KUVEMPU UNIVERSIY

Department of Studies in Mathematics

B.Sc MATHEMATICS SYLLABUS

(WITH EFFECT FROM 2014-15)

Course: B.Sc

Combinations: PCM, PMCs, PME

CHAIRMAN,
P.G./U.G BOARD OF STUDIES IN MATHEMATICS
DEPARTMEN OF P.G. STUDIES AND RESEARCH IN MATHEMATICS,
KUVEMPU UNIVERSITY,JNANA SAHYADRI,
SHANKARAGHATTA-577 451, SHIVAMOGA, KARNATAKA.

2014 -15

B.Sc MATHEMATICS SYLLABUS

(WITH EFFECT FROM: 2014-15)

Course: B.Sc (PCM, PMCs, PME):

There will be eight papers in mathematics for three years (6 semesters) B.Sc. degree courses. One paper for each of the first, second, third and fourth semesters and two papers for each of fifth and sixth semesters. Each paper carries **maximum of 100 marks** consisting of 80 theory examination +20 internal assessment and total **maximum marks is 800**. The teaching hours per week for each paper of **first, second, third and fourth semester is 08 hours** and each of the papers of **fifth and sixth semester is 06 hours**. Thus the total workload of teaching hours **per semester is 28 hours.**

FIRST SEMESTER: PAPER-I

PART-A:

Matrices: Algebra of Matrices; Row and column reduction, Echelon form, Rank of a matrix; Inverse of a matrix by elementary operations; Solution of system of linear equations; Criteria for existence of non trival solutions of homogeneous system. Eigen values and eigenvectors of square matrices, real symmetric matrices and their properties, reduction of such matrices to diagonal form, Cayley-Hamilton theorem, inverse of matrices by Cayley-Hamilton theorem.

(40-Hrs)

Groups: Definition of a group with examples and simple properties, Subgroups, centre of groups, cyclic groups, Coset decomposition, Lagrange's theorem and its consequences. Fermat's and Euler's theorem. Permutation groups: Even and odd Permutations.

(20-Hrs)

PART-B:

Differential Calculus: Limits of a function of a real variable. Bounds of a function (Definition and examples). Algebra of limits-continuity, continuity of sum and product (problems). Differentiability, Differentiability of sum, product and quotient of functions (problems). Differentiability implies continuity. Converse is not true (examples only).

(25-Hrs)

Successive Differentiation: n^{th} $differentiation, (ax+b)^m$, $\log(ax+b), e^{ax}$, $\sin(ax+b)$, $cox(ax+b), e^{ax}\sin(bx+c)$, $e^{ax}cox(bx+c)$, Leibnit'z theorem (with proof) and applications. **(15-Hrs)**

Integral Calculus: Definite Integral Reduction Formulae-for $\int \sin^n x$, $\int \cos^n x\,dx$, $\int \tan^x x\,dx$, $\int \cot^n x\,dx$, $\int \sec^n x\,dx$, $\int cosec^n x\,dx$, $\int \sin^m x \cos^m x\,dx$with definite limit. Differentiation under the integral sign by Leibnit'z rule. **(20 Hrs)**

Reference Books:

1. Shanti Narayan: Elements of Real Analysis, S. Chand & Company, New Delhi.
2. Shanthinarayan: Differentatial Calculus.
3. Herstain: Topics in Algebra, Wiley Eastern Ltd., New Delhi, 1975.
4. Lipman Bers: Calculus.
5. Modern Algebra: L.R. Brickef and Gregory M. McLean.
6. Gopal Krishna: University Algebra.

SECOND SEMESTER: PAPER-II

PART-A:

Number Theory: Division algorithm with proof. Existence of GCD, $d = (a, b)$ and representation $d = sa + t$, prime numbers, fundamental theorem of arithmetic(statement only), congruence relation, residue classes, Euler's Fermat's and Wilson's theorems (statement only), solution of linear congruence, solution of simultaneous linear congruence by Chinese Reminder theorem. **(30-Hrs)**

Analytical Geometry: Position vectors, dividing a segment in a given ratio, lines and planes in space, parametric representation of a line. Equations of plane-parallel planes equation of line mutual position of lines and planes sphere. **(30-Hrs)**

PART-B:

