KARNATAK UNIVERSITY, DHARWAD
ACADEMIC (S&T) SECTION
ಕರ್ನಾಟಕ ವಿಶ್ವವಿದ್ಯಾಲಯ, ಧಾರವಾಡ
ವಿದ್ಯಾಮಂಡಳ (ಎಸ್ & ಟಿ) ವಿಭಾಗ

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NAAC Accredited
'A' Grade 2014

website: kud.ac.in

No. KU/Aca(S&T)/SVB-11/BOS /Maths (UG) /20-21/ ౨౭౭   Date: 1 6 OCT 2020

NOTIFICATION

Sub: Regarding introduction of the syllabus of Mathematics UG under C.B.C.S. w.e.f. the academic year 2020-21 & onwards.

Ref: 1. UGC Letter DO No. 1-1/2016(SECY), dt. 10.08.2016.
2. Special BOS Res. No. 02, dt. 04.07.2020.
3. Special Faculty Res. No. 11, dt. 11.08.2020.
3. Special Academic Council Res. No. 45, dt. 21.08.2020.
4. Vice-Chancellor's order dated   – 07 –10– 2020

Adverting to the above, it is hereby notified to the Principals of all constituent and affiliated degree colleges coming under the jurisdiction of Karnatak University, Dharwad that the Mathematics UG syllabus for I to VI Semester which is annexed herewith in Annexure-A is introduced under C.B.C.S. from the academic year 2020-21 & onwards.

Hence, the contents of this notification may please be brought to the notice of the students and all the concerned. The prescribed C.B.C.S. syllabus may also be obtained through K.U.website (www.kud.ac.in).

Hanf. 15/10/2020

(Dr. Hanumantappa K.T)
REGISTRAR

To,

1. The Chairman, BOS Mathematics (UG), Dept. of Mathematics, K.U.Dharwad.
2. The Chairman, Dept. of Mathematics, K.U.Dharwad.
3. The Principals of all the constituted and affiliated degree colleges under the jurisdiction of Karnatak University, Dharwad. (The same may be sent through e-mail)
4. The Registrar (Evaluation), K.U.Dharwad.

Copy fwcs to:

1. Dr. Ch.Ramesh, Dean, Faculty of Science & Tech., Dept. of Botany, K.U.Dharwad.
2. The Director, IT Section, Examination Section, K.U.Dharwad for information and to upload on K.U.Website (www.kud.ac.in).

Copy to:

1. PS to Vice-Chancellor, K.U.Dharwad.
2. S.A. to Registrar, K.U.Dharwad.
3. O.S., Exam UG / Confl / QP / GAD Section, K.U.Dharwad.
4. The System Analysist, Computer Unit Exam Section, K.U.Dharwad.

KARNATAK UNIVERSITY, DHARWAD

NAAC Accredited with 'A' Grade 2014
University with Potential for Excellence
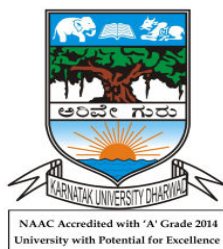
PROPOSED SYLLABUS OF

MATHEMATICS

FOR B.Sc. DEGREE COURSE

UNDER

CHOICE BASED CREDIT SYSTEM (CBCS)

WITH EFFECT FROM 2020-21 AND ONWARDS

Karnatak University, Dharwad

B. Sc. Mathematics Syllabus under Choice Based Credit System(CBCS)

Karnatak University is proposed to introdused to Choice Based Credit System(CBCS) for B. Sc. Programme from the academic year 2020-21. Proposed syllabus has been prepared as per the guidelines. The Board of Studies in Mathematics has prepared this syllabus.

B. Sc. Mathematics Programme Course Matrix for Semester I-IV
Discipline Specific Course(DSC)

Sem	Title of the Course	Type of instruction & hours per week/course 4=(3L+1T)	Credits	Hours of Exam(SEE) Per Course /Sem.	Max. Marks For I.A per Course/Sem.	Max. Marks For SEE per Course/Sem.	Max. Marks per Course/Sem.
I	BMDSC Paper 1.1 Differential Calculus-I	4	3	3	15	60	150
	BMDSC Paper 1.2 Algebra	4	3	3	15	60	
II	BMDSC Paper 2.1 Differential Calculus-II	4	3	3	15	60	150
	BMDSC Paper 2.2 Integral Calculus And Geometry	4	3	3	15	60	
III	BMDSC Paper 3.1 Number Theory and Group Theory	4	3	3	15	60	150
	BMDSC Paper 3.2 Analysis and Trigonometry	4	3	3	15	60	
IV	BMDSC Paper 4.1 Sequences and Series	4	3	3	15	60	150
	BMDSC Paper 4.2 Vector Calculus and Differential Equations	4	3	3	15	60	

