um-W-0 https://youtu.be/xP0irFJW9I4?si=51FsYBU_6v9fvMlz	Explains and narrates with suitable board work	Listens and writes	Understand and apply on some problems
Class 2	Formation of differential equation	https://youtu.be/xP0irFJW9I4?si=C8utlerdENOT8hb5	Explains and narrates with suitable board work	Listens and writes	Understand and apply on some problems
Class 3	- First order differential equations - Transformation of Differential equations by substitution	https://youtu.be/Ecc7SHqymPo?si=hmjOvZPzKOYvLKlh	Explains and narrates with suitable board work	Listens, writes and solve problems	Understand and analyze and apply on some problems
Class 4	- Exact differential equations - Solution of Exact differential equations	https://youtu.be/veWKL3C99vg?si=h-29ZLels74_WaX7	Explains and narrates with suitable board work	Listens and writes	Understand and apply on some problems
Class 5	- Integrating factors - Examples	https://youtu.be/j511hg7Hlbg?si=A7rgjFHsy4MWLSUv	Explains and narrates with suitable board work	Listens and writes	Understand and apply on some problems

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Class 6	- Special integrating factors and transformation - Linear equations	https://youtu.be/u5NGfwNNqHw?si=9Flt9BYjLTVUEKdj https://youtu.be/jyD3uKkxI0g?si=DODOrzVxw420IIBI	Explains and narrates with suitable board work	Listens, writes and solve problems	Understand and analyze
Class 7	- Bernoulli equations - Examples	https://youtu.be/SRqxCKqjTXk?si=mVHgl6P0Hn ef2RdJ	Explains and narrates with suitable board work	Listens and writes	Understand and apply on some problems
Class 8	- the existence and uniqueness theorem of Picard (Statement only) - First order higher degree equations solvable for x - Corresponding examples	https://youtu.be/t-14ZwhtpAs?si=xPuqmjKUNywkWAsG https://youtu.be/owjVBo53hUU?si=W6JzIuj4rFb bQgoM	Explains and narrates with suitable board work	Listens, writes and solve problems	Understand and apply on some problems
Class 9	- First order higher degree equations solvable for y - Corresponding examples	https://youtu.be/-PckYOzQ8xQ?si=dIram74iSUwzH_98	Explains and narrates with suitable board work	Listens, writes and solve problems	Understand and apply on some problems
Class 10	- First order higher degree equations solvable for p - Corresponding examples	https://youtu.be/aYrsPeE7NLQ?si=uT_qNtsem1h kIBq	Explains and narrates with suitable board work	Listens, writes and solve problems	Understand and apply on some problems
Class 11	- First order higher degree equations solvable for Clairaut's equations and singular solution - Some examples	https://youtu.be/pP_ugcoTews?si=DNSWadq6Q5fA8_K2	Explains and narrates with suitable board work	Listens and writes	Understand and analyze and apply on some problems
Class 12	Basic Theory of linear systems in normal form	https://youtu.be/pthhx1P1gEg?si=mpMGjv1zLSIW27-N	Explains and narrates with suitable board work	Listens and writes	Understand
Class 13	- homogeneous linear systems with constant coefficients - Corresponding examples	https://youtu.be/USVS0FV65gs?si=aE8Eb60EdG86l8wC	Explains and narrates with suitable board work	Listens and writes	Understand and apply on some problems

Class 14	- Two Equations in two unknown functions - Corresponding examples	https://youtu.be/FP_w_ZRV_fE?si=VDkhJh1JHu2pOnf8	Explains and narrates with suitable board work	Listens, writes and comprehends	Understand
Class 15	- Linear differential equations of second order - Corresponding examples	https://youtu.be/bVJplOx0NIo?si=GqHYdMfdEC2CeWwv	Explains and narrates with suitable board work	Listens and writes	Understand and analyze
Class 16	Wronskian : its properties and applications	https://youtu.be/B4X6u51AMPM?si=bQJ3DhbagOnUu4is	Explains and narrates with suitable board work	Listens and writes	Understand, analyze and apply on some problems
Class 17	- Linear operator with constant coefficients - Complementary function - Rules for finding complementary function	https://youtu.be/tHqx1qx_A8q4?si=ZhwA3U11FfCeMbVj https://youtu.be/KbZmdWEgPcM?si=5c5RlsKRAK_TqB80	Explains and narrates with suitable board work	Listens, writes and solve problems	Understand and analyze
Class 18	- Particular integral - Rules for finding Particular integral	https://youtu.be/EwsAq2zqyew?si=SedHxg6kBj6CRjdi	Explains and narrates with suitable board work	Listens, writes and solve problems	Understand
Class 19	Short method of finding particular integrals in special cases	https://youtu.be/WC9i98JVyRE?si=X-a7omUy7pJXdAhV	Explains and narrates with suitable board work	Listens and writes	Understand, analyze and apply on some problems
Class 20	- Euler equation - Some important examples	https://youtu.be/1HKn9IvYiEM?si=Sr19c1p7PPEpWzAm	Explains and narrates with suitable board work	Listens and writes	Understand, analyze and apply on some problems
Class 21	- Method of undetermined coefficients - Some important examples	https://youtu.be/Ywq3B_MIkVY?si=YX8IB2EHWWMdoJ_y	Explains and narrates with suitable board work	Listens, writes and solve problems	Understand and apply on some problems
Class 22	- Method of variation of parameters - Some important examples	https://youtu.be/K1U2NEzJIFA?si=L_kylu0UgHGA2Aqk	Explains and narrates with suitable board work	Listens, writes and solve problems	Understand and apply on some problems

Class 23	- System of linear differential equations - Types of linear systems	https://youtu.be/OyTzkF17Vkw?si=JAzvRJpgbdACm62P	Explains and narrates with suitable board work	Listens and writes	Understand and analyze and apply on some problems
Class 24	- Differential operators - An operator method for linear systems with constant coefficients	https://youtu.be/5yRrcvzFIc4?si=TSh_mgxLqM_I_f1_8 https://youtu.be/GGz6fqS1Wzs?si=l8kaxyF3r1iLMjiz	Explains and narrates with suitable board work	Listens and writes	Understand and apply on some problems
Class 25	Planar linear autonomous systems	https://youtu.be/SQ1KLTDnQuQ?si=Ok0tyWWQizqdanw	Explains and narrates with suitable board work	Listens and writes	Understand and apply on some problems
Class 26	Equilibrium (critical) points	https://www.youtube.com/live/TMr71z5oLeY?si=6MdHhhrfVlgSXgPE	Explains and narrates with suitable board work	Listens and writes	Understand and apply on some problems
Class 27	Interpretation of the phase plane and phase portraits	https://youtu.be/qJqrg6789rE?si=qEQ8MVxVFstMXP-b https://youtu.be/SHS4zsNu8y8?si=EfAawZuY9bmeUYKi	Explains and narrates with suitable board work	Listens and writes	Understand, analyze and apply on some problems
Class 28	- Definition of singular point - Definition of regular singular point - Power series solution of a differential equation about an ordinary point - Solution of some problems	https://youtu.be/nWqeWe79o0w?si=kGlVL9ZvNN0lrngB https://youtu.be/0gcBpo5T0pk?si=FcDcOw5giIOTrDM7 https://youtu.be/p8hvZGFTq7I?si=RZ8W6mas6JKOQDT4	Explains and narrates with suitable board work	Listens and writes	Understand
Class 29	- Solution about a regular singular point (up to second order) - Some examples	https://youtu.be/MGLgDlE_uaU?si=pGuarZm_9U6xsR8 https://youtu.be/19Vt7ds8Lvw?si=t9oibSBdEtB_Ousy	Explains and narrates with suitable board work	Listens, writes and solve problems	Understand

Class 30	• Concept of neighbourhood of a point in R^n ($n > 1$) • Interior point • Open set in R^n ($n > 1$) • Closed set in R^n ($n > 1$)	https://youtu.be/ZdTKf8HmZvA?si=88L-zrTEnw4-0efk https://youtu.be/rc8Ye5nTew?si=EbvCT4a6b085sbM	Explains and narrates with suitable board work	Listens and writes	Understand
Class 31	• Limit point • Derived set • Closure of a set • Some important theorems regarding open sets and closed sets	https://youtu.be/1L8QdANtGrI?si=nOtTDmjEzqiMo1Q9	Explains and narrates with suitable board work	Listens and writes	Understand
Class 32	• Functions from R^n ($n > 1$) to R^m ($m \geq 1$) • Limit of functions of two or more variables • Double limit	https://www.youtube.com/live/t1frrf_HNvQ?si=ov7ukY8WG5C4PayF	Explains and narrates with suitable board work	Listens and writes	Understand and apply on some problems
Class 33	• Non existence of double limit • Corresponding examples	https://youtu.be/NFcE_FNm1g?si=VXRlmRxTO51Bee7L	Explains and narrates with suitable board work	Listens and writes	Understand and apply on some problems
Class 34	• Repeated limits • Non-existence of Repeated limits • Relation between double limit & repeated limits	https://youtu.be/MpsVeQLIE80?si=l4zmQHO_Z0mkkr_i	Explains and narrates with suitable board work	Listens, writes and solve problems	Understand
Class 35	• Continuity of functions of two or more variables • Corresponding examples	https://youtu.be/5yFUV_x9-	Explains and narrates with suitable board work	Listens and writes	Understand and apply on some problems
Class 36	• Some important theorems regarding continuity of functions	n8?si=MMlm0msI_AuwfrO_	Explains and narrates with suitable board work	Listens and writes	Understand and analyze
Class 37	• Partial derivatives • Total derivative • Some examples	https://youtu.be/8Yrpo7TG08c?si=eM8z5S1Yr57pjuJu https://youtu.be/9GKfvknvTQk?si=xlmrCj7gULgBl6X1	Explains and narrates with suitable board work	Listens and writes	Understand and apply on some problems

Class 38	- Differentiability - Some important examples	https://youtu.be/X_BuICU9AfQ?si=zJw_PoTMutZKl6BZ	Explains and narrates with suitable board work	Listens and writes	Understand and analyze and apply on some problems
Class 39	- Sufficient condition for differentiability - Application of this theorem	https://youtu.be/GyR1deHScB4?si=RCztpdxC6IBbZ1Uk	Explains and narrates with suitable board work	Listens and writes	Understand and analyze and apply on some problems
Class 40	- Chain rule for one and two independent parameters - Examples	https://youtu.be/CigwEHCU5gI?si=VYJbrdGuCU70twx5	Explains and narrates with suitable board work	Listens, writes and comprehends	Understand and correlate with different type of problems
Class 41	- Directional derivatives - The gradient	https://youtu.be/UTPRAKphIKQ?si=HO_drSdZ34VKUUpL https://youtu.be/so1O6EPOWfs?si=ij7iPp46018pIzBc https://youtu.be/QC-UyowzRN4?si=ArhPY90r2CoSXvKl	Explains and narrates with suitable board work	Listens, writes and solve problems	Understand and apply on some problems
Class 42	Maximal and normal property of the gradient	https://youtu.be/w0zIdhIGLPM?si=9Yg_r-YiN7vDRW_c https://youtu.be/exE8mg6qaSY?si=CgGYutwx9FmYWTf8	Explains and narrates with suitable board work	Listens, writes	Understand
Class 43	- Tangent planes - Corresponding examples	https://youtu.be/UUBdk1LXia8?si=EZJCVQZCGFUKLJbX	Explains and narrates with suitable board work	Listens, writes and solve problems	Understand and apply on some problems
Class 44	- Extrema of functions of two variables - Some examples	https://youtu.be/EMbkrko90FQ?si=ZBOD-B4_cIqj8Jo9 https://youtu.be/yppj3TMaXkI?si=8OtctSGdCb2d2gi2	Explains and narrates with suitable board work	Listens, writes	Understand and apply on some problems

Class 45	- Method of Lagrange multipliers - Corresponding	https://youtu.be/WbYGaz_NY_w?si=yRYZi5loDH-PV2k2n	Explains and narrates with suitable board work	Listens, writes and comprehends	Understand and correlate with different type of problems
Class 46	Constrained optimization problems	https://youtu.be/WbYGaz_NY_w?si=JF9EPCBDeJSDa5	Explains and narrates with suitable board work	Listens, writes	Understand and apply on some problems
Class 47	Discussion of previous year questions of university		Explains and narrates with suitable board work	Listens, writes and comprehends	Understand and correlate with different type of problems
Class 48	Discussion of previous year questions of university		Explains and narrates with suitable board work	Listens, writes and comprehends	Understand and correlate with different type of problems
Class 49	Discussion of previous year questions of university		Explains and narrates with suitable board work	Listens, writes and comprehends	Understand and correlate with different type of problems
Class 50	Discussion of previous year questions of university		Explains and narrates with suitable board work	Listens, writes and comprehends	Understand and correlate with different type of problems

Class 51	• Discussion of previous year questions of university		Explains and narrates with suitable board work	Listens, writes and comprehends	Understand and correlate with different type of problems
Class 52	• Discussion of previous year questions of university		Explains and narrates with suitable board work	Listens, writes and comprehends	Understand and correlate with different type of problems

LECTURE PLAN ON & RELATED LINK

Subject: MTMA, Paper: SEC-A (C-Programming Language)

Semester-III (B.Sc. Mathematics (Hons)) ,Credit-2

Faculty: Dr. Arun Kumar Maiti

Class	Topic	Related Links	Faculty approach	Student activity	Learning Outcome
1&2	➤ An overview of theoretical computers ➤ History of computers ➤ Overview of architecture of computer ➤ Compiler ➤ Assembler	https://youtu.be/GRInNLx3Tug?si=eOAb7cSF18QuLdTT	Lecture and board work	Listening and Writing	Understanding
3&4	➤ Machine language ➤ High level language ➤ Object oriented language ➤ Programming language and importance of C-programming	https://youtu.be/ikEUuttGDOI?si=HiX-PSNrYVmhR_EO	Lecture and board work with example	Listening and simple problem solving	Understanding
5&6	Constants, Variables and Data type of C-Program : ➤ Character set. Constants and variables data types ➤ Expression ➤ Assignment statements, declaration	https://youtu.be/BVnNg20AuYU?si=Rv9Ssya8RAOjYVA	Board work and Deduction and explain	Writing	Analyzing and Understanding

Maiti

7,8 &9	Operation and Expressions: ➤ Arithmetic operators ➤ Relational operators ➤ Logical operators	https://youtu.be/50Pb27JoUrw?si=tmJ2Ej9BQh-XmSk	Explains and Narrates with suitable board work	Comprehends and writing	Analyzing and Understanding
10, 11& 12	Decision Making and Branching: ➤ Decision making with if statement ➤ If-else statement ➤ Nesting if statement ➤ Switch statement ➤ Break and continue statement	https://youtu.be/h1ryKtBN74?si=SOOn7hulWWLqd4Jc9	Explains with suitable board work	Comprehends and writing	Understanding
13& 14	Control Statements: ➤ While statement ➤ Do-while statement ➤ For statement	https://youtu.be/YiPoFeWrSYY?si=k6q2EGDQL96e42kr	Explains and Narrates with suitable board work	Comprehends and writing	Analyzing and Understanding
15, 16& 17	Arrays : ➤ One-dimension, two-dimension and multidimensional arrays ➤ declaration of arrays ➤ initialization of one and multi-dimensional arrays	https://youtu.be/08LWyp6PNI?si=6suMCisa8FWKqL9-	Explains with suitable board work	Comprehends and writing	Understanding
18, 19& 20	User-defined Functions : ➤ Definition of functions ➤ Scope of variables ➤ Return values and their types	https://youtu.be/a8co3S9mAbw?si=8lrzWxafYzTcLJaK	Introduction, deduction & Solution	Comprehends and Writes	Understanding

Maithi

	➤ Function declaration, function call by value ➤ Nesting of functions ➤ Passing of arrays to functions ➤ Recurrence of function				
21 & 22	Introduction to Library functions: ➤ stdio.h , math.h, string.h stdlib.h, time.h etc. ➤ Some hands on examples should be included	https://youtu.be/nuUEHZ4jCPQ?si=AEPtM9POOGdtRbfB	Lecture and Board Work	Comprehe nds and Writes	Understandi ng

mail.