Differential Calculus (Continuation): Polar coordinates, angle between the radius vector and tangent. Angle of Intersection of curves (polar forms), pedal equations. Derivative of an arc in Cartesian, parametric and polar forms.
Function of two and three variables: continuity, partial derivatives EULERS Theorem, maxima and minima (Two variables). **(30-Hrs)**

Groups (Continuation): Normal Subgroups, definition and examples and standard theorems on normal subgroups**.** Quotient groups, Homomorphism, isomorphism and fundamental theorem of homomorphism. **(30-Hrs)**

Reference Books:

1. Co-ordinate Geometry of Three Dimensions - Robert J. T. Bell
2. Higher algebra :Bernard & Child
3. Modern Algebra : L.R. Brickef and Gregory M. McLean
4. Herstain, Topics in Algebra, Wiley Eastern Ltd., New Delhi, 1975.

5. Modern Algebra by Sharma and Vashishta
6. Shanthi Narayan, *Analytical Solid Geometry*. New Delhi: S. Chand and Co. Pvt. Ltd., 2004
7. Textbook Of Bsc Mathemaics Chakravarthy L.N

THIRD SEMESTER: PAPER-III

PART-A:

Differential Equations: Definition of an ordinary differential equation, its order and degree.Classification of solutions. Solution of first degree and first order equations

(1) Variable separable
(2) Homogeneous and reducible to homogeneous form.
(3) Linear and Bernoulli's form
(4) Exact equations and reducible to exact form with standard I.F. Necessary and sufficient condition for the equation to be exact.

Equations of first order and higher degree. Solvable for p, Solvable for x (singular solutions), Solvable for y (singular solutions) and Clairaut's equation. Orthogonal trajectories. Second and higher order linear differential equations with constant co-efficient-complementary functions, Particular integral, standard types, Cauchy-Euler differential equations. Simultaneous differential equations with constant co-efficient (two variables). **(60-Hrs)**

PART-B:

Theory of Plane Curves: Asymptotes, envelopes, singular points, cusp, node, and conjugated points. Area, surface area, volume with applications. **(15-Hrs)**

Differential Calculus (Continuation): Definition of continuity and differentiability(Definition only). Theorems on derivatives: Rolle's Theorem, Mean value theorems of Lagrange and Cauchy. Taylor's and Maclaurin's series (problems only). Statement of L' Hospital's rule and problems there on. **(20-Hrs)**

Vector Calculus: Scalar field- Gradient of a scalar field,geometrical meaning, directional derivatives, maximum directional derivatives.Angle between two surfaces.Vector fields, divergence and curl of a Vector field,solenoidal and irrotational fields. Scalar and vector potentials-Laplacian of a scalar field. Vector identities.Standard properties. **(25-Hrs)**

Reference Books:

1. Ordinary And Partial Differential Equations by M D Raisinghania
2. Shanti Narayan: Elements of Real Analysis, S. Chand & Company, New Delhi.
3. Shanthinarayan: Differentatial Calculus.
4. Lipman Bers: Calculus.

FORTH SEMESTER: PAPER-IV

PART-A:

Ordinary Linear Differential Equations: Solution of ordinary second order linear differential equation with variable coefficients by the methods:

1. When a part of complementary function is given,
2. Changing the independent variable,
3. Changing the dependent variable,
4. When a first integral is given (exact equation),
5. Variation of parameters.

Total And Simultaneous Differential Equation: Necessary condition for the equation P.dx+Q.dy+R.dz=0 to be integrable-problems there on. Solutions of equation of the $\frac{dx}{P} = \frac{dy}{Q} = \frac{dz}{R}$.

Partial Differetial Equation: Formation of partial differential equation –Lagrange's linear equation: $P_p + Q_q = R$. Four standard types of first order partial differential equations, charpits methods. **(60-Hrs)**

PART-B:

Sequence of Reals Numbers: Definition of a sequence, limits of a sequence, algebra of limit of a sequence-Convergent, Divergent and Oscillatory sequence problems there on. Bounded sequence; every convergent sequence is bounded-converse is not true, Monotonic Sequence and Their properties, Cauchy's sequence. **(20-Hrs)**

Infinite Series: Definition of convergent, divergent and oscillatory of series -standard properties and results, Geometric and Hyper geometric series. Cauchy's criterion (statement only). Tests of convergence of series-comparison tests- D'Alemberts Ratio test- Raabe's test-Cauchy's root test. The Integral test-Absolute Convergence and Leibnitz's test for alternating series. Summation of Binomial, Exponential and Logarithmic series. **(40-Hrs)**