SEE : Semester end exam

B. Sc. Mathematics Programme Course Matrix for Semester V-VI
Discipline Specific Electives (DSE)
(Choose any One Group for each Semester)

Sem	Group	Title of the Course	Type of instruction & hours per week/course 4=(3L+1T)	Credits	Horse of Exam(SEE) Per Course/Sem.	Max. Marks For I.A per Course/Sem.	Max. Marks For SEE per Course/Sem.	Max. Marks per Course /Sem.
V	Group 1	BMDSE Paper 5.1A Real Analysis	4	3	3	15	60	150
		BMDSE Paper 5.1B Numerical Analysis	4	3	3	15	60	
	Group 2	BMDSE Paper 5.2A Laplace Transforms and Fourier Analysis	4	3	3	15	60	
		BMDSE Paper 5.2B Finite difference based Numerical Methods	4	3	3	15	60	
VI	Group 1	BMDSE Paper 6.1A Differential Equations	4	3	3	15	60	150
		BMDSE Paper 6.1B Modern Algebra	4	3	3	15	60	
	Group 2	BMDSE Paper 6.2A Topology And Complex Analysis	4	3	3	15	60	
		BMDSE Paper 6.2B Linear Algebra	4	3	3	15	60	

B. Sc. Mathematics Programme Course Matrix for Semester V-VI
Skill Enhancement Course (SEC)
(Choose any One Group for each Semester)

Sem	Group	Title of the Course	Type of instruction & hours per week/course 2=2L	Credits	Horse of Exam(SEE) Per Course/Sem.	Max. Marks For I.A per Course/Sem.	Max. Marks For SEE per Course/Sem.	Max. Marks per Course /Sem.
V	Group 1	BMSEC-Paper 5.1A Difference equation	2	2	1.5	10	40	50+50
		BMSEC-Paper 5.1B Applications of Calculus	2	2	1.5	10	40	
	Group 2	BMSEC-Paper 5.2A Statics	2	2	1.5	10	40	
		BMSEC-Paper 5.2B Dynamics	2	2	1.5	10	40	
VI	Group 1	BMSEC-Paper 6.1A Calculus of variations	2	2	1.5	10	40	50+50
		BMSEC-Paper 6.1B Linear Programming Problems	2	2	1.5	10	40	
	Group 2	BMSEC-Paper 6.2A Graph Theory	2	2	1.5	10	40	
		BMSEC-Paper 6.2B Lattice and Boolean Algebra	2	2	1.5	10	40	

Karnatak University Dharwad
Graduate Programme, B.Sc. (CBCS)
B.Sc – I Semester, Proposed new syllabus: 2020-21 onwards
[BMDSC] Paper 1.1: Differential Calculus-I

Unit 1 :
Real Numbers : Intervals, Absolute Values, Bounded and unbounded sets, Supremum and infimum of a set, Archimedean properties of real numbers. Neighbourhoods and limit points of a set.

Limits and Continuity: Definition of limit and continuity of a function in $\varepsilon - \delta$ form. Algebra of limits (with proof) and continuity (without proof). Boundedness of continuous function. Properties of continuous function. Intermediate value theorem. Uniform continuity – Definition. Theorems i) Uniform continuity implies continuity and ii) continuity on closed interval implies Uniform continuity. Differentiability: Definition and problems on continuity as well Differentiability of a function**.**   **(25 hrs)**

Unit 2 : Indeterminate forms: L- Hospital rule (Statement only). Evaluation of Limits using L-Hospital rule.

Higher Order Derivatives : The nth derivative of $(ax+b)^m, \log(ax+b)$, $e^{ax}, \sin(ax+b), \cos(ax+b)$, $e^{ax}\sin(bx+c)$, $e^{ax}\cos(bx+c)$. Leibnitz Theorem on n^{th} derivative of a product of functions and its application.