Shyampur Siddheswari Mahavidyalaya

AJODHYA, SHYAMPUR, HOWRAH,

PIN-711312, WB

LECTURE PLAN & RELATED LINKS

Subject: MTMA **Paper:** CC-8 (Riemann Integration & Series of Functions)

Semester: V (B.Sc. Mathematics Honours)

Credit: 6

Instructor: Mrs. Rini Maiti

Class	Content	Related Links	Faculty Approach	Student Activity	Learning Outcome
Class 1	- Introduction of partition of a closed and bounded interval - Upper Darboux sum $U(P, f)$ and lower Darboux sum $L(P, f)$ and associated results	https://youtu.be/9SgRKZcQfLQ?si=ZcnYwdBGPvUCuzl- https://youtu.be/Gp52wuNTJpU?si=S9TrPAnL2ZQLHh2t	Explains and narrates with suitable board work	Listens and writes	Understand and apply on some problems
Class 2	- Upper integral and lower integral - Examples - Condition for integrability	https://youtu.be/7qjc5PHZvIU?si=WoNAyQ56u34T0tWn	Explains and narrates with suitable board work	Listens and writes	Understand and apply on some problems
Class 3	- Norm of a partition - Refinement of partition of a closed and bounded interval	https://youtu.be/nRAX6OYeMaM?si=o2XDkM9w2z8LzLS6 https://youtu.be/7isoR3A8pPU?si=bakwUpjkg n7ESotO	Explains and narrates with suitable board work	Listens and writes	Understand and apply on some problems
Class 4	- Darboux's theorem - Some examples - Darboux's definition of integration over a closed and bounded interval	https://youtu.be/KdvvfXCX6ulY?si=3ZCqW_xM28cR3n04	Explains and narrates with suitable board work	Listens and writes, and solve problems	Understand and analyze
Class 5	- Necessary and sufficient condition for Riemann integrability. - Corresponding examples	https://youtu.be/GSh8HuG8lgw?si=XQt-rgyYs_J-s2bb https://www.youtube.com/live/imUtInNfgiU?si=-tW36xumY65FE6YZi	Explains and narrates with suitable board work	Listens and writes and solve problems	Understand and apply on some problems

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Class 6	Some Riemann integrable functions	https://www.youtube.com/live/imUtInNfgiU?si=tW36xumY65FE6YZi	Explains and narrates with suitable board work	Listens and writes and solve problems	Understand and apply on some problems
Class 7	f is monotone on $[a,b]$ implies f is integrable on $[a,b]$ f is continuous on $[a,b]$ implies f is integrable on $[a,b]$	https://youtu.be/xAkpRQGVwUc?si=Wu3bWDVe3xiQW1dv	Explains and narrates with suitable board work	Listens and writes	Understand
Class 8	- Concept of negligible set (or zero set) defined as a set covered by countable number of open intervals sum of whose lengths is arbitrary small - Examples of negligible sets - Any subset of a negligible set, finite set, countable union of negligible sets are negligible sets	https://youtu.be/oj4NimFnMcI?si=30-kwDfP6rDjqZ9q https://youtu.be/MDrhlzbtrWA?si=DLEbuIMONmn6Fj2G	Explains and narrates with suitable board work	Listens and writes	Understand and apply on some problems
Class 9	- A bounded function on closed and bounded interval is Riemann integrable if and only if the set of points of discontinuity is negligible - Example of Riemann integrable functions	https://youtu.be/GLcP1XbDl_c?si=B-XsfLUV5H1_Ymrj https://www.youtube.com/live/imUtInNfgiU?si=iV6L74ohj5lbiwFp	Explains and narrates with suitable board work	Listens and writes	Understand and analyze and apply on some problems
Class 10	Integrability of sum, scalar multiple, product of Riemann integrable functions	https://youtu.be/PEKKx5bb9xA?si=pxekuTJsGWiaH6l	Explains and narrates with suitable board work	Listens, writes and comprehends	Understand
Class 11	- Integrability of quotient, modulus of Riemann integrable functions - Properties of Riemann integrable functions arising from the above results	https://youtu.be/4eK_orcPdIM?si=GM0BECB6tqz3gCN_	Explains and narrates with suitable board work	Listens, writes and comprehends	Understand

Class 12	Function defined by definite integral $\int_a^x f(t)dt$ and its properties	https://youtu.be/leE_cYUV9gI?si=nkYg4s0V4NCZMq72	Explains and narrates with suitable board work	Listens and writes	Understand
Class 13	- Antiderivative (primitive or indefinite integral) - Corresponding Examples	https://youtu.be/MMv-027KEqU?si=E56-5NNbZg4TxwL3	Explains and narrates with suitable board work	Listens and writes	Understand and apply on some problems
Class 14	- Integration by substitution - Integration by parts - Examples	https://youtu.be/Pzgl6aDceQg?si=Q2AjZCyeF3Je625Z https://youtu.be/mzDBZxSRthY?si=n7bX05L-ON5q0WUT	Explains and narrates with suitable board work	Listens and writes	Understand
Class 15	- First mean value theorem - Application of this theorem	https://youtu.be/q6fvO6WqkTs?si=MTULtdvvxeroOI1J	Explains and narrates with suitable board work	Listens and writes	Understand and apply on some problems
Class 16	- Second mean value theorem : Bonnet's form & Weierstrass' form - Application of these theorem	https://youtu.be/C2nh3aQIEDE?si=MsWFnGKLfCt7zzlH	Explains and narrates with suitable board work	Listens and writes	Understand and apply on some problems
Class 17	Properties of Logarithmic function defined as the definite integral $\int_1^x \frac{dt}{t}$, $x > 0$	https://www.youtube.com/live/V7z-kBZUzNk?si=AydVznGDa6HBPGus	Explains and narrates with suitable board work	Listens and writes	Understand
Class 18	- Fundamental theorem of Integral Calculus - Application of this theorem	https://youtu.be/HQGwkeWdtI4?si=rd2J5glXwBfOCz7q https://youtu.be/Xo-qPaYby6s?si=I7dUeJEiFSPJuvey	Explains and narrates with suitable board work	Listens and writes	Understand
Class 19	- Introduction of Improper integrals - Range of integration, finite or infinite	https://youtu.be/QbrmeGz4hvl?si=ac6LBgtrDpA24f0 https://youtu.be/I7I04v9yJ1w?si=CTve6FIL39E9gF0P	Explains and narrates with suitable board work	Listens and writes	Understand and apply on some problems

Class 20	- Improper integrals on a closed and bounded interval, the integrand having infinite discontinuities - Corresponding examples	https://youtu.be/17I04v9yJ1w?si=CTve6FIlL39E9gF0P	Explains and narrates with suitable board work	Listens and writes	Understand and apply on some problems
Class 21	- Test for convergence, positive integrand - Comparison test - Limit form of Comparison test - Corresponding examples	https://youtu.be/Jln8vUdRe0s?si=F7cUse1zNjGuUjLg https://youtu.be/Jln8vUdRe0s?si=mCk1PYoFDvktNlkC	Explains and narrates with suitable board work	Listens and writes	Understand and apply on some problems
Class 22	μ test - Application of this test	https://www.youtube.com/live/7WoMx6tfp1U?si=W5DKeHyLmwgi8U8	Explains and narrates with suitable board work	Listens and writes	Understand and apply on some problems
Class 23	Convergence & working knowledge of Beta function	https://youtu.be/laG-24lhULY?si=cs8j1zqg7Qy6LA73	Explains and narrates with suitable board work	Listens and writes	Understand and analyze
Class 24	- Cauchy theorem - Absolute convergence - Corresponding examples	https://youtu.be/itR39Et4ZY?si=Dg7UtowLWlvcJ-R9 https://youtu.be/HbvukzbI4_A?si=wglNioVxQIJTuvdu	Explains and narrates with suitable board work	Listens and writes	Understand and apply on some problems
Class 25	- Improper integral on an unbounded interval - Test for convergence, positive integrand - Comparison test - Limit form of Comparison test - Corresponding examples	https://youtu.be/8kVmCOdmu90?si=sW1Vct0FUrgF9Hxx https://youtu.be/-oQ5cKbtPzo?si=40g_Q0j2yFNo2s6d	Explains and narrates with suitable board work	Listens and writes	Understand
Class 26	μ test - Corresponding examples - Cauchy –Maclaurin integral test - Corresponding examples	https://youtu.be/8kVmCOdmu90?si=sW1Vct0FUrgF9Hxx	Explains and narrates with suitable board work	Listens and writes	Understand and apply on some problems

Class 27	- Cauchy theorem - Absolute convergence - Corresponding examples	https://youtu.be/1p0p3gCU-B0?si=-mmjSZpoUnLqnG34 https://youtu.be/ncmyzk5_4k?si=bvnlyIViXOxo_yAR	Explains and narrates with suitable board work	Listens and writes	Understand
Class 28	- Test for convergence of the integral of a product - Statement of Abel's test for convergence on the integral of a product - Statement of Dirichlet's test for convergence on the integral of a product - Corresponding examples	https://youtu.be/vGfufwora0?si=EnD7lrCR34mMTPwV https://youtu.be/Lm2g3aZ9pAU?si=sTp7PbZOWGoLLBri https://youtu.be/grHtZEaGdgw?si=uZFB84DHehEBN5S1	Explains and narrates with suitable board work	Listens and writes	Understand and apply on some problems
Class 29	- Statement of some important theorems - Evaluation of some improper integrals	https://youtu.be/yHMS0_j30Do?si=1dbk61Hhs_SpySj https://youtu.be/4mDJxBIISLI?si=U_VinGcXjSkTotI5	Explains and narrates with suitable board work	Listens and writes	Understand and apply on some problems
Class 30	- Convergence and working knowledge of Gamma function - Interrelation of Beta and Gamma function	https://youtu.be/IaG-24lhULY?si=8d8fqGP8IwQSEFlv https://youtu.be/A_Ep8iGpzml?si=BqToK_n7K7dRa7I2	Explains and narrates with suitable board work	Listens and writes	Understand and analyze
Class 31	- Proof of $\Gamma(m)\Gamma(1-m)=\pi\sin m\pi, 0<m<1$ - Computation of the integrals $\int_0^{\pi/2} \sin^n x \, dx$, $\int_0^{\pi/2} \cos^n x \, dx$, $\int_0^{\pi/2} \tan^n x \, dx$ when they exist (using Beta and Gamma function)	https://youtu.be/R31R0m4CRNE?si=F6LenRCXSu0Dx8dQ	Explains and narrates with suitable board work	Listens and writes	Understand and apply on some problems
Class 32	- Sequence of functions defined on a set - Pointwise convergence - Limit function of a sequence - Corresponding examples	https://youtu.be/-LcblAy_e6c?si=GNJRCHx_3ZU1RywY https://youtu.be/0oi_UKeb88o?si=DZJ6K_8HkUqDs0Th	Explains and narrates with suitable board work	Listens and writes	Understand

Class 33	- Uniform convergence - Corresponding examples	https://youtu.be/IXzC8y-RnVM?si=m1DbF_5JlbFI05SY	Explains and narrates with suitable board work	Listens and writes	Understand and apply on some problems
Class 34	- Cauchy criterion of uniform convergence - Equivalent statement for Cauchy criterion - Application of this criterion	https://youtu.be/Zhq1IBHBSyY?si=sU5gHwauan2sQdFH	Explains and narrates with suitable board work	Listens and writes	Understand and apply on some problems
Class 35	- Consequences of uniform convergence - Some important theorems on uniform convergence	https://youtu.be/78q-Kh5bdtE?si=3FuOKmkWZlJncj53	Explains and narrates with suitable board work	Listens and writes	Understand
Class 36	- Weirstrass' M-test - Application of this test	https://youtu.be/9jqknn dZNI8?si=OEK3Gax47Iv63sEn	Explains and narrates with suitable board work	Listens and writes	Understand and apply on some problems
Class 37	Boundedness of the limit function of a sequence of functions in case of uniform convergence	https://youtu.be/U-c0ApwOEql?si=w3dowx62_vtBXAJ6	Explains and narrates with suitable board work	Listens, writes and comprehends	Understand and correlate with different type of problems
Class 38	Continuity of the limit function of a sequence of functions in case of uniform convergence	https://youtu.be/NzRHK2c8EjE?si=p1LuUJQDEBz_n3SI	Explains and narrates with suitable board work	Listens and writes	Understand and apply on some problems
Class 39	- Integrability of the limit function of a sequence of functions in case of uniform convergence - Corresponding examples	https://youtu.be/Xfh19Jwucp4?si=OUANqX9POvUWQ2hP	Explains and narrates with suitable board work	Listens and writes	Understand and apply on some problems
Class 40	- Differentiability of the limit function of a sequence of functions in case of uniform convergence - Corresponding examples	https://youtu.be/z7pmORkNedc?si=8MsxE308Fp2XeaHA	Explains and narrates with suitable board work	Listens and writes	Understand and apply on some problems

Class 41	- Dini's theorem - Examples of different types problems	https://youtu.be/B3piK99K4DQ?si=pTeOmyNBDL_T_2IH https://youtu.be/4gCTHThm_9c?si=L_0vndvXzMNGgqZg	Explains and narrates with suitable board work	Listens and writes	Understand and apply on some problems
Class 42	- Series of functions defined on a set - Pointwise convergence - Uniform convergence - Absolute convergence - Corresponding examples	https://youtu.be/Oss0MED_ssI?si=Nj_WLqEDJLxVuQrq https://youtu.be/Nb2XeDAgwqw?si=Ze69gwt4PpUBddUG	Explains and narrates with suitable board work	Listens and writes	Understand and apply on some problems
Class 43	- Cauchy criterion of uniform convergence - Application of this criterion	https://youtu.be/wMPYIqumv7g?si=o3ghniS-YravY_se	Explains and narrates with suitable board work	Listens and writes	Understand and apply on some problems
Class 44	- Weierstrass' M-test - Corresponding examples	https://youtu.be/DMKRrlch9rw?si=JKcxJ40ZdaGligVg	Explains and narrates with suitable board work	Listens and writes	Understand and apply on some problems
Class 45	- Consequences of uniform convergence - Passage to the limit term by term - Boundedness of a series of functions in case of uniform convergence	https://youtu.be/4z88vpCXxE?si=i3cErpDYzy pK2s2-	Explains and narrates with suitable board work	Listens and writes	Understand and analyze
Class 46	- Continuity of a series of functions in case of uniform convergence - Integrability of a series of functions in case of uniform convergence	https://youtu.be/62PLY YIATU0?si=1GDvqaXi Zlbe6cRS	Explains and narrates with suitable board work	Listens and writes	Understand and analyze
Class 47	- Differentiability of a series of functions in case of uniform convergence - Abel's test - Application of this test	https://youtu.be/p1ScnETm53k?si=VGRb0arnTFAndNne	Explains and narrates with suitable board work	Listens and writes	Understand and apply on some problems

Class 48	- Dirichlet's test - Corresponding examples	https://www.youtube.com/live/_doYMzJm0jo?si=nMgo0XKqml-Qxfgp	Explains and narrates with suitable board work	Listens and writes	Understand and apply on some problems
Class 49	- Introduction of power series - Fundamental theorem of power series	https://youtu.be/8FhIY5kjDqE?si=P6-miFqIxV9ou-ue https://youtu.be/SuygWwhEwdU?si=2jU3OSdb8yUIKViO	Explains and narrates with suitable board work	Listens and writes	Understand
Class 50	- Cauchy-Hadamard theorem - Ratio test - Applications of these theorem	https://youtu.be/DULe6zOkSBI?si=ogvLqeNHIttgjTBL	Explains and narrates with suitable board work	Listens and writes	Understand
Class 51	- Determination of radius of convergence - Properties of a power series	https://youtu.be/FH5a3USaf_A?si=RuclNo73xFzCqq_e	Explains and narrates with suitable board work	Listens and writes	Understand and apply on some problems
Class 52	- Uniform convergence of power series - Absolute convergence of power series - Corresponding examples	https://youtu.be/uHYmHIIdppXc?si=hpl-bfqcMnDqcue5 https://www.youtube.com/live/NUsLQlv469U?si=uaDfq7fab7udtk1P	Explains and narrates with suitable board work	Listens and writes	Understand and apply on some problems
Class 53	- Properties of sum function - Differentiation of power series - Integration of power series	https://youtu.be/Dohz0foVR5Q?si=NGKEOIdQKDG23Nw https://youtu.be/FAcBkgqxayk?si=cdTm0DX_drrlDT07	Explains and narrates with suitable board work	Listens and writes	Understand and apply on some problems
Class 54	- Abel's limit theorems - Uniqueness of power series having sum function	https://youtu.be/ZNIuwKCmUp8?si=ORllaYs1cCIHn6nb https://youtu.be/UuziZZBtRes?si=6x37-v0gpLKVr2Zw	Explains and narrates with suitable board work	Listens and writes	Understand and analyze