Reference Books:

1. Ordinary And Partial Differential Equations by M D Raisinghania,

2. Frank Ayres: *Schaum's outline of theory and problems of Differential Equations,*

3. I N Sneddon: *Elements of Partial Differential Equations.*

FIFTH SEMESTER: PAPER-V

PART-A:

Rings, Integral Domains And Fields: Rings- Definition, Types of rings. Examples properties of rings-Rings of Integers. Modulo-n-Integral domains-Fields. Examples-subrings-Ideals-Principal ideals, Maximal ideal commutative rings, examples and standard properties-Homomorphism and Isomorphism-properties of homomorphism of rings. Quotient rings.

(45-Hrs)

PART-B:

Laplace Transforms: Definition of Laplace transform, linearity property- Piecewise continuous function. Existence of Laplace transform, Functions of exponential order and of class A. First and secondshifting theorems of Laplace transform, Change of scale property-Laplace transform of derivatives, Initial value problems, Laplace transform of integrals, Multiplication by t, Divisionby t, Evaluation of integrals. Laplace transform of periodic functions, Heaviside function and Dirac-delta function.

Definition of Inverse Laplace transforms, Linearity property, Standard formulae, Convolution theorem. Problems.

Applications of Laplace transforms: Applications of Laplace transforms to the solution of ordinary differential equations with constant coefficients, integral equations.

(45-Hrs)

Reference Books:

1. Murray Spiegel: Schaum's Outline of Laplace Transforms.
2. Modern Algebra: L.R. Brickef and Gregory M. McLean.
3. Herstain: Topics in Algebra, Wiley Eastern Ltd., New Delhi, 1975.
4. Modern Algebra by Sharma and Vashishta.
5. Raisinghania M.D., *Laplace and Fourier Transforms*. New Delhi, India: S. Chand and Co. Ltd., 1995.

PAPER-VI:

PART-A:

Topology: Basic concepts. Closure, Neighbourhood, Limit points and Derived sets. Interior, Exterior and Boundary. Bases and sub-bases. Sub-spaces, $T1$ and $T2$ spaces.

(25-Hrs)

Fourier series: Periodic functions and properties-Fourier series of functions with period 2π and period 2L. Half range cosine and sine series.

(20-Hrs)

PART-B:

Numerical Analysis: Solution of algebraic and transcendental equations of one variable by bisection, Regula-Falsi and Newton-Raphson methods; Finite differences (Forward and Backward differences) Interpolation, Newton's forward and backward interpolation formulae. Divided differences-Newton's divided difference formula. Lagrange's interpolation formulae.

Numerical differentiation using Newton's forward and backward interpolation formulae.

Numerical Integration-Simpson's one-third and three -eighth's rule, Weddle's rule. (All formulae / rules without proof)

Numerical solution of ordinary differential equations of first order and first degree; Picard's method, modified Euler's method, Runge-kutta method of fourth-order. (No derivations of formulae). **(45-Hrs)**

Reference Books:

1. J.L. Kelly: General Topology.
2. Topology: James R. Munkres.
3. E. Sampath Kumar and K.S. Amur: Introduction to Modern Algebra and Topology.
4. S.S. Shastry: Numerical Analysis.
5. Numerical Methods: M.K. Jain S.R.K. Iyengar R.K. Jain.
6. S.C.Malik: Real Analysis.

SIXTH SEMESTER: PAPER-VII:

PART-A:

Linear Algebra: Vector spaces, examples, subspaces, criterion for a subset to be a subspace. Concepts of linear dependence and independence. Fundamental theorem of linear dependence. Basis and dimension, standard properties of linearly independent and dependent setsexamples, illustrations, concepts and results.
Linear transformations, Matrix representation of linear maps. Rank and nullity of a linear transformation. Inner product, Euclidean Vector space, examples, Orthogonality of vectors, orthogonalisation of a basis of a vector space by Gram-Schmidt's orthoganilastion process, examples. **(45-Hrs)**

PART-B:

Linear programming: Meaning of linear programming-definition of a norm in R^n-examples from R^2 to R^3 open and closed sets in R^n-convex combination of vectors-convex sets-examples and immediate consequences-linear inequality graph and solution sets in one and two variables-statement of general linear programming problem and its matrix version. Definition of feasible solutions-basic solution, basic feasible solutions and optimum solutions basis properties of feasible solution. Definition of canonical form of system of linear equations-examples from linear system in three Variables-solutions of linear programming problem in two variables by graphical method and simplex method. **(25-Hrs)**