Mean Value Theorems **:** (*Recap of Rolle's and Lagrange's theorems*) Cauchy's mean value theorem. Monotonic functions; its applications in establishing some inequalities, Taylor's theorem (with Schlomilchand Rocheform of remainder), Maclaurin's theorem (without proof) Maclaurin's expansion of some standard functions.   **(20 hrs)**

Reference Books:

1. **Differential Calculus** : Shanthi Narayan & P.K Mittal (S. Chand & Co.), 2010.
2. **Advanced Calculus**: B.R.Takur, G.P.Shrivastva & Bhanu Tripati Prasad and sons,
3. **Advanced Calculus** : Murry R. Spiegal (Schaum Series), 2010.
4. **Mathematical Analysis** : S. C. Malik (Wiley Eastern), 1992.
5. **Text book of B.Sc. Mathematics** : G.K. Ranganath and others, 2015.
6. **Real Analysis** : P.N. Chatterji, A Pragati edition, 2019
7. **Real Analysis** : Shanthi Narayan (S. Chand & Co.), 2005.
8. **Real Analysis**: Sharma and Vasishta, Krishna publications, 2014
9. **A Course in B.Sc. Mathematics:** Prof. Bhoosnurmath, C S Salimath & V S Shetiya
10. **College Mathematics for B.Sc.**: Dr. N. Rudraiah

[BMDSC] Paper 1.2 : Algebra

Unit 1 :

Set Theory : (*Recap of operations on sets, equivalence relation*) Indexed sets, Arbitrary union and intersection of sets, Generalized De'Morgan's Laws. Images , inverse images of functions, Set functions, properties of set functions. Properties of composite functions, Countable and uncountable sets.

Matrices: Row and column transformations in matrices, Rank of a matrix, Reduction to normal forms, Inverse of a matrix by elementary operations. Solution of system of linear equations, Necessary condition for a system of equation to be consistent, Solution of system of linear equations by Gauss Elimination and Gauss-Jordan methods. **(30 hrs)**

Unit 2.

Theory of equations: (*Recap of Quadratic equation: sum & products of roots and relation between the roots and coefficients*), Factor theorem and remainder theorem. Cubic and Bi-quadratic equations, solution of the equations when Roots are in A.P, G.P and H.P. Irrational and complex roots, Solutions of equations by synthetic division. **(15 hrs)**

Reference Books:

1. **Matrices** : Shanthi Narayan (S. Chand & Co.), 2010.
2. **Elements of Modern Algebra and Topology** : Sampathkumar & K. S. Amur.
3. **Matrices** : M. Pille
4. **Matrices**: M.D. Raisighania, H.C, Sexena and H.K Das
5. **Matrices:** P.N. Chatterji
6. **Theory of Equations** : M.L. Kanna
7. **Set Theory and related topics** : Lipschotz:. -Schaum Series, 1998.
8. **Elementary Set Theory**: M.L Khanna, 1998.
9. **A Course in B.Sc. Mathematics :** Prof. Bhoosnurmath, C S Salimath & V S Shetiya
10. **College Mathematics for B.Sc.**:Dr. N. Rudraiah
11. **A Text Book of B.Sc.Mathematics :**G K Ranganath

Karnatak University Dharwad
Graduate Programme, B.Sc. (CBCS)
B. Sc – II Semester, Proposed new syllabus: 2020-21 onwards
[BMDSC] Paper 2.1: Differential Calculus-II

Unit 1. Differentiation in polar Co-ordinates. Plane curves in Polar and Pedal forms. Angle between the radius vector and the tangent. Angle of intersection of curves (polar form). Length of Polar tangent , normal, sub-tangent and sub-normal at any point on the curve. Length of perpendicular from pole to the tangent. Pedal equations. Derivative of an arc length of a plane curve.   **(15 hrs)**

Unit 2.(*Recapitulation of Maximum and Minimum of a function*)
Concavity, Convexity and Points of inflexion of curves. Curvature of plane curves. Derivation of Radius of curvature in Cartesian, parametric and polar forms. Center of curvature. Evolutes & involutes, Envelopes of a plane curves. Asymptotes of a plane curves: Asymptotes parallel to coordinate axes and oblique asymptotes, theorems and problems.
Tracing of curves: Definitions, Singular points, multiple points, Node, Cusp and isolated points. General rules for tracing of curves in Cartesian, polar forms. Examples on tracing of simple curves.   **(30 hrs)**

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 Reference Books:
1. **Advanced Calculus**: B.R.Takur, G.P.Shrivastva & Bhanu Tripati, Prasad and sons, 2005.
2. **Differential Calculus** by Shanthi Narayan & P.K Mittal (S. Chand & Co.), 2010.
3. **Differential Calculus** by N. P. Bali (Golden series), 2015.
4. **A Course in B.Sc. Mathematics :** Prof. Bhoosnurmath, C S Salimath & V S Shetiya
5. **College Mathematics for B.Sc.:**Dr. N. Rudraiah
6. **A Text Book of B.Sc.Mathematics :**G K Ranganath