Class 55	• Introduction of Fourier series • Trigonometric series • of sufficient condition for a trigonometric series to be a Fourier series	https://youtu.be/CDeT2yV_CbM?si=8y7GNNkoOjIyxQo https://youtu.be/EenEo4at160?si=G0nm049o04uhl6VB	Explains and narrates with suitable board work	Listens and writes	Understand
Class 56	• Fourier coefficients for periodic functions defined on $[-\pi, \pi]$ • Statement of Dirichlet's condition of convergence	https://youtu.be/Hvi9Mk86Y3M?si=1tfCS32Bl_egrC81K https://youtu.be/blS_OImUJ-c?si=8YRZs3AfM8koAT5W	Explains and narrates with suitable board work	Listens and writes	Understand
Class 57	• Statement of theorem of sum of Fourier series • Some problems on Fourier series	https://youtu.be/9g-NMLf48_8?si=w5HbXCcQynMFb1ed https://youtu.be/ZeDc3jlnUI8?si=FlZRwIqo6v5C3cv0	Explains and narrates with suitable board work	Listens and writes	Understand and apply on some problems
Class 58	• Discussion of previous year questions of university on Riemann integration		Explains and narrates with suitable board work	Listens and writes	Understand and correlate with different type of problems
Class 59	• Discussion of previous year questions of university on Riemann integration		Explains and narrates with suitable board work	Listens and writes	Understand and correlate with different type of problems
Class 60	• Discussion of previous year questions of university on Improper integral		Explains and narrates with suitable board work	Listens and writes	Understand and correlate with different type of problems
Class 61	• Discussion of previous year questions of university on Beta and Gamma function		Explains and narrates with suitable board work	Listens and writes	Understand and correlate with different type of problems

Class 62	• Discussion of previous year questions of university on Sequence of function		Explains and narrates with suitable board work	Listens and writes	Understand and correlate with different type of problems
Class 63	• Discussion of previous year questions of university on Series of functions		Explains and narrates with suitable board work	Listens and writes	Understand and correlate with different type of problems
Class 64	• Discussion of previous year questions of university on power series		Explains and narrates with suitable board work	Listens and writes	Understand and correlate with different type of problems
Class 65	• Discussion of previous year questions of university on Fourier series		Explains and narrates with suitable board work	Listens and writes	Understand and correlate with different type of problems

LECTURE PLAN ON & RELATED LINK

Subject: MTMA, Paper: CC-9 (Partial Differential equation & Multivariate Calculus-II)

Semester-IV(B.Sc. Mathematics (Hons)) ,Credit-6

Faculty: Dr. Arun Kumar Maiti

Class	Topic	Related Links	Faculty approach	Student activity	Learning Outcome
1	➤ Partial differential equations of the first order. ➤ Lagrange's solution. ➤ Non linear first order partial differential equations.	https://youtu.be/THjaxvPBGOU?si=gylc2fSgIXUcH8Q-	Lecture and board work	Listening and Writing	Understanding
2 & 3	➤ Charpit's general method of solution. ➤ Some special types of equations which can be solved easily by methods other than the general method.	https://youtu.be/6cmfkXB9MEY?si=xNsGg5fB EUerf4Q	Lecture and board work with example	Listening and simple problem solving	Understanding
4&5	➤ Derivation of heat equation. ➤ Wave equation and Laplace equation.	https://youtu.be/9d8PwnKVA-U?si=mIYpyIPBOL5AO2Lv https://youtu.be/1RXw67TAr64?si=1NuMPMzbCv-nVcUt	Lecture and board work	Listening and simple problem solving	Understanding
6&7	➤ Classification of second order linear equations as hyperbolic, parabolic or elliptic.	https://youtu.be/VpPB5ILZOvc?si=7SU-YD85j3fujYnB	Board work and Deduction and explain	Writing	Analyzing and Understanding

Maiti

	➤ Reduction of second order linear equations to canonical forms.				
8&9	➤ The Cauchy problem. ➤ Cauchy-Kowalewskaya theorem. ➤ Cauchy problem of finite and infinite string. ➤ Linearization and stability analysis.	https://youtu.be/dhNj6BiNYvI?si=sqJhqXbzpq66eeH	Explains and Narrates with suitable board work	Comprehends and writing	Analyzing and Understanding
Classes	Topic	Related Links	Faculty Approach	Student activity	Learning Outcome
10&11	➤ Initial boundary value problems. ➤ Semi-infinite string with a fixed end. ➤ Semi-infinite string with a free end.	https://youtu.be/1Ui2HHsYMqM?si=cldurfcA0uZ-2fS https://youtu.be/LWXbLnplCNA?si=RUSzJQGg-sOt339D	Explains and Narrates with suitable board work	Comprehends and writing	Analyzing and Understanding
12 & 13	➤ Equations with non-homogeneous boundary conditions. ➤ Non-homogeneous wave equation.	https://youtu.be/okWz5CWx770?si=UjSh7VZ7H5iCGD- https://youtu.be/M-myT7u1w?si=uAddnLLFCRGWn27e	Explains with suitable board work	Comprehends and writing	Understanding
14 & 15	➤ Method of separation of variables. ➤ solving the vibrating string problem. ➤ Solving the heat conduction problem.	https://youtu.be/ywrgWRSQ3PY?si=K8-3BtcNXJ4p-70a	Formulation of the model and Deduction	Writing and solving Problems	Analyzing

Maithi

16& 17	Multiple integral: ➤ Concept of upper sum, lower sum, upper integral, lower-integral and double integral (no rigorous treatment is needed). ➤ Statement of existence theorem for continuous functions.	https://youtu.be/SKD4A6mi9l0?si=P6d3m4c4tkrRNaMo	Introduction, deduction & Solution	Comprehends and Writes	Understanding
18& 19	➤ Iterated or repeated integral. ➤ Change of order of integration. Triple integral. ➤ Cylindrical and spherical coordinates.	https://youtu.be/LUvynduoUX0?si=STvAWr8EKd7xSwZc https://youtu.be/U-13q74uvTo?si=cn6Rqfni3DFpIYj4	Lecture and Board Work	Comprehends and Writes	Understanding
20& 21	➤ Change of variables in double integrals and triple integrals. ➤ Transformation of double and triple integrals (problems only).	https://youtu.be/hhFzJvaYU?si=izhbfkDWUKb-XoQM	Lecture and Board Work with Explanation	Comprehends and Writes	Understanding and knowledge built
22& 23	➤ Determination of volume and surface area by multiple integrals (problems only). ➤ Differentiation under the integral sign, Leibniz's rule (problems only).	https://youtu.be/GQNTfhgE8U?si=aynTfD_2Tsl-Zuz7 https://youtu.be/LQTgrr2qNT0?si=aaVnizm5jOhlV2p0	Board Work and Explain	Listening and Writing	Understanding

Maiti

24& 25	➤ Definition of vector field, divergence and curl. ➤ Line integrals, applications of line integrals : mass and work. ➤ Fundamental theorem for line integrals. ➤ Conservative vector fields, independence of path.	https://youtu.be/ZFiDtXOGhc?si=1PhnWmekFcCs6Oa2 https://youtu.be/wET0pXuIJEM?si=jnfxb9vhL5AUTJDO	Board Work for Formulation of the Model and stability analysis.	Find out the steady States and analyze their Stability	Understanding by hand to hand Calculation
26& 27	➤ Green's theorem. ➤ Surface integrals. ➤ Integrals over parametrically defined surfaces. ➤ Stoke's theorem. ➤ The Divergence theorem.	https://youtu.be/kdTxN4E0vbo?si=cG5ILfmGMwER-Au9 https://youtu.be/0UvNFcfBJ4?si=VWYQMgIHHn2foqJD https://youtu.be/vZGvggru4TwE?si=bZT54ucbXqNxuk_g	Board Work and Explain with suitable Example	Solving Simple Problem to understand the limit cycles and Stability Criteria	Clear Conception

Mani

Lecture plan / Lesson Plan of CC 10 (Mechanics)

Semester - IV (MTMA CBCS) Instructor Name : Snehendu Mandal

class	Content	Related Links	Faculty approach	Students activity	Learners outcomes
Class 1	- Coplanar forces in general : - Resultant force - and resultant couple	https://youtube.com/playlist?list=PLT3bOBUU3L9jVJYwDCDE8FOJDvr0cU6U0&si=W X3Dil1I- 1jwNOB	Explains Board work	Listens	Understanding & analyze
Class 2	- Special cases, - Varignon's theorem - examples	https://youtube.com/playlist?list=PLDN15nk5uLiD8YZCLHiJLKrqf_BR7KW0c&si=hEK JijMqEaxMRE6k	Explains Board Work with examples	Listens & write	Understanding & analyze
Class 3	- Necessary and Sufficient conditions of equilibrium. - problems	https://youtube.com/playlist?list=PLvbKJaHKFw3aM-RFWTAP0iC1FUSaFuEix&si=E9tOeGKxcSAOA3ju	Explains Board work	Listens & write	Develop Skills Problem solving
Class 4	- Equilibrium equations of the first, - Second and Third Equilibrium equation	https://youtube.com/playlist?list=PLvbKJaHKFw3aM-RFWTAP0iC1FUSaFuEix&si=A_2s16ekJXjtFChh	Explains Board Work with examples	Listen & write	Develop Skills Problem solving
Class 5	- Some important Results on equilibrium - Theorems - Problems	https://youtube.com/playlist?list=PLvbKJaHKFw3aM-RFWTAP0iC1FUSaFuEix&si=A_2s16ekJXjtFChh	Explains Board Work with examples	Listen & write	Develop Skills Problem solving
Class 6	- An arbitrary force system in space : - Moment of a force - examples	https://youtube.com/playlist?list=PLDN15nk5uLiB4EPdnPnEvaB4wabPM8RfR&si=TXhKgl0cxL6xOUDf	Explains Board work	understanding	Understanding analyze
Class 7	- Varignon's theorem. - Resultant force and resultant couple - Examples - Problems	https://youtube.com/playlist?list=PLDN15nk5uLiB4EPdnPnEvaB4wabPM8RfR&si=yZL0GC0QYFG94Y-g	Explains Board work	Listens understand	Understanding analyze
Class 8	- Necessary and Sufficient conditions of equilibrium. - Theorems & Applications .	https://youtu.be/AzZTYtJBHoE?si=tvxv7F_kJESRZfTc	Explains Board work	Listens & write understand	Understanding analyze
Class 9	- Problems based on Forces in 3D - exercises	https://youtu.be/AzZTYtJBHoE?si=tvxv7F_kJESRZfTc	Explains Board work	Listens & write understand	Understanding analyze
Class 10	- Equilibrium equations, - Reduction to a wrench,	https://youtu.be/iwd9zpWnW0I?si=knbA0VUugba4f0Zl	Explains Board Work with examples	Listens	Develop Skills Problem solving

Snehan

	Poinsot's central axis,				
Class 11	- Intensity and pitch of a wrench, - Invariants of a system of forces	https://youtu.be/kxHOe1WgDhU?si=EhTHuDS9cJpS20Fy	Explains Board work	Listens & write	Develop Skills Problem solving
Class 12	- Statically determinate and indeterminate problems. - Examples - Problems	https://youtube.com/playlist?list=PLPLlcVV9fXj9W0u-5C1-o-gZZefHGR-B_&si=LxhgCvfhraAT5RuW	Explains Board Work with examples	Listens & write	Understanding & analyze
Class 13	- Equilibrium in the presence of sliding Friction force : - Contact force between bodies	https://youtube.com/playlist?list=PLIhUrsYr8yHwY1TDraJpyYkU8Zug-kM4m&si=qOgol6stWwJf_Mf	Explains Board work	Listen & write	Understanding & analyze
Class 14	- Coulomb's laws of static Friction and dynamic friction. The angle and cone of friction, - the equilibrium region.	https://youtube.com/playlist?list=PLIhUrsYr8yHwY1TDraJpyYkU8Zug-kM4m&si=yWkd5X9hTsaWJbXg	Explains Board work	understanding	Understanding & analyze
Class 15	- Virtual work : Workless - constraints – - examples, - virtual displacements	https://youtube.com/playlist?list=PLi0hoi2vOpnSmaOZHoryV9IT5RmP7WcEf&si=zElavyPFp226uxZB	Explains Board work	Listens understand	Develop Skills Problem solving
Class 16	- The principle of virtual work, - Deductions of the Necessary and Sufficient conditions of equilibrium of an arbitrary force	https://youtu.be/w43T4LXUyVI?si=V-VmsFrFemwfw0c	Explains Board Work with examples	Listens & write understand	Develop Skills
Class 17	- Some important Results on Virtual Works - Theorems & Applications	https://youtube.com/playlist?list=PLcNjltm-f-4cKGHGIV90Rgig7s3W7Q2u3&si=j1vxjRLMnVyddmJD	Explains Board work	understanding	Understanding
Class 18	- System in plane and space, acting on a rigid body - exercises	https://youtu.be/w43T4LXUyVI?si=V-VmsFrFemwfw0c	Explains Board Work with examples	Listens & write	Understanding
Class 19	- Stability of equilibrium : Conservative force field, - energy test of stability	https://youtube.com/playlist?list=PLd3pZCUa5I6qDgUTJstkayeUz5AHRmhJ9&si=X2_xeLmzPvfgvJr4	Explains Board work	Listens understand	Understanding & analyze
Class 20	- condition of stability of a perfectly rough heavy body lying on a fixed body. - Rocking stones.	https://youtube.com/playlist?list=PLd3pZCUa5I6qDgUTJstkayeUz5AHRmhJ9&si=OYP3yZl4ILunw1bL	Explains Board Work with examples	Listens & write understand	Understanding
Class 21	- Kinematics of a particle - velocity	https://youtu.be/q9IW0Q199_o?si=PFPDMOPjv-q-7lid	Explains Board work	Listens	Develop Skills Problem solving

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	• acceleration, • angular velocity				
Class 22	• Linear and angular momentum. • Relative velocity and acceleration.	https://youtu.be/nFSMu3bxXVA?si=0e_6TBhl7Lv8O31	Explains Board Work with examples	Listens & write	Develop Skills Problem solving
Class 23	➤ Expressions for velocity and acceleration in case of rectilinear motion	https://youtube.com/playlist?list=PLjReJAzc4wUgX9Aiz2vBqIiv23ggl34c7&si=RHD-okfdUJSqih41	Explains Board work	Listens understand	Understanding & analyze
Class 24	➤ Planar motion - in Cartesian Co-ordinates ➤ Examples & Theorems ➤ Applications	https://youtu.be/MlNmIY_yoZ0?si=VABWkj85YHLdvGNQ	Explains Board work	understanding	Understanding & analyze
Class 25	➤ Planar motion - in polar co-ordinates, ➤ Examples & Theorems ➤ Applications	https://youtu.be/MlNmIY_yoZ0?si=VABWkj85YHLdvGNQ	Explains Board Work with examples	Listens & write	Understanding & analyze
Class 26	➤ tangential and normal components of velocity & Accelerations ➤ Important Results & Theorems	https://youtu.be/fVX9x-QnE_Q?si=6R7H-lbm1zRfp42	Explains Board work	Listens understand	Understanding & analyze
Class 27	➤ Uniform circular motion. ➤ Important Results & Theorems ➤ Problems	https://youtu.be/Y9XNWQSXuBw?si=q59ePhghX_b5qQ0E	Explains Board Work with examples	Listens & write understand	Understanding & analyze
Class 28	➤ Newton laws of motion and law of gravitation : ➤ Space, time, ➤ mass, force,	https://youtu.be/fVX9x-QnE_Q?si=6R7H-lbm1zRfp42	Board Work with examples	Listens & write	Develop Skills Problem solving
Class 29	• Inertial reference frame, • principle of equivalence and gravity. • Vector equation of motion	https://youtu.be/pD9NxAlaV7E?si=cQTFeQD3hO4pzHtc	Explains Board work	Listens understand	Develop Skills Problem solving
Class 29	• Work, power ➤ Important Results & Theorems ➤ Problems	https://youtube.com/playlist?list=PLOT4DcVotrwd_W8ndkf0Awkyl_98uqMT8&si=jZ176fDsf8MeI-CO	Board Work with examples	Listens & write	Develop Skills Problem solving

