DEPARTMENT OF MATHEMATICS

COURSE MODULE
FOR
MATHEMATICS (HONOURS) COURSE

Under Choice Based Credit System (CBCS)
Effective from 2017-2018

Course : BMH1CC01

Calculus, Geometry & Differential Equations(Marks : 75)

Total lecture hours: 60

Module-1: Hyperbolic functions, higher order derivatives, Leibnitz rule and its applications to problems of type , , $(ax+b)^n \sin x$, $(ax+b)^n \cos x$, L'Hospital's rule, applications in business, economics and life sciences, **06 L**

Module-2: Concavity and inflection points, envelopes, asymptotes, curve tracing in Cartesian coordinates, tracing in polar coordinates of standard curves, **06 L**

Module-3: Reduction formulae, derivations and illustrations of reduction formulae for the integration of sin nx, cosnx, tan nx, sec nx, $(\log x)_n$, $\sin_n x \sin_m x$, **06 L**

Module-4: Parametric equations, parametrizing a curve, arc length, arc length of parametric curves, area of surface of revolution.
Techniques of sketching conics. **06L**

Module-5: Reflection properties of conics, translation and rotation of axes and second degree equations, classification of conics using the discriminant, polar equations of conics. **06L**

Module-6: Spheres.Cylindrical surfaces. Central conicoids, paraboloids, plane sections of conicoids, Generating lines, classification of quadrics, Illustrations of graphing standard quadric surfaces like cone, ellipsoid. **06L**

Module-7: Differential equations and mathematical models. General, particular, explicit, implicit and singular solutions of a differential equation.Exact differential equations and integrating factors, **06L**

Module-8: separable equations and equations reducible to this form, linear equation and Bernoulli equations, special integrating factors and transformations. **06L**

Graphical Demonstration (Teaching Aid) 12L

Module-9

1. *Plotting of graphs of function* e^{ax+b}, $\log(ax+b)$, $1/(ax+b)$, $\sin(ax+b)$, $\cos(ax+b)$, $|ax+b|$ *and to illustrate the effect of a and b on the graph*

2. *Plotting the graphs of polynomial of degree 4 and 5, the derivative graph, the second derivative graph and comparing them.* ***06 L***

Module-10

3. *Sketching parametric curves (Eg. Trochoid, cycloid, epicycloids, hypocycloid).*

4. *Obtaining surface of revolution of curves.*

5. *Tracing of conics in Cartesian coordinates/polar coordinates.* ***06L***

Course : BMH1CC02

Algebra(Marks : 75)

Total lecture hours: 60

Module1 : Polar representation of complex numbers, n-th roots of unity, De Moivre's theorem for rational indices and its applications. Inequality: The inequality involving AM≥GM≥HM, Cauchy-Schwartz inequality . **9L**

Module2: Theory of equations: Relation between roots and coefficients,Transformation of equation,Descartes rule of signs, Cubic and biquadratic equations, reciprocal equation,separation of the roots of equations,Strum's theorem .**8L**

Module -3 : Equivalence relations and partitions, Functions, Composition of functions, Invertible functions, One to one correspondence and cardinality of a set. Well-ordering property of positive integers,**7L**

Module -4 : Division algorithm, Divisibility and Euclidean algorithm.Congruence relation between integers.Principles of Mathematical Induction, statement of Fundamental Theorem of Arithmetic.**8L**

Module -5: Systems of linear equations, row reduction and echelon forms, vector equations, the matrix equation Ax=b, solution sets of linear systems, applications of linear systems, linear independence. **10L**

Module 6: Introduction to linear transformations, matrix of a linear transformation, inverse of a matrix, characterizations of invertible matrices. Vector spaces, Subspaces of R_n, dimension of subspaces of R_n, **10L**

Module 7: Rank of a matrix, Eigen values, Eigen Vectors and Characteristic Equation of a matrix. Cayley-Hamilton theorem and its use in finding the inverse of a matrix. **8L**

DEPARTMENT OF MATHEMATICS

COURSE MODULE
FOR
MATHEMATICS (GENERAL) COURSE

Under Choice Based Credit System (CBCS)
Effective from 2017-2018

Course : BMG1CC1A

Differential Calculus (Marks : 75)

Total lecture hours: 60

Module 1 : Limit and Continuity (ε and δ definition), Types of discontinuities, Differentiability of functions, Successive differentiation, Leibnitz's theorem, **15L**

Module 2 : Partial differentiation, Euler's theorem on homogeneous functions. **10L**

Module 3 : Tangents and normals, Curvature, Asymptotes, Singular points, Tracing of curves. Parametricrepresentation of curves and tracing of parametric curves, Polar coordinates and tracing of curvesin polar coordinates. **15L**