Riemann integration: Upper and Lower sums, Refinement of partitions, upper and lower integrals, integrability,Criterion for integrability, continuous and monotonic functions are Riemann integrable,integral as the limit of a sum, integrability of the sum and product of integrable functions, integrability of the modulus of an integrable function, the fundamental theorem of calculus. **(20-Hrs)**

Reference Books:

1. Modern Algebra: L.R. Brickef and Gregory M. McLean.
2. Herstain, Topics in Algebra, Wiley Eastern Ltd., New Delhi, 1975.

PAPER-VIII:

PART-A:

Complex Analysis: Complex numbers, the complex plane-conjugate and madulae of a complex number-the modulus-argument form-geometric representation-Equation to circle and line in the complex form.

Functions of a complex variable, limit, continuity and differentiability of function-Analytic function-Cauchy-Reimann equations in Cartesian form. Sufficient conditions for analytic (in Cartesian form). Real and imaginary parts of analytic functions are harmonic-construction of analytic function given real or imaginary parts.

The complex line integral-examples and properties Cauchy's integral theorem (proof using Green's theorem) and its consequences .The Cauchy's integral formula for the function and the derivatives. Application to the evaluation of simple line integrals, Cauchy's inequalities. Lioville's theorem, fundamental theorem of Algebra.

Transformations: Definition of a conformal map. An analytic function with non vanishing derivative is conformal, the bilinear transformation, transforms circles into circles or lines. Problems there on. **(45-Hrs)**

PART-B:

Line And Multiple Integrals: Definition of line integral and basic properties, examples on evaluation of line integrals. Definition of double integrals, evaluation of double integrals (1) under given limits

(2) In regions bounded by given curves-change of variables, surface area as double integrals. Definition of triple integrals and evaluation, volume as a triple integral.

Improper Integrals: Definition of gamma and beta functions and results following the definitions. Relations between gamma and beta functions. Applications to evaluations of integrals. **(45-Hrs)**

Reference Books:

1. R.V.Churchill: Introduction to complex variables and applications.
2. Ponnuswamy: An introduction to complex analysis.
3. M.R. Spiegel: Complex Variables, Schaum's Outline Series.
4. S.C. Malik: Mathematical Analysis.
5. Shanthinarayan: Mathematical Analysis.
6. Advanced Engineering Mathematics by Erwin Kreyszig.

PATTEREN OF THE QUESTION PAPER IN MATHEMATICS
FROM 1ST TO 6TH SEMESTER

Time:3 Hours **Max.Marks:80**

I	Answer any 10 of the following (12 questions are given,6 from Part-A and 6 from Part-B)	10x2=20 Marks
II	Answer any THREE of the following (05 questions from first half of the Part-A)	3X5=15Marks
III	Answer any THREE of the following (05 questions from second half of the Part-A)	3X5=15Marks
IV	Answer any THREE of the following (05 questions from first half of the Part-B)	3X5=15Marks
V	Answer any THREE of the following (05 questions from second half of the Part-B)	3X5=15Marks

PATTEREN OF THE QUESTION PAPER
PAPER -I

Time:3 Hours **Max.Marks:80**

NOTE:Answer All Questions

I. Answer any 10 of the following: Marks : 10x2=20

1.
2.
3. Matrices
4.
5. Groups
6.
7.
8. Differential Calculus
9.
10. --- Successive Differentiation
11. Integral Calculus:
12.

II. Answer any THREE of the following : 3X5=15Marks

1
2
3 Matrices up to diagonal form
4
5

III. Answer any THREE of the following 3X5=15Marks

1 ---- Cayley-Hamilton theorem
2
3 Groups
4
5

IV Answer any THREE of the following 3X5=15Marks

1
2 Differential Calculus
3

4
5
V Answer any THREE of the following 3X5=15Marks
1
2 Sucessive Differentiation
3
4 Integral Calculus:
5

PAPER -II

Time:3 Hours **Max.Marks:80**

NOTE:Answer All Questions

I Answer any 10 of the following 10x2=20 Marks

1.
2. **Number theory:**
3.
4.
5. **Analytical Geometry**
6.
7.
8. **Differential Calculus**
9.
10.
11. **Groups**
12.