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Class 30	• Energy • kinetic energy, • conservative forces	https://youtube.com/playlist?list=PLOT4DcVotrwd_W8ndkf0Awkyl_98uqMT8&si=jZ176fDsf8MeI-C0	Explains Board Work with examples	Listens & write	Develop Skills Problem solving
Class 31	➤ potential energy. ➤ Existence of potential energy function ➤ Theorems	https://youtu.be/GoJ2NRa2f4I?si=bt0fD1ahs6ajbcl0	Explains Board work	Listens understand	Understanding & analyze
Class 32	• Energy conservation in a conservative field. • Stable equilibrium and small oscillations •	https://youtu.be/BcZfRSlaw7s?si=nNgQ_ZAfhcduDWJ6	Explains Board work	understand	Understanding & analyze
Class 33	➤ Approximate equation of motion for small oscillation. ➤ Results & Applications	https://youtu.be/SkLSkBQvw4M?si=spWIDy1-rUfWKV3	Explains Board work	Listens understand	Understanding & analyze
Class 34	➤ Impulsive forces ➤ Important theorems ➤ Results & Applications ➤	https://youtu.be/x12o6zxWpFg?si=Ko-KI5_YJJwz12Nc	Board Work with examples	Listens & write	Problem solving
Class 35	➤ Problems in particle dynamics : ➤ Rectilinear motion in a given force field ➤	https://youtube.com/playlist?list=PLNsLYdDVEWEpSQwitytQ12BJnciYdJjWg&si=FrH6_YM8DB6MUEAr	Board Work with examples	Listens & write understand	Understanding & analyze
Class 36	➤ vertical motion under uniform gravity, ➤ different aspect of Vertical Motions ➤ application on physics	https://youtu.be/x12o6zxWpFg?si=Ko-KI5_YJJwz12Nc	Explains Board work	Listens	Develop Skills
Class 37	➤ Inverse square field, constrained rectilinear motion ➤ Important Results ➤ applications	https://youtu.be/x12o6zxWpFg?si=Ko-KI5_YJJwz12Nc	Board Work with examples	Listens & write	Problem solving
Class 38	➤ vertical motion under gravity in a Resisting medium, ➤ resistance as a function of Velocity	https://youtube.com/playlist?list=PLd3pZCUa5l6oxA5lyC6SltrqeqUvBEXAH&si=R7VHwvVM7tt5wn5b	Explains Board Work with examples	Listens & write	Develop Skills
Class 39	➤ Simple harmonic motion ➤ Various aspects ➤ Time period of S.H.M	https://youtu.be/hgcudPr73LU?si=5GmDDyVWI9ksA-5p	Explains Board Work with examples	Listens & write	Develop Skills Problem solving
Class 40	• Planar motion of a particle • Motion of a projectile in a resisting medium under gravity • Applications	https://youtube.com/playlist?list=PLjwfUIZhB8d1fwjflLkYKVeO5z88krWP9&si=siNUVLI7BU8pOUB6	Explains Board work	Listens understand	Understanding & analyze

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Class 41	• Motions in a central Force Field • Law of Force • Apse , Areal Velocity • examples	https://youtube.com/playlist?list=PL5yMBq57i_xQa_Uj3ku6U3wVvUNTErz8q&si=xKPR2xxOB10SczHs	Explains Board Work with examples	Listens & write	Develop Skills Problem solving
Class 42	➤ orbits in a central force field, ➤ Stability of nearly circular orbits ➤	https://youtube.com/playlist?list=PL5yMBq57i_xQa_Uj3ku6U3wVvUNTErz8q&si=xKPR2xxOB10SczHs	Explains Board Work with examples	understanding	Understanding & analyze
Class 43	➤ Motion under the attractive inverse square law ➤ Kepler's laws on planetary motion. Slightly disturbed orbits,	https://youtu.be/G76A6w7FuwM?si=SRSUibfWNn3TvSGz	Explains Board work	Listens understand	Understanding & analyze
Class 44	➤ Motion of artificial satellites. ➤ Various Aspects ➤ Results & Applications ➤	https://youtube.com/playlist?list=PLd3pZCUa5l6plNgYzqjjh1iSBzcO_smCa&si=vwIhTSsIHxPtGTsK	Explains Board work	Listens & write understand	Understanding & analyze
Class 45	➤ Constrained motions ➤ Theorems & Results ➤ Results & Applications	https://youtu.be/2E9fY8H6O1g?si=_9p7aqGX0KmP5hfh	Explains Board Work with examples	Listens & write	Develop Skills Problem solving
Class 46	• motion of a particle on smooth and rough curves. • Equations of motion referred to a set of rotating axes •	https://youtube.com/playlist?list=PLd3pZCUa5l6plNgYzqjjh1iSBzcO_smCa&si=rBTkfxENTG-bn7N-	Explains Board work	Listens	Develop Skills
Class 47	• Motion of a particle in three dimensions : • Motion on a smooth sphere, cone, and on any surface •	https://youtube.com/playlist?list=PLSvEurTtrYfLYfy2Sk_ehdH3hg4kO0tyG&si=JphIQI6BEI3Kmkyyq	Explains Board Work with examples	Listens & write	Develop Skills
Class 48	• Many particles system The linear momentum principle : • Linear momentum •	https://youtube.com/playlist?list=PL2ub1_oK_Cn7rAwrB5g2yLZnCN8-jGHbFm&si=R5FI91r7ATTcvLLV	Explains Board work	Listens understand	Understanding & analyze
Class 49	• linear momentum principle, motion of the centre of mass • conservation of linear momentum. •	https://youtu.be/2E9fY8H6O1g?si=_9p7aqGX0KmP5hfh	Explains Board Work with examples	Listens & write understand	Understanding & analyze
Class 50	➤ The angular momentum principle : ➤ Moment of a force about a point ➤	https://youtu.be/hgcudPr73LU?si=5GmDDyVW19ksA-5p	Explains Board Work with examples	Listens & write understand	Develop Skills

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LECTURE PLAN & RELATED LINKS

Subject: MTMA, Paper: **SEC B** (Scientific computing with SageMath)

Semester-IV (B.Sc. Mathematics (Hons)), Credit-2

Instructor: Dr. Deepshikha

(30 Classes)

Class	Topic	Related Links	Faculty approach	Student activity	Learning Outcome
1	Introduction to SageMath, Installation Procedure	https://youtu.be/Pmx-RdCHoXw?si=MOSdhK-njujyZqkd	Explain and board work with example	Listening and Writing	Understanding
2 & 3	Use of SageMath as a Calculator	https://youtu.be/x1zUKiCBxpY?si=3TrmoyJEsMD8JKPq	Explain and board work with example	Listening and Writing	Understanding
4	Numerical and symbolic computations using mathematical functions like ➤ square root ➤ trigonometric functions ➤ logarithms ➤ exponentiations	https://youtu.be/BEG-eadc6Ak?si=PAAxKGmzWFaaNTxs	Lecture and board work	Listening, writing and simple problem solving	Understanding, Analyzing, and Applying
5 & 6	Discussion of Exercises on SageMath as a Calculator		Explains	Solves Problems	Apply
7 & 8	Graphical representations of few functions ➤ plotting in a given interval ➤ plotting of polynomial functions ➤ trigonometric functions ➤ Plots of functions with asymptotes	https://youtu.be/z37JqJrjQKk?si=-wIOTrTkrLTB8BjI	Lecture, board work and Deduction	Listening, writing and problem solving	Understanding, Analyzing, and Applying



Class	Topic	Related Links	Faculty approach	Student activity	Learning Outcome
9 & 10	➤ superimposing multiple graphs in one plot ➤ plotting a curve along with a tangent on that curve (if it exists) ➤ polar plotting of curves	https://youtu.be/p8RHE52L74s?si=YDchHQFKDSIZ6y31	Explain and board work with example	Listening and writing	Understanding
11 & 12	Discussion of Exercises on graphs		Explains	Solves Problems	Apply
13	SageMath commands for differentiation ➤ higher order derivatives ➤ plotting $f(x)$ and $f'(x)$ together	https://youtu.be/hzopk5mTC8c?si=w5Q4c2GsgFHzn6Q5	Explains	Solves Problems	Apply
14	➤ integrals ➤ definite integrals	https://youtu.be/i_qYne4jpfM?si=jeu1ybYbZGLRudxX	Explain and board work with example	Listening and writing	Understanding
15	Discussion of Exercises on differentiation & integration		Explains	Solves Problems	Apply
16	Introduction to Programming in SageMath ➤ relational and logical operators	https://youtu.be/IDtI3xN-wm8?si=rCYp8iuVytS9nxHN	Explain and board work with example	Comprehends, Writing and solving Problems	Understanding and Analyzing
17	conditional statements	https://youtu.be/jFLCMFewIUc?si=X9Wuypgq9_sx3YS4	Explain and board work with example	Listening and Writing	Understanding
18 & 19	loops and nested loops	https://youtu.be/jFLCMFewIUc?si=X9Wuypgq9_sx3YS4	Explain and suitable board work	Listening, Comprehend and Writing	Understanding and apply

Class	Topic	Related Links	Faculty approach	Student activity	Learning Outcome
20 & 21	Discussion of Exercises on conditional statements		Explains	Solves Problems	Apply
22, 23 & 24	without using inbuilt functions write programs for ➤ average of integers ➤ mean ➤ median ➤ mode ➤ factorial ➤ checking primes ➤ checking next primes ➤ finding all primes in an interval ➤ finding gcd, lcm ➤ finding convergence of a given sequence	https://youtu.be/6TgEcDzryNo?si=rZ9U3dg7mbzWWQJ-	Explain and suitable board work	Listening, and Writing	Understanding
25 & 26	Discussion of Exercises on loops		Explains	Solves Problems	Apply
27	Use of inbuilt functions that deal with ➤ matrices ➤ determinant ➤ inverse of a given real square matrix (if it exists) ➤ solving a system of linear equations ➤ finding roots of a given polynomial	https://youtu.be/4QZwb_0OOxY?si=RzwZQqPgqqEileIx https://youtu.be/kugcHfxyZSk?si=fdD0mzO-xQNa8p4e	Lecture, board work and Deduction	Listening, writing and problem solving	Understanding, Analyzing, and Applying
28	solving differential equations.	https://youtu.be/8RB3REV432Y?si=M479dn6sWOOES7tg	Lecture, board work and Deduction	Listening, writing and problem solving	Understanding, Analyzing, and Applying

29 & 30	Revision and Class Tests		Doubt Clearing using suitable Examples	Solves Problems	Analyze and apply
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Dr. P. M.

Lecture plan / Lesson plan of CC 11 (Probability & statistics)

Semester - V (MTMA CBCS) Instructor Name : Snehendu Mandal

class	Content	Related Links	Faculty approach	Students activity	Learners outcomes
Class 1	• Random experiment • σ-field • examples	https://youtu.be/tMNmG_oKn9k?si=bXcBJ6WXF-BYbcJV https://youtu.be/X05H5sR1MbQ?si=Twe-Cvf0404IwWb2	Explains Board Work with examples	Listens understand	Understanding
Class 2	➤ Sample space ➤ probability as a set function ➤ examples ➤	https://youtu.be/X05H5sR1MbQ?si=Twe-Cvf0404IwWb2	Explains Board work	Listens & write understand	Understanding
Class 3	• probability axioms statements • probability axioms description • probability space	https://youtu.be/Y5J-3WWRTcA?si=BT0eV_a6hbaoZeA	Explains Board work	Listens	Develop Skills Problem solving
Class 4	• Finite sample spaces. • Conditional probability • Examples	https://youtu.be/evyT3_8Dnhs?si=aDBtuwQVJkBIUz8	Explains Board work	Listens & write	Develop Skills Problem solving
Class 5	• Bayes theorem • Applications 7 problems Based on Bayes theorem •	https://youtu.be/HZGCoVF3YvM?si=Y5wqul3SVHZcg7uI	Explains Board Work with examples	Listens understand	Understanding analyze
Class 6	• Independence of events • Mutual independence & Pairwise Independence • Examples • Problems	https://youtu.be/1MxZ1Z59tzc?si=v2Jy2uElgBW2mlz	Explains Board work	Listens & write	Understanding & analyze
Class 7	➤ Joint Experiments or Compound Experiments ➤ Bernoullian Sequence of Independence Trials	https://youtu.be/fZ0bbrbNq58?si=kW_2R0qISQ-81wID	Explains Board work	Listens & write	Understanding & analyze
Class 8	➤ Poisson trials ➤ Binomial Law ➤ Poisson Aproximation to Binomial Law ➤ Important Results	https://youtu.be/fZ0bbrbNq58?si=kW_2R0qISQ-81wID	Explains Board work	Listens & write	Understanding & analyze

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	➤ problems				
Class 9	- Real random variables - Examples - problems	https://youtube.com/playlist?list=PLU6Sq_dYcYsfIaokdZTmptaf-PK7s-B0ju&si=1JQVNcA0VPgz3d2P	Explains Board work	understanding	Understanding analyze Problem solving
Class 7	- cumulative distribution function - probability mass function - Probability density functions	https://youtu.be/l0ecMiNUZu8?si=q4Rx5BSSIppC8Yyq https://youtube.com/playlist?list=PLU6Sq_dYcYsfIaokdZTmptaf-PK7s-B0ju&si=djJXacAfPQWMQNJN	Explains Board Work with examples	Listens understand	Understanding analyze Problem solving
Class 8	- Important discrete distribution function & mass function - Important continuous Distribution Function & Density Function - examples	https://youtu.be/Txlm4ORI4Gs?si=zA0wc_oADRzKj9Sho https://youtu.be/L0zWnBrjhng?si=hRaLc_rChi0I8BSv	Explains Board work	Listens & write understand	Develop Skills Problem solving
Class 9	- Graphs of mass function vs Distribution function - Graphs of density function vs distribution function	https://youtu.be/Txlm4ORI4Gs?si=zA0wc_oADRzKj9Sho https://youtu.be/YXLVjCKVP7U?si=1irNzX5loQXPHw-B	Explains Board Work with examples	Listens	Develop Skills Problem solving
Class 10	- Distribution in 2D - Joint mass function - Joint density function - Joint distribution function - Marginal distribution - examples	https://youtu.be/L0zWnBrjhng?si=hRaLc_rChi0I8BSv	Explains Board work	Listens & write	Understanding & analyze
Class 11	- mathematical expectation - moments, - moment generating function - examples	https://youtu.be/H2Ji-Q4MfqU?si=PvOzx2jAPx1aNe0r	Explains Board work	Listens understand	Understanding & analyze
Class 12	- characteristic function. - Discrete distributions : - uniform, binomial, - Poisson, geometric, - negative binomial	https://youtu.be/LPiTC0ZFkQ?si=r_St1GrWqOxMnUmr https://youtu.be/mYFygtQrDxc?si=NuQH_YdKxRpbSPUmY	Explains Board work	understanding	Problem solving Understanding & analyze
Class 13	- Continuous distributions : - uniform - normal, - exponential.	https://youtu.be/hfBeF8jdO6U?si=ysJQLJVZi5DRSvsf	Explains Board Work with examples	Listens understand	Understanding & analyze
Class 14	Joint cumulative distribution function	https://youtu.be/hfBeF8jdO6U?si=ysJQLJVZi5DRSDns	Explains Board work	Listens & write	Develop Skills Problem solving

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	• and its properties • joint probability density functions • examples			understand	
Class 15	• marginal and conditional distributions, • expectation of function of two random variables • examples	https://youtu.be/osjPsSiks2M?si=5au-meKAJtlR_gKO	Explains Board Work with examples L	Listens Listens & write	Develop Skills Problem solving
Class 16	• moments, • covariance, • correlation coefficient, • independent random variables	https://youtube.com/playlist?list=PLNKD1qB9pptsPVHBQenKnL-Xn8JoeJRPx&si=NbeScU-gVo4-5EEz	Explains Board work	Listens & write	Understanding & analyze
Class 17	• joint moment generating function (jmgf) and • calculation of covariance from jmgf, • characteristic function	https://youtu.be/dff1gU6ORPo?si=hBue9ORhyVgH1UjM	Explains Board Work with examples	Listens understand	Understanding & analyze Develop Skills Problem solving
Class 18	• Conditional expectations, • linear regression for two variables, • examples	https://youtu.be/zUQr6HAAKp4?si=Hch8vVELi4RqIP0a	Explains Board work	understanding	Understanding & analyze
Class 19	• Chebyshev's inequality • Convergence in Probability • Examples • Problems	https://youtu.be/Ajar_6MAOLw?si=tjkZG54oWvfNyuPC	Explains Board work	Listens understand	Develop Skills Problem solving
Class 20	• statement and interpretation of weak law of large numbers • and strong law of large numbers • examples	https://youtu.be/Yh5bR7X3ch8?si=4HKovR7HVf7k1OX5	Explains Board work	Listens & write understand	Understanding & analyze
Class 21	• Central limit theorem for independent and identically distributed random variables with finite variance. • examples	https://youtu.be/zeJD6dqJ5lo?si=-ghJSTRdRLHlcBop	Explains Board Work with examples	Listens understand	Problem solving Understanding & analyze
Class 22	• Sampling and Sampling distributions • Examples • Simple problems	https://youtube.com/playlist?list=PL95A2Zei0C9h1-CgD01_RsCqI0Y5NT2l&si=tAADPo9snfLqLQa	Explains Board work	Listens & write understand	Understanding & analyze
Class 23	• Populations and • Samples, Random • Examples • Problems	https://youtu.be/-WfQ-T6Sd7s?si=e5jfGggZeWX2qjAw	Explains Board Work with examples	Listens	Develop Skills Problem solving
Class 24	• distribution of the sample, • Simple random sampling with and	https://youtu.be/acfjqWTwee0?si=R3niMXfUkqzhZU04	Explains Board work	Listens & write	Develop Skills Problem solving