Module 4 : Rolle's theorem, Mean Value theorems, Taylor's theorem with Lagrange's and Cauchy's formsof remainder, Taylor's series, Maclaurin's series of sin x, cos x, e x , log(l+x), (l+x)n , Maxima andMinima, Indeterminate forms. **20L**

DEPARTMENT OF MATHEMATICS

COURSE MODULE IN SEM-II
FOR
MATHEMATICS (HONOURS) COURSE

Under Choice Based Credit System (CBCS)
Effective from 2017-2018

Course : BMH2CC03

Real Analysis (Marks : 75)

Total lecture hours: 60

Module-1: Review of Algebraic and Order Properties of $\mathbb{R}$, ε-neighbourhood of a point in $\mathbb{R}$. Idea of countable sets, uncountable sets and uncountabilityof $\mathbb{R}$. Bounded above sets, Bounded below sets, Bounded Sets, Unbounded sets. Suprema and Infima. Completeness Property of $\mathbb{R}$ and its equivalent properties. The Archimedean Property, Density of Rational (and Irrational) numbers in $\mathbb{R}$, Intervals. **10L**

Module-2: Limit points of a set, Isolated points, Open set, closed set,derivedset,Illustrations of Bolzano-Weierstrass theorem for sets, compact sets in $\mathbb{R}$,Heine-Borel Theorem. **10L**

Module-3: Sequences, Bounded sequence, Convergent sequence, Limit of a sequence, liminf, limsup. Limit Theorems. **06L**

Module-4: Monotone Sequences, Monotone Convergence Theorem. Subsequences, Divergence Criteria.Monotone Subsequence Theorem (statement only), Bolzano Weierstrass Theorem for Sequences.Cauchy sequence, Cauchy's Convergence Criterion. **09L**

Module-5: Infinite series, convergence and divergence of infinite series, Cauchy Criterion, Tests for convergence: Comparison test, Limit Comparison test, Ratio Test, Cauchy's nth root test, Integral test. **10L**

Module-6: Alternating series, Leibniz test. Absolute and Conditional convergence. **05L**

Graphical Demonstration (Teaching Aid) 10L

Module-7:

1. Plotting of recursive sequences.
2. Study the convergence of sequences through plotting.
3. Verify Bolzano-Weierstrass theorem through plotting of sequences and hence identify convergent subsequences from the plot**. 05L**

Module-8:

4. Study the convergence/divergence of infinite series by plotting their sequences of partial sum**.**
5. Cauchy's root test by plotting nth roots.
6. Ratio test by plotting the ratio of nth and (n+1)th term. **05L**

Course : BMH2CC04

Differential Equation and Vector Calculus (Marks : 75)

Total lecture hours: 60

Module-1: Lipschitz condition and Picard's Theorem (Statement only). General solution of homogeneous equation of second order, principle of super position for homogeneous equation, Wronskian: its properties and applications. **7L**

Module-2: Linear homogeneous and non-homogeneous equations of higher order with constant coefficients, Euler's equation, method of undetermined coefficients, method of variation of parameters. **13L**

Module-3: Systems of linear differential equations, types of linear systems, differential operators, an operator method for linear systems with constant coefficients. **10L**

Module-4: Basic Theory of linear systems in normal form, homogeneous linear systems with constant coefficients: Two Equations in two unknown functions. **10L**

Module-5: Equilibrium points, Interpretation of the phase plane . Power series solution of a differential equation about an ordinary point, solution about a regular singular point. **6L**

Module-6: Triple product, introduction to vector functions, operations with vector-valued functions, limits and continuity of vector functions, differentiation and integration of vector functions. **10L**

Module-7: Graphical Demonstration (Teaching Aid) : **4L**

1. Plotting of family of curves which are solutions of second order differential equation.
2. Plotting of family of curves which are solutions of third order differential equation.

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COURSE MODULE IN SEM-II
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Course :BMG2CC1B

Differential Equations (Marks : 75)

Total lecture hours: 60

Module-1: First order exact differential equations. Integrating factors, rules to find an integrating factor. First order higher degree equations solvable for x, y, p. **7L**

Module-2: Methods for solving higher-order differential equations. Basic theory of linear differential equations, Wronskian, and its properties. Solving a differential equation by reducing its order. **13L**

Module-3: Linear homogenous equations with constant coefficients, Linear non-homogenous equations,The method of variation of parameters, The Cauchy-Euler equation.**10L**

Module-4: Simultaneous differential equations, Total differential equations. **6L**

Module-5: Order and degree of partial differential equations, Concept of linear and non-linear partial differential equations. **5L**

Module-6: Formation of first order partial differential equations, Linear partial differential equation of first order, Lagrange's method, Charpit's method. **10L**

Module-7: Classification of second order partial differential equations into elliptic, parabolic and hyperbolic through illustrations only. **9L**