II. Answer any THREE of the following 3X5=15Marks

1.
2.
3. **Number theory:**
4.
5.

III. Answer any THREE of the following 3X5=15Marks

1.
2.
3. **Analytical Geometry**
4.
5.

IV. Answer any THREE of the following 3X5=15Marks

1.
2.
3. **Differential Calculus**
4.
5.

V. Answer any THREE of the following 3X5=15Marks

1.
2.
3. **Groups**
4.
5.

PAPER -III

Time:3 Hours **Max.Marks:80**

NOTE:Answer All Questions

I Answer any 10 of the following 10x2=20 Marks

1.
2.
3. **Differential Equations (Up to** Exact **Equations)**
4.
5.
6. **Differential Equations (Remaining Part)**
7. **Theory of Plane Curves**
8.
9.
10. **Differential Calculus**
11.
12. Vector Calculus

II. Answer any THREE of the following 3X5=15Marks

1.
2. **Differential Equations Up to** Exact **Equations**
3.
4.
5.

III. Answer any THREE of the following 3X5=15Marks

1
2 **Differential Equations (Remaining Part)**
3
4
5

IV. Answer any THREE of the following 3X5=15Marks

1
2 **3 Questions from Theory of Plane**
3 **2 Questions from Differential Calculus(Up to Cauchy`s Mean Value Theorem)**
4
5

V. Answer any THREE of the following 3X5=15Marks

1
2 **2 Questions from Differential Calculus(**Taylor's and Maclaurin's series, L' Hospital's rule)
3 **3 Questions from** Vector Calculus
4
5

PAPER -IV

Time:3 Hours **Max.Marks:80**

NOTE:Answer All Questions

I Answer any 10 of the following 10x2=20 Marks

1.
2. Ordinary Linear Differential Equations
3.
4. Total and Simultaneous Differential Equation
5. Partial Differetial Equation:
6.
7.
8. Sequence of Reals Numbers
9.
10. Infinite Series:
11.

12.

II. Answer any THREE of the following 3X5=15Marks

1
2
3
4 Ordinary Linear Differential Equations
5

III. Answer any THREE of the following 3X5=15Marks

1 Total and Simultaneous Differential Equation
2
3 Partial Differetial Equation:
4
5

IV. Answer any THREE of the following 3X5=15Marks

1
2 Sequence of Reals Numbers
3
4
5 --- Infinite Series

IV. Answer any THREE of the following 3X5=15Marks

1
2 Infinite Series
3
4 Summation of series
5

PAPER -V

Time:3 Hours **Max.Marks:80**

NOTE:Answer All Questions

I Answer any 10 of the following 10x2=20 Marks

1.
2.
3.
4. Rings, Integral Domains and Fields:
5.
6.
7.
8.
9. Laplace Transforms
10.
11.
12.

II. Answer any THREE of the following 3X5=15Marks

1
2
3 Rings, Integral Domains and Field(Up to Ideals)
4
5

III. Answer any THREE of the following 3X5=15Marks

1 Principal and Maximal ideals of commutative rings
2
3 Quotient rings ,Homomorphism and Isomorphism of Rings
4
5

IV. Answer any THREE of the following 3X5=15Marks

1
2
3 Laplace transform up to Heaviside function
4
5

IV. Answer any THREE of the following 3X5=15Marks

1
2 Inverse Laplace transform, Convolution theorem and Applications of Laplace transforms
3
4
5

PAPER -VI

Time:3 Hours **Max.Marks:80**

NOTE:Answer All Questions

I Answer any 10 of the following 10x2=20 Marks

1.
2. **Topology**
3.
4.
5. **Fourier Series**
6.
7.
8.
9. **Numerical Analysis**
10.
11.
12.

II. Answer any THREE of the following 3X5=15Marks

1
2
3 **Topology**
4
5

III. Answer any THREE of the following 3X5=15Marks

1
2
3 **Fourier Series**
4
5

IV. Answer any THREE of the following 3X5=15Marks

1 **Numerical Analysis**
2
3 **(2 Questions from** Solution of algebraic and transcendental equations and 3 **Questions from** Finite differences **)**
4
5

IV. Answer any THREE of the following 3X5=15Marks

1 **Numerical Analysis**
2
3 **(3 Questions from** Numerical differentiation and Numerical_Integration and 2 **Questions from** Numerical solution of ordinary differential equations**)**
4
5

---------------**END**-------------------