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	- without replacement - examples				
Class 25	- Sample characteristics - Types /examples - properties	https://youtu.be/4N2_yz1dmzM?si=8mxXZWP14SkprYII	Explains Board Work with examples	Listens understand	Understanding &analyze
Class 26	- Sampling Distributions : - Statistic, - Sample moments. - Sample variance,	https://youtu.be/3uA7ZdlphIo?si=3vFiWucNZ0do7JCI	Explains Board work	understanding	Problem solving Understanding &analyze
Class 27	- Sampling from the normal distributions, - Examples - Applications	https://youtu.be/dXB3cUGnaxQ?si=Q0n48DtdRyZR1hHH	Explains Board work	Listens understand	Understanding &analyze
Class 28	- Chi-square test and - F-distributions - Various Problems on Non Parametric test	https://youtu.be/HKDqIYSLt68?si=445tH7m6JcYLI0bu	Explains Board work	Listens & write understand	Develop Skills Problem solving
Class 29	- Sampling distribution of $\bar{X}$, s^2, $\sqrt{n}(\bar{X} - \mu)/s$ - problems	https://youtu.be/TuBAhUK9fWc?si=NGgc8h_Lv8tvqbAi	Explains Board work	Listens & write understand	Develop Skills Problem solving
Class 30	- Estimation of parameters : - Point estimation - Interval Estimation - Examples - problems	https://youtu.be/NPmDCjN9s7A?si=xy585WfpMbpazNCZ	Explains Board Work with examples	Listens	Develop Skills Problem solving
Class 31	- Confidence Intervals for mean and variance of Normal Population. - Examples	https://youtu.be/NPmDCjN9s7A?si=xy585WfpMbpazNCZ	Explains Board work	Listens & write	Understanding &analyze Develop skills
Class 32	- Mean-squared error - Examples - problems	https://youtu.be/IET4uQLpmM0?si=BOMMnAgG7GW2LJtb	Explains Board work	Listens & write understand	Develop Skills Problem solving
Class 33	- Properties of good estimators - Various Problems	https://youtu.be/Y4gSdAsCO2g?si=MMk--iv1Q7jBQFGD	Explains Board Work with examples	Listens understand	Problem solving Understanding &analyze
Class 34	- Unbiasedness, consistency & sufficiency, examples	https://youtu.be/gS5cbk-4Xw?si=8xBRC_i3KBGom8up	Explains Board work with examples	Listens & write	Develop Skills Problem solving
Class 35	- Minimum-Variance Unbiased Estimator (MVUE).	https://youtu.be/E5ZJqy40ydc?si=dJs0cpCVhJRym5e5	Explains Board work	understanding	Understanding &analyze Develop skills

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Class 36	- Method of Maximum likelihood - Examples - problems	https://youtu.be/66FqSpf1trA?si=ZeGcg38BGusDkd0k	Explains Board work	Listens & write understand	Develop Skills Problem solving
Class 37	- likelihood function, - ML estimators for discrete Models	https://youtu.be/E5ZJqy40ydc?si=dJs0cpCVhJRym5e5	Explains Board Work with examples	Listens Understand write	Develop Skills Problem solving
Class 38	- ML estimators for continuous models. - examples	https://youtu.be/XepXtl9YKwc?si=R1zWSpZKtgtTK6Ce	Explains Board work	Listens & write	Develop Skills
Class 39	- Statistical hypothesis : - Simple and composite hypotheses - examples	https://youtube.com/playlist?list=PLEIbY8S8u_DJYKayvumNh8tVj94PzKWWr&si=JkqZt5_G6uCJijw4	Explains Board work	Listens & write understand	Develop Skills Problem solving
Class 40	- null hypotheses, alternative - hypotheses - examples	https://youtube.com/playlist?list=PLEIbY8S8u_DJYKayvumNh8tVj94PzKWWr&si=JkqZt5_G6uCJijw4	Explains Board work	Listens Understand	Understanding & analyze
Class 41	- one sided and two-sided hypotheses - Examples & Applications	https://youtu.be/XHPIEp-3yC0?si=kdDzD-US0HOhtv28	Explains Board work	Listens & write understand	Develop Skills Problem solving
Class 42	- The critical region and test statistic - Theorems & Results	https://youtu.be/LOJRPxX2QX8?si=UHaWJzgiCbrepaxg	Explains Board work	Listens & write	Problem solving Understanding & analyze
Class 43	- type I error and type II error, - examples - level of significance	https://youtu.be/9yQm9F2_ylk?si=QwvBsnwaNvmGY3gt	Explains Board work	Listens & write understand	Develop Skills Problem solving
Class 44	- Power function of a test, - Examples - Applications	https://youtu.be/m8ZCCBVlY_o?si=bba91QD0iN9DKkx	Explains Board Work with examples	Listens understand	Understanding & analyze
Class 45	- most powerful test - problems	https://youtu.be/vZdCk4L1lgo?si=q0eBvNIpg4KulxyQ	Explains Board work	Listens & write understand	Develop Skills Problem solving
Class 46	- The p-value (observed level of significance) - Calculating p-values.	https://youtu.be/xdZSWsKk5P0?si=MYFOHAtj8lYjfpk7	Explains Board work	Understanding write	Develop Skills Problem solving
Class 47	- Exercises on basic probability & Joint Distribution - Exercises on	https://youtube.com/playlist?list=PLpEFfNAthorfhZVYKNRfGtWJp2R1vTZfj&si=wH41AbklKOt2EIG	Explains Board Work with examples	Listens understand	Develop Skills Problem solving

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	Expectation				
Class 48	Exercises on one Dimensional & Two dimensional Distribution	https://youtu.be/oI3hZJqXJuc?si=UGISFA4fH8_WDM8Y	Explains Board work	Understand Problem solving	Develop Skills Problem solving
Class 49	- Exercises on convergence in probability - Exercises on Statistics	https://youtube.com/playlist?list=PLV3oHJg9b1NQNg2KmOz_41x7hYKcwydzM&si=-wGJIB5s-pFwjMot	Explains Board Work with examples	Understand Problem solving	Develop Skills Problem solving
Class 50	Exercises on Testing hypothesis	https://youtu.be/m8ZCCBV1Y_o?si=bba91QD0iN9DKkx	Explains Board Work with examples	understand	Understanding & analyze



LECTURE PLAN & Related Links

Subject: MTMA, Paper: CC12 (Group Theory-II & Linear Algebra-II)

Semester-V (B.Sc. Mathematics (Hons)) ,Credit-6

Instructor: Dr. Deepshikha

Class	Topic	Related Links	Faculty approach	Student activity	Learning Outcome
Unit-1 : Group theory (35 Classes)					
1 & 2	Automorphism ➤ Definition ➤ Examples	https://www.youtube.com/watch?v=wWeCIJ9FsOk&list=PL8WTUM4A_UNIH4fXTzjBDxJX4oCBbYmnl&index=3 https://www.youtube.com/watch?v=OXTrIloYzFw&list=PL8WTUM4A_UNIH4fXTzjBDxJX4oCBbYmnl&index=5	Explain and board work with example	Listening and Writing	Understanding
3	Inner automorphism ➤ Definition ➤ Examples	https://www.youtube.com/watch?v=Ps7Ke5xbBko&list=PL8WTUM4A_UNIH4fXTzjBDxJX4oCBbYmnl&index=8	Explain and board work with example	Listening and Writing	Understanding
4, 5 & 6	Automorphism groups ➤ Standard Examples of Automorphism groups ➤ Inner automorphism group ➤ $\text{Inn}(G)$ is a subgroup of $\text{Aut}(G)$ ➤ Order of $\text{Inn}(G)$ for dihedral groups	https://www.youtube.com/watch?v=PJ5IMKg3DjY&list=PL8WTUM4A_UNIH4fXTzjBDxJX4oCBbYmnl&index=4	Lecture and board work	Listening, writing and simple problem solving	Understanding
7 & 8	automorphism groups of finite and infinite cyclic groups ➤ Detailed explanation of $\text{Aut}(\mathbb{Z}_n)$ is isomorphic to $U(n)$ ➤ Some applications of the above properties	https://www.youtube.com/watch?v=Xo8jke7vqf0&list=PL8WTUM4A_UNIH4fXTzjBDxJX4oCBbYmnl&index=6 https://www.youtube.com/watch?v=G-jUosUp1ck&list=PL8WTUM4A_UNIH4fXTzjBDxJX4oCBbYmnl&index=7	Lecture, board work and Deduction	Listening, writing and problem solving	Understanding , Analyzing, and Applying



Class	Topic	Related Links	Faculty approach	Student activity	Learning Outcome
9 & 10	Applications of factor groups to automorphism groups	https://www.youtube.com/watch?v=Mw0zMmxJcLA&list=PL8WTUM4A_UNIH4fXTzjBDxJX4oCBbYmnl&index=10	Explains and narrates with suitable board work	Comprehends, writing and problem solving	Analyzing, and Applying
11 & 12	Discussion of Exercises on Automorphisms & Inner Automorphisms		Explains	Solves Problems	Apply
13 & 14	External direct product and its properties ➤ Definition of EDP ➤ Proof that EDP is a group ➤ Examples	https://www.youtube.com/watch?v=Nh87gJPx-SU&list=PL8WTUM4A_UNIH4fXTzjBDxJX4oCBbYmnl&index=18 https://www.youtube.com/watch?v=1CgfvEYifwI&list=PL8WTUM4A_UNIH4fXTzjBDxJX4oCBbYmnl&index=19	Explain and board work with example	Listening and writing	Understanding
15,16 & 17	The group of units modulo n as an external direct product ➤ Order of elements of EDP ➤ Characterization for EDP of cyclic groups to be cyclic ➤ Counting of number of elements of some order in EDP ➤ Counting of subgroups of EDP	https://www.youtube.com/watch?v=tr90bpLW2ns&list=PL8WTUM4A_UNIH4fXTzjBDxJX4oCBbYmnl&index=22 https://www.youtube.com/watch?v=pwMbPfkZk8I&list=PL8WTUM4A_UNIH4fXTzjBDxJX4oCBbYmnl&index=23 https://www.youtube.com/watch?v=ivbOQU7npR4&list=PL8WTUM4A_UNIH4fXTzjBDxJX4oCBbYmnl&index=27	Explain and board work with example	Comprehends, Writing and solving Problems	Understanding and Analyzing
18 & 19	Discussion of Exercises on EDP		Explains	Solves Problems	Apply

Class	Topic	Related Links	Faculty approach	Student activity	Learning Outcome
20, 21 & 22	Internal direct product ➤ Definition ➤ Examples ➤ Isomorphism of EDP and IDP	https://www.youtube.com/watch?v=X9PnZ00TxMo&list=PL8WTUM4A_UNIH4fXTzjBDxJX4oCBbYmnl&index=38 https://www.youtube.com/watch?v=XAaHUyqCic0&list=PL8WTUM4A_UNIH4fXTzjBDxJX4oCBbYmnl&index=39 https://www.youtube.com/watch?v=F1IePK3xww&list=PL8WTUM4A_UNIH4fXTzjBDxJX4oCBbYmnl&index=41	Explain and board work with example	Listening and Writing	Understanding
23 & 24	Converse of Lagrange's theorem for finite abelian group ➤ Applications of the converse of Lagrange's theorem	https://www.youtube.com/watch?v=GALuY0tLV4&list=PL8WTUM4A_UNIH4fXTzjBDxJX4oCBbYmnl&index=42	Explain and suitable board work	Listening, Comprehend and Writing	Understanding and apply
25	Cauchy's theorem for finite abelian group	https://www.youtube.com/watch?v=SatUENnEHwg&list=PL8WTUM4A_UNIH4fXTzjBDxJX4oCBbYmnl&index=43	Explain and suitable board work	Listening, and Writing	Understanding
26, 27 & 28	Fundamental theorem of finite abelian groups	https://www.youtube.com/watch?v=4A25wEp5opo&list=PL8WTUM4A_UNIH4fXTzjBDxJX4oCBbYmnl&index=44	Explain and suitable board work	Listening, and Writing	Understanding
29 & 30	Applications of Fundamental theorem of finite abelian groups	https://www.youtube.com/watch?v=hdUSDY6OGwY&list=PL8WTUM4A_UNIH4fXTzjBDxJX4oCBbYmnl&index=47	Explains and narrates with suitable board work	Listening, writing and Comprehends	Understanding

Class	Topic	Related Links	Faculty approach	Student activity	Learning Outcome
31, 32 & 33	Discussions on Exercises of IDP & Fundamental theorem of finite Abelian groups		Explains	Solves Problems	Apply
34 & 35	Revision and Class Tests		Doubt Clearing using suitable Examples	Solves Problems	Analyze and apply
Unit-2 : Linear algebra (40 Classes)					
1 & 2	Inner product spaces ➤ Definitions of IPS ➤ Examples of IPS on Euclidean Spaces, Function spaces, sequence spaces, unitary spaces ➤ Properties of IPS	https://www.youtube.com/watch?v=ERfbtPBEYVA&list=PLbMVogVj5nJQ2vsW_hmyvVfO4GYWaaPp7&index=40	Explain and board work with example	Listening and Writing	Understanding
3 & 4	Norms ➤ Definition of norms ➤ How to generate norms from inner product ➤ Properties of norm generated from inner product ➤ Examples	https://www.youtube.com/watch?v=rZRTc0DWbc4&list=PLbMVogVj5nJQ2vsW_hmyvVfO4GYWaaPp7&index=41	Explain and board work with example	Listening, writing and simple problem solving	Understanding and apply
5 & 6	Gram-Schmidt orthonormalization process ➤ Concept of orthogonal vectors ➤ Definition & Properties of orthonormal basis ➤ Reducing a linearly independent set into orthonormal set	https://www.youtube.com/watch?v=n3zN2hZCul4&list=PLbMVogVj5nJQ2vsW_hmyvVfO4GYWaaPp7&index=42	Lecture and board work	Listening, writing and simple problem solving	Understanding and apply

Class	Topic	Related Links	Faculty approach	Student activity	Learning Outcome
7 & 8	Orthogonal complements ➤ Definition ➤ Properties ➤ Examples	https://www.youtube.com/watch?v=J41-1sCeyww&list=PLbMVogVj5nJQ2vsW_hmyvVfO4GYWaaPp7&index=45	Explain and board work with example	Listening and writing	Understanding
9	Bessel's inequality	https://www.youtube.com/watch?v=0q38-WzRGcc&list=PLbMVogVj5nJQ2vsW_hmyvVfO4GYWaaPp7&index=43	Explain and board work	Listening, And writing	Understanding
10 & 11	The adjoint of a linear operator and its basic properties	https://www.youtube.com/watch?v=ctxDj_sfGvQ&list=PLbMVogVj5nJQ2vsW_hmyvVfO4GYWaaPp7&index=47	Explains and narrates with suitable board work	Listening, Comprehends, and writing	Understanding & Analyzing,
12 & 13	Discussions on Exercises IPS, Norms, Orthogonal complements, Adjoint Operator		Explains	Solves Problems	Apply
14 & 15	Bilinear and quadratic forms ➤ Basic concept ➤ Examples	https://www.youtube.com/watch?v=HXm4h-xvx1w&list=PLLy_2iUCG87BLKl8eISe4fHKdE2_j2B_T&index=43	Explain and board work with example	Listening and writing	Understanding
16	Diagonalization of symmetric matrices	https://www.youtube.com/watch?v=RQCHPP1I7Oo&list=PLbMVogVj5nJQnz6Sn9o6RTpu4Evx0LOT&index=34	Explain and board work	Listening, writing and simple problem solving	Understanding and apply
17	Second derivative test for critical point of a function of several variables ➤ Basic concept ➤ Examples	https://www.youtube.com/watch?v=hnoxydv6hDY	Explain and board work with example	Comprehends, Writing and solving Problems	Understanding and Apply
18	Hessian matrix, Sylvester's law of inertia	https://www.youtube.com/watch?v=fqq_UR4zhfi	Explain and board work	Listening, and writing	Understanding

Class	Topic	Related Links	Faculty approach	Student activity	Learning Outcome
19	Index, signature ➤ Definition of index & signature ➤ How to find index & signature ➤ Examples	https://www.youtube.com/watch?v=jqU0q21PHEQ&list=PLEAYkSg4uSQ1MyOJM8bdM1gEvR0blurpE	Explain and board work	Listening, writing and simple problem solving	Understanding and apply
20 & 21	Discussions on Exercises of various forms of matrices, index, signature of matrices.		Explains	Solves Problems	Apply
22	Dual spaces ➤ Concept ➤ Dual Spaces of Euclidean Spaces, Sequence Spaces, Function Spaces	https://www.youtube.com/watch?v=9pqhfDyzbhw&list=PLbMVogVj5nJQ2vsW_hmyvVfO4GYWaaPp7&index=22	Explain and suitable board work	Listening, and Writing	Understanding
23 & 24	Dual basis ➤ Basic concept ➤ Dimension of dual spaces ➤ Properties of dual spaces of finite dimensional spaces	https://www.youtube.com/watch?v=KrU1UdmooFM&list=PLbMVogVj5nJQ2vsW_hmyvVfO4GYWaaPp7&index=23	Explain and suitable board work	Listening, and Writing	Understanding
25 & 26	Double dual ➤ Reflexive spaces ➤ Basis & dimension of double duals ➤ Some standard examples	https://www.youtube.com/watch?v=CC4uia8NsMc&list=PLbMVogVj5nJQ2vsW_hmyvVfO4GYWaaPp7&index=25	Explain and board work	Listening, writing and simple problem solving	Understanding and apply
27	Transpose of a linear transformation and its matrix in the dual basis, Annihilators ➤ Basic concept ➤ Examples	https://www.youtube.com/watch?v=AvnzZgdr_jc&list=PLbMVogVj5nJQ2vsW_hmyvVfO4GYWaaPp7&index=24	Explain and board work	Listening, writing and simple problem solving	Understanding, analyzing & apply

Class	Topic	Related Links	Faculty approach	Student activity	Learning Outcome
28 & 29	Discussions on Exercises of Dual spaces.		Explains	Solves Problems	Apply
30 & 31	Eigenspaces of a linear operator ➤ Concept of eigenvectors, eigenvalues ➤ Concept of eigenspaces ➤ Finding eigenvectors and eigenspaces of some linear transformations ➤ Eigenvectors & eigenvalues of differential operator	https://www.youtube.com/watch?v=wrSJ5re0TAw&list=PLbMVogVj5nJQ2vsW_hmyvVfO4GYWaaPp7&index=27	Explain and board work	Listening, writing and simple problem solving	Understanding and apply
32 & 33	Diagonalizability ➤ Definition in terms of basis ➤ Geometric and algebraic multiplicity of eigenvalues ➤ Diagonalizable linear operator ➤ Properties & Applications of diagonalizability ➤ Some standard examples of diagonalizable operators	https://www.youtube.com/watch?v=H9p0-hlseh0&list=PLbMVogVj5nJQ2vsW_hmyvVfO4GYWaaPp7&index=28	Explain and board work	Listening, writing and simple problem solving	Understanding, analyzing and apply
34	Invariant subspaces and Cayley-Hamilton theorem	https://www.youtube.com/watch?v=8D3WViAyJvc&list=PLbMVogVj5nJQ2vsW_hmyvVfO4GYWaaPp7&index=30 https://www.youtube.com/watch?v=aRewVVUzJ2c&list=PLbMVogVj5nJQ2vsW_hmyvVfO4GYWaaPp7&index=31	Explain and suitable board work	Listening, and Writing	Understanding

Class	Topic	Related Links	Faculty approach	Student activity	Learning Outcome
35	Minimal polynomial for a linear operator ➤ Definition ➤ Computation of minimal polynomial ➤ Characterization of diagonalizable linear operator in terms of minimal polynomial ➤ Examples	https://www.youtube.com/watch?v=E-2klyKouSg&list=PLbMVogVj5nJQ2vsW_hmyvVfO4GYWaaPp7&index=29	Explains and narrates with suitable board work	Listening, writing and comprehends	Understanding and analyzing
36, 37 & 38	Canonical forms (Jordan & rational) ➤ Concept of canonical forms ➤ Computation of Jordan & rational forms of various matrices ➤ Computation of Jordan forms from characteristic & minimal polynomial	https://www.youtube.com/watch?v=nV7JC2RbwU0&list=PLbMVogVj5nJQ2vsW_hmyvVfO4GYWaaPp7&index=36	Explain and board work	Listening, writing and simple problem solving	Understanding and apply
39	Discussion on Exercises of Diagonalizability		Explains	Solves Problems	Apply
40	Revision and Class Tests		Doubt Clearing using suitable Examples	Solves Problems	Analyze and apply

LECTURE PLAN ON & RELATED LINK

Subject: MTMA, Paper: DSE-A(BioMathematics)

Semester-V(B.Sc. Mathematics (Hons)) ,Credit-6

Faculty: Dr. Arun Kumar Maiti

Class	Topic	Related Links	Faculty approach	Student activity	Learning Outcome
1	1.1 Mathematical biology and modeling process: an overview.	https://youtu.be/ORTNjFdSbzY?si=yVPL4e20AZkOxA2R	Lecture and board work	Listening and Writing	Understanding
2 & 3	1.2 Simple single-species continuous population models: Malthus model – deduction, analytic solution, behaviour of population size as 't' tends to infinity, limitations.	https://youtu.be/OLmfQZ1El88?si=t5iA2UbuGe015CE	Lecture and board work with example	Listening and simple problem solving	Understanding
4&5	1.3 Logistic model: formulation, analytic solution, behaviour of population size as 't' tends to infinity for different initial population size, carrying capacity.	https://youtu.be/uemhtgZHnak?si=XyTj5AVmwAwH3Qcb	Lecture and board work	Listening and simple problem solving	Understanding
6	1.4 Gompertz model: deduction and analytic solution.	https://youtu.be/K6jUVW-xrh8?si=3lrTVyI6dDNN20Om	Board work and Deduction and explain	Writing	Analysing and Understanding
7&8	1.5 Qualitative analysis of continuous models: Autonomous first order differential equations- steady states (or fixed points or stationary points or equilibrium points). Biological interpretation of steady states. Stability and asymptotic stability of a steady state. Geometrical analysis. Linearization and stability analysis.	https://youtu.be/lhrOY64iMSU?si=hYsBv0VpqrE5hfEm https://youtu.be/KgpUyKUC85Q?si=6NIFO8STzltHoRS8	Explains and Narrates with suitable board work	Comprehends and writing	Analysing and Understanding

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Classes	Topic	Related Links	Faculty Approach	Student activity	Learning Outcome
9	1.6 Stability analysis of the steady states of the Malthus model, logistic model and other single species models.	https://youtu.be/sInlaUGQQzo?si=05PFEJUEneB1kL96	Explains and Narrates with suitable board work	Comprehends and writing	Analysing and Understanding
10 & 11	1.7 Allee effect: Basic idea and discussion with the model $\frac{dx}{dt} = rx \left(1 - \frac{x}{K}\right) \left(\frac{x}{K_0} - 1\right),$ stability analysis of steady states.	https://youtu.be/bVZZqIW6Ds?si=j6tN3cnO1kUn76na	Explains with suitable board work	Comprehends and writing	Understanding
12, 13 & 14	1.8 Harvesting problems of a single natural population: Constant-yield harvesting, constant-effort harvesting.	https://youtu.be/PmViZ9N6bnc?si=PFURUtibCmwkgP1v	Formulation of the model and Deduction	Writing and solving Problems	Analysing
15, 16	1.9 Non-dimensionalisation and reparametrisation in a model: Necessity and application.	https://youtu.be/K6jUVW-xrh8?si=3lrTVyl6dDNN20Om	Formulation of the model and Deduction	Writing and solving Problems	Analysing
17, 18 & 19	1.10 Bifurcation: Saddle-node, transcritical and pitchfork bifurcations in one dimensional case.	https://youtu.be/lhrOY64iMSU?si=hYsBvOVpqrE5hfEm	Board work and Deduction using suitable example	Listening and Writing	Understanding
20, 21	1.11 Insect outbreak model: The spruce budworm model – deduction, analysis of steady states, presence of saddle-node bifurcation.	https://youtu.be/HlqRGoiqVwg?si=-lztKulrZC W7lx	Formulation of the model, Deduction and explanation using graph.	Listening and Writing	Understanding through examples
22, 23 & 24	Revision and Class Tests		Doubt Clearing using suitable Example	Various Types of Problem Solving	Home Work

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Classes	Topic	Related Links	Faculty Approach	Student activity	Learning Outcome
1&2	2.1 Interacting populations: predator-prey systems and Lotka-Volterra model – deduction, analytic solution.	https://youtu.be/NC1VLU35qUc?si=z2HSnBVdop_2v10K https://youtu.be/c2LPT9z4RJY?si=4RXXiROc1aDOgZt2	Introduction, deduction & Solution	Comprehends and Writes	Understanding
3&4	2.2 Qualitative analysis of continuous models: Two-dimensional nonlinear systems - steady states, nullclines. Linearisation and stability analysis of a steady state.	https://youtu.be/sm4NjEMM4T0?si=IZLC6Yd2BR1N3Kbr https://youtu.be/cx1xVFgqavg?si=J27MLacZsGMAkhrC	Lecture and Board Work	Comprehends and Writes	Understanding
5&6	2.3 Routh-Hurwitz criteria, Steady states and linear stability analysis of biologically meaningful steady states of Lotka -Volterra predator-prey model.	https://youtu.be/IQqFELMJV2E?si=Uj7ytH9SZfMHkmOS https://youtu.be/Zg9k9ijiYPA?si=-l-rORRNUJCTGNqne	Lecture and Board Work with Explanation	Comprehends and Writes	Understanding and knowledge built
7&8	2.4 Different types of functional responses - Holling type -I, II,III growths.	https://youtu.be/NKTFsk09AWM?si=9LfWwlrIP_rJxkA0 https://youtu.be/NC1VLU35qUc?si=z2HSnBVdop_2v10K	Board Work and Explain	Listening and Writing	Understanding
9,10 &11	2.5 Improved predator-prey model introducing the logistic growth term for the prey and other predator-prey models, their steady states and linear stability analysis.	https://youtu.be/6C2Z8mh6gpY?si=v4SXDqRHXB6ViLbd	Board Work for Formulation of the Model and stability analysis.	Find out the steady States and analyze their Stability	Understanding by hand to hand Calculation

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12,13,14 & 15	2.6 Periodic solutions and limit Cycles: Statement of Poincare-Bendixson theorem, Bendixson's negative criterion, Dulac criterion, Hopf bifurcation and. Hopf bifurcation theorem (statement only). Examples in the context of biological scenario.	https://youtu.be/EocHy9kufpA?si=OnYOLrJwBYQERkR5 https://youtu.be/3SbaONTk1mU?si=ZgqkcR1OiU80nQhp https://youtu.be/7-Ax8AzEIDg?si=5EwUewKAQE62EnhO	Board Work and Explain with suitable Example	Solving Simple Problem to understand the limit cycles and Stability Criteria	Clear Conception
16 & 17	2.7 The Chemostat: Bacterial growth in a chemostat. Michaelis-Menten kinetics. Formulation of the model and steady states.	https://youtu.be/dBBFmZ_uHS0?si=DP4KRF9qtPflr5Xn	Board Work and Explain	Comprehends and Solve various types of problem	Knowledge built
18,19 & 20	2.8 Populations in competition: Lotka-Volterra competition model, steady states and linear stability analysis.	https://youtu.be/lAcDV9breXM?si=XLIOExdqR9dMoyf0	Lecture and Board Work	Listening and Writing	Understanding
21,22 & 23	2.9 Epidemic models: Basic terminologies. SI model	https://youtu.be/Vi1HDyaCWcg?si=JaXydpT34nKhJoTU	Board Work for Model Formation and Solution	Listening and simple problem solving	Understanding
24,25 & 26	2.10 Kermack-McKendrick SIR, SIRS models: Formulation of the models. Basic reproduction number.	https://youtu.be/vL6NfB7BKeY?si=tVqDWO_XQFD99hpo	Model Formation and Stability analysis	Comprehends and writes	Understanding
27,28,29 & 30	Revision and class Tests		Doubt Clearing using suitable Example	Various Types of Problem Solving	Home Work

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Class	Topic	Related Links	Faculty Approach	Student Activity	Learning Outcome
1&2	3.1 Discrete single-species models: Linear models, growth models, logistic model.	https://youtu.be/AQNNRvUEwRk?si=2wdJAx4zgAVrsTVJ	Board Work and explain the discrete models	Listening and Writing	Clear Concept about the models
3&4	3.2 Overview of nonlinear difference equations: Steady states.	https://youtu.be/3tcaAB5isFA?si=nniDpTuu7f8m6D3K	Board Work to Solve nonlinear Difference Equations	Finding steady States	Understanding
5,6 & 7	3.3 Graphical solution of difference equations - cobwebbing. Systems of two difference equations: Concepts of steady states and linear stability analysis.	https://youtu.be/YloukM31_nI?si=bcK4lpUIGu8kazK https://youtu.be/3JFRkV9ehm0?si=4LWBBS3NfDad-OUW	Board work for Cobwebbing Method	Analyze the Stability of Steady States	Clear Concept of Cobwebbing Method
8&9	3.4 Discrete predator-prey Model : Model formulation.	https://youtu.be/iQSRn3Kj9qM?si=DBT9ep99JPvb_Ugt	Board Work for Model Formation	Writing	Understanding
10,11 ,12& 13	3.5 Host-parasitoid Systems : Nicholson-Bailey model-formulation. Stability of discrete nonlinear systems: Linear stability analysis of biologically meaningful steady states of discrete predator-prey model and Nicholson-Bailey model.	https://youtu.be/YQ3Dpd786zw?si=lim3X1EH1UzFnjJM https://youtu.be/uThApoWsvcg?si=Ow-C8eu-DPzql8LM	Board Work For Model Formation and Explain	Finding Steady States and analyze their Stabilities	Understanding
14 & 15	Revision and Class Tests		Doubt Clearing using suitable Example	Various Types of Problem Solving	Home Work

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LECTURE PLAN & Related Links

Subject: MTMA, Paper: DSE-B(1) (Linear Programming & Game Theory)

Semester-V (B.Sc. Mathematics (Hons)), Credit-6

Instructor: Dr. Deepshikha

Class	Topic	Related Links	Faculty approach	Student activity	Learning Outcome
Unit-1 (15 Classes)					
1	Definition of Linear Programming Problem (L.P.P.) ➤ Definition ➤ Formation of L.P.P. from daily life involving inequations ➤ Examples	https://www.youtube.com/watch?v=a2QgdDk4Xjw&list=PLAD23E7AEFE221F70	Explain and board work with example	Listening and Writing	Understanding
2	Graphical solution of L.P.P. ➤ How to solve LPP graphically ➤ Types of solutions of LPP ➤ Solution of bounded LPP ➤ Solution of unbounded LPP	https://www.youtube.com/watch?v=XEA1pOtyrfo&list=PLAD23E7AEFE221F70&index=3	Explain and board work with example	Listening, writing and simple problem solving	Understanding and apply
3 & 4	Basic solutions and Basic Feasible Solution (B.F.S) with reference to L.P.P. ➤ Basic concept ➤ Degenerate and Non-degenerate B.F.S. ➤ Examples	https://www.youtube.com/watch?v=pzbsURDWluA&list=PLAD23E7AEFE221F70&index=2 https://www.youtube.com/watch?v=z5OV3dHthos&list=PL50F86BDF6873CED9&index=4	Explains and board work	Listening, writing and simple problem solving	Understanding and apply
5	Matrix formulation of L.P.P. ➤ Concept ➤ Examples to convert LPP into matrix form	https://www.youtube.com/watch?v=pzbsURDWluA&list=PLAD23E7AEFE221F70&index=2	Explains and narrates with suitable board work	Listening, writing and problem solving	Understanding and Applying



Class	Topic	Related Links	Faculty approach	Student activity	Learning Outcome
6 & 7	Hyperplane, Convex set, Cone, extreme points, convex hull and convex polyhedron ➤ Basic concepts ➤ Examples ➤ Computation of extreme points	https://www.youtube.com/watch?v=eXGOBmSBze8&list=PL50F86BDF6873CED9&index=5	Explains and board work	Listening, writing and problem solving	Understanding, Analyzing, and Applying
8	Supporting and Separating hyperplane ➤ Basic concept ➤ Examples ➤ Proof of the theorem: the collection of a feasible solutions of an L.P.P. constitutes a convex set		Explains and board work	Listening and writing	Understanding
9 & 10	The extreme points of the convex set of feasible solutions correspond to its B.F.S. and conversely ➤ Proof ➤ Applications	https://www.youtube.com/watch?v=Jnz31G9hG2E&list=PL50F86BDF6873CED9&index=7	Explain and board work	Listening, and writing	Understanding and analyzing
11	The objective function has its optimal value at an extreme point of the convex polyhedron generated by the set of feasible solutions (the convex polyhedron may also be unbounded) ➤ Proof ➤ Applications	https://www.youtube.com/watch?v=Jnz31G9hG2E&list=PL50F86BDF6873CED9&index=7	Explain and board work	Listening, and writing	Understanding and analyzing
12	In the absence of degeneracy, if the L.P.P. admits of an optimal solution then at least one B.F.S. must be optimal ➤ Proof ➤ Applications	https://www.youtube.com/watch?v=Jnz31G9hG2E&list=PL50F86BDF6873CED9&index=7	Explain and board work	Listening, and writing	Understanding and analyzing

Class	Topic	Related Links	Faculty approach	Student activity	Learning Outcome
13	Reduction of a F.S. to a B.F.S	https://www.youtube.com/watch?v=dC2nBoa2yvw&list=PL50F86BDF6873CED9&index=3	Explains and narrates with suitable board work	Listening, writing and problem solving	Understanding and Applying
14 & 15	Revision and Class Test		Doubt Clearing using suitable Examples	Solves Problems	Analyze and apply
UNIT-2 (20 Classes)					
1, 2 & 3	Slack and surplus variables. Standard form of L.P.P ➤ Conversion of any LPP into canonical form ➤ Conversion of any LPP into canonical form	https://www.youtube.com/watch?v=nWh7JrnL2IA&list=PLYihddLF-CgZGDFVwB1v699kv14FMeAr-&index=2	Explains and narrates with suitable board work	Listening, writing and problem solving	Understanding and Applying
4, 5 & 6	Theory of simplex method ➤ How to decide exit vectors & entry vector ➤ Selection of next BFS	https://www.youtube.com/watch?v=qxls3cYg8to&list=PLAD23E7AEFE221F70&index=4	Explain and board work	Listening, and Writing	Understanding and analyzing
6 & 7	Feasibility and optimality conditions. ➤ Test of bounded solution & unbounded solution ➤ Test of optimal condition	https://www.youtube.com/watch?v=wdGiekwXM2w&list=PLAD23E7AEFE221F70&index=5	Explain and suitable board work	Listening, and Writing	Understanding
8, 9 & 10	Algorithm of simplex method ➤ Examples to compute optimal solution	https://www.youtube.com/watch?v=cCBFC8LmNDE&list=PLAD23E7AEFE221F70&index=6	Explains and narrates with suitable board work	Listening, writing and problem solving	Understanding and Applying
11, 12 & 13	Two phase method ➤ Basic concept ➤ Examples	https://www.youtube.com/watch?v=uNjfcensZIs&list=PLYihddLF-CgZGDFVwB1v699kv14FMeAr-&index=11	Explains and narrates with suitable board work	Listening, writing and problem solving	Understanding and Applying

Class	Topic	Related Links	Faculty approach	Student activity	Learning Outcome
14 & 15	Discussion on Exercises of simplex method & two phase method		Explains	Solves Problems	Apply
16, 17 & 18	Degeneracy in L.P.P. and its resolution	https://www.youtube.com/watch?v=0NPKCDkajTI&list=PLYihddLF-CgZGDFVwB1v699kv14FMeAr-&index=14	Doubt Clearing using suitable Examples	Solves Problems	Analyze and apply
19 & 20	Revision and Class Test		Doubt Clearing using suitable Examples	Solves Problems	Analyze and apply
UNIT-3 (10 Classes)					
1	Duality theory ➤ To find dual of any Lpp ➤ Proof of the theorem that the dual of dual is the primal ➤ Examples	https://www.youtube.com/watch?v=gmDwUCvOJQ8&list=PLAD23E7AEFE221F70&index=8	Explain and board work with example	Listening and Writing	Understanding
2, 3 & 4	Relation between the objective values of dual and the primal problems ➤ Relation between their optimal values ➤ Proofs of some standard theorems ➤ Examples to deduce optimal solutions by looking at duals	https://www.youtube.com/watch?v=ziHfSkOhAmg&list=PLAD23E7AEFE221F70&index=9	Explain, board work with example and deductions	Listening, writing and simple problem solving	Understanding, analyze and apply
5	Complementary slackness	https://www.youtube.com/watch?v=wrkcoRrsPQE&list=PLAD23E7AEFE221F70&index=10	Lecture and board work	Listening and writing	Understanding

Class	Topic	Related Links	Faculty approach	Student activity	Learning Outcome
6 & 7	Duality and simplex method and their applications	https://www.youtube.com/watch?v=wrkcoRrsPQE&list=PLAD23E7AEFE221F70&index=10	Explain and board work with example	Listening, writing and simple problem solving	Understanding and apply
8	Discussion on Exercises of duals & primals		Explains	Solves Problems	Apply
9 & 10	Revision and Class Test		Doubt Clearing using suitable Examples	Solves Problems	Analyze and apply
UNIT-4 (30 Classes)					
1, 2 & 3	Transportation and Assignment problems. ➤ Formation of LPP of transportation problem ➤ Matrix of Assignment problem ➤ Mathematical justification for optimality criterion	https://www.youtube.com/watch?v=Q31jKiEXxdc&list=PLAD23E7AEFE221F70&index=13 https://www.youtube.com/watch?v=RnZnIIksdwU&list=PLAD23E7AEFE221F70&index=14	Explain and board work with example	Listening and writing	Understanding
4 & 5	Hungarian method ➤ Basic concept ➤ Examples	https://www.youtube.com/watch?v=BUGIhEecipE&list=PLAD23E7AEFE221F70&index=16	Explain and board work	Listening, writing and simple problem solving	Understanding and apply
6 & 7	Traveling Salesman problem ➤ Concept ➤ How to find solution of the problem ➤ Examples	https://www.youtube.com/watch?v=-cLsEHP0qt0&list=PLjc8ejfjpgTf0LaDEHgLB3gCHZYcNtsoX&index=24	Explain and board work with example	Comprehends, Writing and solving Problems	Understanding and Apply
8 & 9	Discussion on Exercises		Explains	Solves Problems	Apply

Class	Topic	Related Links	Faculty approach	Student activity	Learning Outcome
10	Concept of game problem ➤ Rectangular games ➤ Formation of games	https://www.youtube.com/watch?v=h0bdo06qNVw&list=PLjc8ejfpgTf0LaDEHgLB3gCHZYcNtsoX&index=33	Explain and board work with example	Listening and writing	Understanding
11	Pure strategy and Mixed strategy ➤ Basic concept ➤ Examples	https://www.youtube.com/watch?v=h0bdo06qNVw&list=PLjc8ejfpgTf0LaDEHgLB3gCHZYcNtsoX&index=33	Explain and board work with example	Comprehends, Writing and solving Problems	Understanding and Apply
12	Saddle point and its existence	https://www.youtube.com/watch?v=GdAQH4TxjgU&list=PLOzRYVm0a65fY-Vh8Caiv3wAYmDd7SnrN&index=14	Explain and board work with example	Listening and writing	Understanding
13 & 14	Optimal strategy and value of the game ➤ Concept ➤ Examples to compute value of the game	https://www.youtube.com/watch?v=4VHiud7UEEk&list=PLOzRYVm0a65dbzLZE-Y4Uh2QhVA7TBLXN&index=9	Explain and board work with example	Comprehends, Writing and solving Problems	Understanding and Apply
15	Necessary and sufficient condition for a given strategy to be optimal in a game	https://www.youtube.com/watch?v=sIov2zIy6ew&list=PLOzRYVm0a65fY-Vh8Caiv3wAYmDd7SnrN&index=18	Explain and suitable board work	Listening, and Writing	Understanding
16	Discussion on Exercises		Explains	Solves Problems	Apply
17	Concept of Dominance ➤ Definition ➤ Examples	https://www.youtube.com/watch?v=1NJap38veP4&list=PLOzRYVm0a65dbzLZE-Y4Uh2QhVA7TBLXN&index=7	Explain and board work with example	Comprehends, Writing and solving Problems	Understanding and Apply
18	Fundamental Theorem of rectangular games		Explain and board work	Listening and writing	Understanding

Class	Topic	Related Links	Faculty approach	Student activity	Learning Outcome
19, 20 & 21	Algebraic method ➤ Concept ➤ Examples	https://www.youtube.com/watch?v=iw7OrxoLJcw&list=PLOzRYVm0a65dbzLZE-Y4Uh2QhVA7TBLXN&index=10	Explain and board work with example	Comprehends, Writing and solving Problems	Understanding and Apply
22, 23 & 24	Graphical method and Dominance method of solving Rectangular games	https://www.youtube.com/watch?v=h0bdo06qNVwA	Explain and board work with example	Comprehends, Writing and solving Problems	Understanding and Apply
25 & 26	Discussion on Exercises		Explains	Solves Problems	Apply
27 & 28	Inter-relation between theory of games and L.P.P	https://www.youtube.com/watch?v=h0bdo06qNVwA	Explain and board work	Listening and writing	Understanding
29 & 30	Revision and Class Test		Doubt Clearing using suitable Examples	Solves Problems	Analyze and apply

LECTURE PLAN & RELATED LINKS

Subject: MTMA, Paper: **CC13** (Metric Spaces & Complex Analysis)

Semester-VI (B.Sc. Mathematics (Hons)), Credit-6

Instructor: Dr. Deepshikha

Class	Topic	Related Links	Faculty approach	Student activity	Learning Outcome
Unit-1 : Metric space (40 Classes)					
1 & 2	Metric Spaces ➤ Definition ➤ Examples	https://youtu.be/r2x23g_5rhc?si=3HSCwXM6-YO4afzV https://youtu.be/IUC7p0HYYgg?si=G11hMb06VCBLKgX	Explain and board work with example	Listening and Writing	Understanding
3, 4 & 5	Concept of Open ball, Open set, Closed set, Interior point, Limit point, closure of a set, Boundary point and boundary of a set. Properties of interior, closure and boundary.	https://youtu.be/vmJ85VYXoTc?si=y8MCUBELKv2SzqaX https://youtu.be/7ajKKkbLAdM?si=MO3S217LDSd6yz8T	Explain and board work with example	Listening and Writing	Understanding
6 & 7	Bounded set and diameter of a set. Distance between two sets. Subspace of a metric space.	https://youtu.be/33zfpYzd0HU?si=8jpb6O1zstKb2jeu	Lecture and board work	Listening, writing and simple problem solving	Understanding, Analyzing, and Applying
8 & 9	Discussion of Exercises on metric, open sets, closed sets, diameter of set.		Explains	Solves Problems	Apply
10	Convergent sequences	https://youtu.be/v83oWVzfmBE?si=6k3mg1jLk6nfjfvw	Lecture, board work and Deduction	Listening, writing and problem solving	Understanding, Analyzing, and Applying
11 & 12	Cauchy sequences ➤ Examples ➤ Every convergent sequence is Cauchy and bounded, but the converse is not true.	https://youtu.be/v83oWVzfmBE?si=6k3mg1jLk6nfjfvw	Explains and narrates with example	Comprehends, writing and problem solving	Analyzing, and Applying



Class	Topic	Related Links	Faculty approach	Student activity	Learning Outcome
13, 14 & 15	Completeness ➤ Cantor's intersection theorem. ➤ $\mathbb{R}$ is a complete metric space. ➤ $\mathbb{Q}$ is not complete.	https://youtu.be/KJ1lgw7Aog4?si=cHGOx9m5ZCP6gviu https://youtu.be/uH6vkoMOzF4?si=_nVrtIE0i5tLV1Pp	Explain and board work with example	Listening and writing	Understanding
16 & 17	Discussion of Exercises on sequences		Explains	Solves Problems	Apply
18, 19 & 20	Continuous mappings ➤ sequential criterion of continuity. ➤ Uniform continuity ➤ Examples of continuous and non-continuous maps	https://youtu.be/ErqwclTc6w8?si=RgILj7tJQ5sWRi77 https://youtu.be/6KkomiUsQ7A?si=fkigPkvsycP_lbP6 https://youtu.be/CHGc6ePLSqA?si=M0Rw6V_eLD3QE1Ab	Explain and board work with example	Listening and writing	Understanding
21 & 22	Discussion of Exercises on continuity		Explains	Solves Problems	Apply
23, 24 & 25	Compactness ➤ Sequential compactness, ➤ Examples of compact spaces ➤ Heine-Borel theorem in $\mathbb{R}$. ➤ Finite intersection property ➤ Continuous functions on compact sets.	https://youtu.be/brwzwAPJnXI?si=rHHMcXLD0bJBKbh5	Explain and board work with example	Comprehends, Writing and solving Problems	Understanding and Analyzing
26, 27 & 28	Discussion of Exercises on compact metric spaces		Explains	Solves Problems	Apply
29, 30 & 31	Concept of connectedness ➤ examples of connected metric space ➤ characterization of connected spaces ➤ connected subsets of $\mathbb{R}$ ➤ connected subsets of $\mathbb{C}$	https://youtu.be/9l7EBc3rF5Y?si=3U1ItWNSlt9g-H_U	Explain and board work with example	Listening and Writing	Understanding

Class	Topic	Related Links	Faculty approach	Student activity	Learning Outcome
32 & 33	Discussion of Exercises on connectedness		Explains	Solves Problems	Apply
34 & 35	Contraction mappings ➤ Concept ➤ Examples	https://youtu.be/BYdlGbs-by8?si=ZfRp0CCZRzEbj211	Explain and suitable board work	Listening, Comprehend and Writing	Understanding and apply
36 & 37	Banach Fixed point Theorem and its application to ordinary differential equations.	https://youtu.be/uhXxsktKITg?si=-VekpLcB2-az_-yy	Explain and suitable board work	Listening, and Writing	Understanding
38	Discussion of Exercises on Fixed point theorem		Explains	Solves Problems	Apply
39 & 40	Revision and Class Tests		Doubt Clearing using suitable Examples	Solves Problems	Analyze and apply
Unit-2 : Complex analysis (35 Classes)					
1 & 2	Stereographic projection.	https://youtu.be/yNnm2DCRnhw?si=geE-tG0vHpLZlvf3	Explain and board work	Listening and Writing	Understanding
3	Regions in the complex plane	https://youtu.be/gFjlBKW8aZU?si=OSqoW63eM9s3CbNd	Explain and board work with example	Listening, writing and simple problem solving	Understanding and apply
4 & 5	Limits ➤ Examples ➤ limits involving the point at infinity.	https://youtu.be/7iBqrgHA1oQ?si=Vx8W10mPFBYycNl4	Lecture and board work	Listening, writing and simple problem solving	Understanding and apply
6 & 7	Discussion of Exercises on stereographic projection & limits		Explains	Solves Problems	Apply

Class	Topic	Related Links	Faculty approach	Student activity	Learning Outcome
8	Continuity of functions of complex variable ➤ Definition ➤ Examples	https://youtu.be/Ug37yZWlqRQ?si=8vQoLxQmKkLW375K	Explain and board work with example	Listening and writing	Understanding
9 & 10	Derivatives ➤ Concept ➤ Examples ➤ Differentiation formulas	https://youtu.be/qZ4OMmOE67Q?si=PwWMc8ZaQjE5qavR	Explain and board work	Listening, And writing	Understanding
10	➤ Cauchy-Riemann equations ➤ sufficient conditions for differentiability	https://youtu.be/HswQxH4G63c?si=WW-4w6iM6cYgbQgX	Explains and narrates with suitable board work	Listening, Comprehe nds, and writing	Understanding & Analyzing,
11 & 12	Discussions on Exercises of continuity & differentiability		Explains	Solves Problems	Apply
13, 14, 15 & 16	Analytic functions ➤ Entire Functions ➤ exponential function ➤ logarithmic function ➤ trigonometric functions ➤ hyperbolic functions	https://youtu.be/znvskofPNXc?si=fbrivSkOHqfAky82 https://youtu.be/yfruyHKBTl8?si=y9PEd16B7lXk1FaY https://youtu.be/KP5Ag1BkfCc?si=2hWAOlgetQwa-b4	Explain and board work with example	Listening and writing	Understanding
17	Mobius transformation	https://youtu.be/ChxFR7I95c?si=cpWD8KIOm8BgS35o	Explain and board work	Listening, writing and simple problem solving	Understanding and apply
18 & 19	Discussions on Exercises of analytic functions & mobius transformation		Explains	Solves Problems	Apply
20 & 21	Power series ➤ Examples ➤ Cauchy-Hadamard theorem ➤ Determination of radius of convergence & interval of convergence	https://youtu.be/ZulypU7YStQ?si=QM2JsM9oEPqpx8v	Explain and board work	Listening, and writing	Understanding

Class	Topic	Related Links	Faculty approach	Student activity	Learning Outcome
22	Uniform and absolute convergence of power series	https://youtu.be/JgAJeF2Dlpo?si=oh_6ZW1y0sxWS8ut	Explain and board work	Listening, writing and simple problem solving	Understanding and apply
23 & 24	➤ Analytic functions represented by power series. ➤ Uniqueness of power series.	https://youtu.be/n3I_1kCZALQ?si=TCmFHpGCHO7U3DbR	Explain and board work	Listening, writing and simple problem solving	Understanding and apply
25 & 26	Discussions on Exercises of power series		Explains	Solves Problems	Apply
27 & 28	Contours ➤ complex integration along a contour ➤ examples	https://youtu.be/ASxJJ5kcvQ?si=fRInYWa1Ahq4X-eU	Explain and suitable board work	Listening, and Writing	Understanding
29	upper bounds for moduli of contour integrals	https://youtu.be/a4QMxbI6U9M?si=x8OIW_YsAVn7iciZ	Explain and suitable board work	Listening, and Writing	Understanding
30	Cauchy- Goursat theorem (statement only) and its consequences	https://youtu.be/hTU_kj5TGws?si=PjHawk5EpMhZfqoS	Explain and board work	Listening, writing and simple problem solving	Understanding and apply
31	Cauchy integral formula	https://youtu.be/0BefhOps3IM?si=y9vPIJgNdaqAhD8	Explain and board work	Listening, writing and simple problem solving	Understanding, analyzing & apply
32 & 33	Discussions on Exercises of contour integration		Explains	Solves Problems	Apply
34 & 35	Revision and Class Tests		Doubt Clearing using suitable Examples	Solves Problems	Analyze and apply

LECTURE PLAN ON & RELATED LINK

Subject: MTMA, Paper: CC-14 (Numerical Methods)

Semester-VI(B.Sc. Mathematics (Hons)) ,Credit-4

Faculty: Dr. Arun Kumar Maiti

Class	Topic	Related Links	Faculty approach	Student activity	Learning Outcome
1&2	➤ What is Numerical Analysis? Errors in Numerical computation: ➤ Gross error, ➤ Round off error. ➤ Truncation error. ➤ Approximate numbers. ➤ Significant figures. ➤ Absolute, relative and percentage error. Operators: ➤ $\Delta, \nabla, E, \mu, \delta$ (Definitions And simple relations among them).	https://youtu.be/KjBCjVAobVs?si=lxrOitGu3q120y7D	Lecture and board work	Listening and Writing	Understanding
3& 4	Interpolation: ➤ Problems of interpolation, ➤ Weierstrass' approximation Theorem (only statement). ➤ Polynomial interpolation. ➤ Equispaced arguments. ➤ Difference table. ➤ Deduction of Newton's forward and backward interpolation formulae.	https://youtu.be/RpxoN9-i7Jc?si=07ZcDLPq8FasJcXM	Lecture and board work with example	Listening and simple problem solving	Understanding

Maiti

5&6	➤ Statements of Stirling's and Bessel's interpolation formulae. ➤ Error terms. General interpolation formulae : ➤ Deduction of Lagrange's interpolation formula.	https://youtu.be/9d8PwnKVA-U?si=mIYpyIPB0L5AO2Lv https://youtu.be/1RXw67TAr64?si=1NuMPMzbCv-nVcUt	Lecture and board work	Listening and simple problem solving	Understanding
7&8	➤ Divided difference. Newton's General Interpolation formula (only statement). ➤ Inverse interpolation. ➤ Interpolation formulae using the values of both $f(x)$ and its derivative $f'(x)$. ➤ Idea of Hermite interpolation formula(only the basic concepts).	https://youtu.be/ynU52aLxrSg?si=oJ44MjTcoHgOTFgk	Board work and Deduction and explain	Writing	Analysing and Understanding
9&10	➤ Numerical Differentiation based on Newton's forward & backward and Lagrange's formulae.	https://youtu.be/pitoyz9II9c?si=4wXoI0KIQi9sqv4Q	Explains and Narrates with suitable board work	Comprehends and writing	Analysing and Understanding

Maiti

11&12	Numerical Integration: ➤ Integration of Newton's interpolation formula. ➤ Newton-Cote's formula.	https://youtu.be/EG62xCOdLLA?si=aLH6EMQ55LgGHLn8	Explains and Narrates with suitable board work	Comprehends and writing	Analysing and Understanding
13 & 14	➤ Basic Trapezoidal and Simpson's $\frac{1}{3}$rd. formulae. Their composite forms. ➤ Weddle's rule (only statement). ➤ Statement of the error terms associated with these formulae. ➤ Degree of precision (only definition).	https://youtu.be/Y0PsatcDpas?si=EfybZL-AOKYJsnKf	Explains with suitable board work	Comprehends and writing	Understanding
15 & 16	Numerical solution of non-linear equations: ➤ Location of a real root by tabular method. ➤ Bisection method. ➤ Secant/Regula-Falsi methods.	https://youtu.be/mzQFG0vH-mk?si=fFCCOvasgt5MDOpP https://youtu.be/pg1I8AG59Ik?si=WA1GQzoB1QAdwhRS	Formulation of the model and Deduction	Writing and solving Problems	Analysing
17 & 18	➤ Newton-Raphson methods, their geometrical significance. ➤ Fixed point iteration method.	https://youtu.be/YSI37OYMLFw?si=oiVqNrq06JF6_Ngm	Introduction, deduction & Solution	Comprehends and Writes	Understanding
19 & 20	Numerical solution of a system of linear equations: ➤ Gauss elimination method.	https://youtu.be/H4tJDdTdEqQ?si=CV0hJeL_q67VSby4 https://youtu.be/...	Lecture and Board Work	Comprehends and Writes	Understanding

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	➤ Iterative method – Gauss-Seidal method. ➤ Matrix inversion by Gauss Elimination method(only problems – upto 3×3 order).	e/pQVqaiFBvoU?si=M54sh3QWfdSdRqVd			
21&22	Eigen value Problems: ➤ Power method for numerically extreme eigen values.	https://youtu.be/PDyi5BVY-E?si=UrHisUIF9T3W2ES	Lecture and Board Work with Explanation	Comprehends and Writes	Understanding and knowledge built
23&24	Numerical solution or Ordinary Differential Equation : ➤ Basic ideas, nature of the problem. ➤ Picard, Euler and Runge-Kutta(4^{th} order) methods (emphasis on the problems only).	https://youtu.be/C4UymmEi3Kw?si=pehR26bY3Olny0Na https://youtu.be/00DTrCST-zA?si=YtaYTihERZQVf-0I	Board Work and Explain	Listening and Writing	Understanding

Maiti

LECTURE PLAN & RELATED LINKS

Subject: MTMA, Paper: **DSE-A(2)** (Mathematical Modelling)

Semester-VI (B.Sc. Mathematics (Hons)), Credit-6

Instructor: Dr. Deepshikha

Class	Topic	Related Links	Faculty approach	Student activity	Learning Outcome
Unit-1 (20 Classes)					
1, 2 & 3	Power series solution ➤ Examples ➤ Bessel's equation ➤ Legendre's equation	https://youtu.be/utSvQMsr3g8?si=7KZoSOHQ2pwFbcyi https://youtu.be/5c4KptxCS80?si=KLKPOu38u4dhN-4P https://youtu.be/aK61gh-wUa4?si=ldMUqUJLr2ABEcZk	Explain and board work with example	Listening and Writing	Understanding
4, 5 & 6	Laplace transform	https://youtu.be/XU5hUrh6-18?si=9oc-c4zvi7ixHqyG https://youtu.be/E1UwJDHGQEI?si=Kea0V4Vlws_3ylTH	Explain and board work with example	Listening and Writing	Understanding
8, 9 & 10	Inverse Laplace transform	https://youtu.be/ZzwvuzVrXsA?si=G0Fchlgl4L8VYgyMk https://youtu.be/m-eIx4hyFbc?si=GIZdgpo hiE4OFcVi	Lecture and board work	Listening, writing and simple problem solving	Understanding, Analyzing, and Applying
11, 12 & 13	Discussion of Exercises on power series solution, Laplace transform & inverse Laplace transform		Explains	Solves Problems	Apply
14 & 15	Application of Laplace transform to initial value problem up to second order	https://youtu.be/1nHUaL2mwYc?si=VeZljVTg satRTz0f	Lecture, board work and Deduction	Listening, writing and problem solving	Understanding, Analyzing, and Applying



Class	Topic	Related Links	Faculty approach	Student activity	Learning Outcome
16 & 17	Discussion of Exercises on initial value problem		Explains	Solves Problems	Apply
18, 19 & 20	Revision and Class Tests		Doubt Clearing using suitable Examples	Solves Problems	Analyze and apply
Unit-2 (45 Classes)					
1 & 2	Monte Carlo simulation modelling: simulating deterministic behavior (area under a curve, volume under a surface)	https://youtu.be/dkbPE6bR0II?si=dH4XSUtmxXHhrgzi	Explain and board work with example	Listening and writing	Understanding
3, 4 & 5	simulating deterministic behavior ➤ area under a curve ➤ volume under a surface	https://youtu.be/b77RRwlofCM?si=SKECU-4PeJsPkm7	Explains	Solves Problems	Apply
6 & 7	Discussion of Exercises on simulating models		Explains	Solves Problems	Apply
8, 9 & 10	generating random numbers ➤ middle square method ➤ linear congruence method	https://youtu.be/d7C6MJ49lMM?si=XHPBzc8y4fJIObVi	Explain and board work with example	Listening and writing	Understanding
11 & 12	Discussion of Exercises on generating random numbers		Explains	Solves Problems	Apply
13, 14, 15 & 16	Queuing models ➤ harbor system ➤ morning rush hour	https://youtu.be/xGkpXk-AnWU?si=nDsvnHwNmQNV4piy	Explain and board work with example	Comprehends, Writing and solving Problems	Understanding and Analyzing
17, 18 & 19	Discussion of Exercises on Queuing model		Explains	Solves Problems	Apply

Class	Topic	Related Links	Faculty approach	Student activity	Learning Outcome
20, 21, 22 & 23	Overview of optimization modelling	https://youtu.be/T3804kTFhG8?si=CnOz6MnebdnBozuD https://youtu.be/2aPlzhsEsIw?si=rNtD7g1IXMENOf23	Explain and board work with example	Listening and Writing	Understanding
24, 25 & 26	Discussion of Exercises on optimization modelling		Explains	Solves Problems	Apply
27, 28 & 29	Linear programming model ➤ geometric solution ➤ algebraic solution	https://youtu.be/MybeH09ZjMs?si=TzhyG95UIB_Ot5hE	Explain and suitable board work	Listening, Comprehend and Writing	Understanding and apply
30 & 31	Discussion of Exercises on LPP		Explains	Solves Problems	Apply
32, 33, 34 & 35	Simplex method	https://youtu.be/GDCe0Rs0bOc?si=5wXAi8seGgVMS4eS https://youtu.be/e4G4YsUHXgE?si=nCwsheOgXx2zcaCK https://youtu.be/qqZK1h0Lh_M?si=ky2nV39U5Um_6ws1	Explain and suitable board work	Listening, and Writing	Understanding
36 & 37	Discussion of Exercises on simplex method		Explains	Solves Problems	Apply
38, 39 & 40	Sensitivity analysis ➤ Concept ➤ Examples	https://youtu.be/3vNBvooCR0s?si=-BIYCoyPELUeVMhB https://youtu.be/MM2QWdooOno?si=kmx_cJ8qLhHqnYD9	Lecture, board work and Deduction	Listening, writing and problem solving	Understanding, Analyzing, and Applying
41 & 42	Discussion of Exercises on sensitivity analysis		Explains	Solves Problems	Apply

43, 44 & 45	Revision and Class Tests		Doubt Clearing using suitable Examples	Solves Problems	Analyze and apply
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QyH

LECTURE PLAN ON ADVANCED MECHANICS & RELATED LINK

Subject: MTMA, Paper: DSE-B(Advanced mechanics)

Semester-VI(B.Sc. Mathematics (Hons)) ,Credit-6

Faculty: Dr. Arun Kumar Maiti

Classes	Topic	Related Links	Faculty approach	Students' Activity	Learning Outcome
1	➤ Degrees of freedom. ➤ Reactions due to constraints. ➤ D'Alembert's principle.	https://youtu.be/xA9hGd3gmTk?si=GZFbV98sWsBMZJmT https://youtu.be/215kHB8Fp20?si=Ubyr4tE9Ch7OUfQ5	Lecture and board work	Listening and Writing	Understanding
2	➤ Lagrange's first kind equations. ➤ Generalized coordinates. ➤ Generalized forces.	https://youtu.be/sl6yAjcU11Y?si=n9GfkCy7YrwTqsYp	Lecture and board work with example	Listening and simple problem solving	Understanding
3	Lagrangian; ➤ Second kind Lagrange's equations of motion. ➤ Cyclic coordinates.	https://youtu.be/LY-JcuYqSEk?si=1qTHv9OrmR_psu_zW	Lecture and board work	Listening and simple problem solving	Understanding
4	➤ Velocity dependent potential. ➤ Principle of energy. ➤ Rayleigh's dissipation function.	https://youtu.be/othkMiXrZ0?si=6UbO8SyJh0SOfcWy	Board work and Deduction and explain	Writing	Analysing and Understanding

Maiti

5&6	➤ Revision and Class Tests.		Doubt Clearing using suitable Example	Various Types of Problem Solving	Home Work
Classes	Topic	Related Links	Faculty Approach	Students' Activity	Learning Outcome
1&2	➤ Action Integral. ➤ Hamilton's principle. ➤ Lagrange's equations by variational methods.	https://youtu.be/SZbNx4VfMzg?si=TiyARm4AQhxpVZtz https://youtu.be/5KLdiwaJFMg?si=ZOpc3GfmpVCn9YoJ	Explains and Narrates with suitable board work	Comprehends and writing	Analysing and Understanding
3&4	➤ Hamilton's principle for non-holonomic system. ➤ Symmetry properties and conservation laws.	https://youtu.be/-zexXMB293A?si=t3r6qyPWOW2YH0fF	Explains with suitable board work	Comprehends and writing	Understanding
5&6	➤ Noether's theorem. Canonically conjugate coordinates and momenta.	https://youtu.be/04ERSb06dOg?si=nQTJjfAQTFNo1Bfr	Formulation of the model and Deduction	Writing and solving Problems	Analysing
7	➤ Legendre transformation. ➤ Routhian approach. ➤ Hamiltonian.	https://youtu.be/h0_3cCQRUec?si=CotCXlhOv7DyWWHA	Formulation of the model and Deduction	Writing and solving Problems	Analysing

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8&9	➤ Revision and Class Tests.		Doubt Clearing using suitable Example	Various Types of Problem Solving	Home Work
Classes	Topic	Related Links	Faculty Approach	Students' Activity	Learning Outcome
1&2	➤ Hamilton's equations from variational principle. ➤ Poincare-Cartan integral invariant.	https://youtu.be/QhyiS07YOqs?si=aLiDLXRPw4M58eB2	Explains and Narrates with suitable board work	Comprehends and writing	Analysing and Understanding
3&4	➤ Principle of stationary action. ➤ Fermat's principle.	https://youtu.be/ALyN9nZYqgl?si=8DC4lYw4d5Jm0c5n	Explains with suitable board work	Comprehends and writing	Understanding
5&6	➤ Revision and Class Tests.		Doubt Clearing using suitable Example	Various Types of Problem Solving	Home Work
Classes	Topic	Related Links	Faculty Approach	Students' Activity	Learning Outcome
1&2	➤ Canonical transformation. ➤ Generating function; Poisson Bracket.	https://youtu.be/i5cLXan2Xj4?si=0OHvBf6njPk8YeWD https://youtu.be/ykD-rXB04Hw?si=vxiZGH1xryaiYzqw	Introduction, deduction & Solution	Comprehends and Writes	Understanding

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3&4	➤ Equations of motion; Action-angle variables. ➤ Hamilton-Jacobi's equation.	https://youtu.be/IV8YzK_fDF4?si=uJ_W8LeeTwUnxUme	Lecture and Board Work	Comprehends and Writes	Understanding
5&6	➤ Hamilton's principal function. ➤ Hamilton's characteristics function.	https://youtu.be/DksCD4MlksE?si=T2H_i7gU9QwKzrU0	Lecture and Board Work with Explanation	Comprehends and Writes	Understanding and knowledge built
7	➤ Li-ouville's theorem.	https://youtu.be/-eKTUFirtw0?si=sZQzHfPJ4Gb9Koz5	Board Work and Explain	Listening and Writing	Understanding
8&9	➤ Revision and Class Test		Doubt Clearing using suitable Example	Various Types of Problem Solving	Home Work

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