[BMDSC]   Paper- 2.2: Integral Calculus and Geometry

Unit 1. Integral Calculus: Reduction formulae for evaluating $\int \sin^n x \, dx$, $\int \cos^n x \, dx$, $\int \tan^n x \, dx$, $\int \sec^n x \, dx$, $\int Co \sec^n x$, $\int \cot^n x \, dx$, $\int x^n e^{ax} dx$ and $\int x^m (\log x)^n \, dx$ with definite limits. Application of definite integrals to area under a curve (only polar curves), volumes and surfaces of the solid generated by the revolution. Length of plane curves. **(20 hrs)**

Unit 2. Analytical Geometry of three dimensions:
Sphere: Equation of a Sphere. Section of a sphere by a plane. Equation of a Sphere through a circle. Equation of a sphere with two given points as the ends of diameter, Tangent planes. Orthogonal spheres.
Cone: Equation of a cone. Quadric cone. Enveloping cone of a sphere. Right circular cone.
Cylinder: Equation of a cylinder. Enveloping cylinder of a sphere. Right   circular cylinder.
Coordinate geometry: Polar equation of the conic. Polar Equation of the directrix and tangent to the conic. Equation of asymptotes to the conic.
(25 hrs)

Reference Books:

1. **Integral Calculus** : Shanthi Narayan & P.K. Mittal, (S.Chand), 2005.
2. **Integral Calculus** : Vasishta , Sharma & N.P Bali, Krishna Publication, 2014.
3. **Coordinate Geometry** : M. L. Khanna
4. **The elements of Coordinate Geometry** : S.L.Loney, 2016.
5. **A Course in B.Sc. Mathematics :** Prof. Bhoosnurmath, C S Salimath & V S Shetiya
6. **College Mathematics for B.Sc.:**Dr. N. Rudraiah
7. **A Text Book of B.Sc.Mathematics :**G K Ranganath

Karnatak University Dharwad
Graduate Programme, B.Sc. (CBCS)
B.Sc – III Semester- Proposed new syllabus: 2021-22 onwards
[BMDSC] Paper- 3.1: Number Theory and Group Theory

Unit 1. Number theory: Divisibility. Properties of divisibility. Division algorithm. GCD. Euclid's algorithm. Relatively prime numbers. Fundamental theorem of arithmetic. The number of positive divisors and sum of all the positive divisors of a number. The theory of Congruences. Basic Properties of congruences. Linear Congruences. The Chinese remainder theorem. Euler's phi-functions, Euler's theorem, Fermat's theorem. Wilson's Theorem. **(20 hrs)**

Unit 2. Group Theory: Groups. Abelian Group. Standard examples of Groups.

Properties of Groups. Sub-Groups and its properties. Permutation Groups.

Cyclic Groups, Cosets. Lagrange's theorem. Normal sub-Groups. Quotient Groups. Homomorphism and Isomorphism of Groups. Kernel of homomorphism. Fundamental theorem of homomorphism. **(25 hrs)**

Reference Books:
1. **Theory of Numbers:** Prakash Om, Golden series, 2005.
2. **Higher Algebra** : Ray & Sharma (S. Chand & co.)
3. **Modern Algebra** : P.N Chatterjee
4. **Higher Algebra**: Hall and Knight, Arihant, 2016.
5. **Modern Algebra**: M.L. Khanna
6. **Modern Algebra** : B. S. Vatsa & others(New Age International), 2009
7. **A Course in B.Sc. Mathematics :** Prof. Bhoosnurmath, C S Salimath & V S Shetiya
8. **College Mathematics for B.Sc.:**Dr. N. Rudraiah
9. **A Text Book of B.Sc.Mathematics :**G K Ranganath

[BMDSC] Paper-3.2: Analysis and Trigonometry

Unit 1: Real Analysis:

Real valued functions of more than one variable. Limits and continuity definitions. Partial derivatives. Homogeneous functions- Euler's theorems and its extension. Total differentials –composite function and implicit function. Jacobians: Chain rule, Inverse rule, Jacobian of implicit function and functional dependence. Taylor's theorem (Generalized mean value theorem) and Maclaurin's form for functions of two variables. Maxima and Minima of functions of two and three variables. Lagrange's method of undetermined multipliers.

(25 hrs)

Unit 2 : Trigonometry

Complex numbers in terms of polar form, D'Moivre's theorem. (statement only). n^{th} roots of a complex number. Expansion of $\sin n\theta$, $\cos n\theta$ and $\tan n\theta$ in terms of $\sin \theta$, $\cos \theta$ and $\tan \theta$ respectively. Expansion of $\sin^n \theta$, $\cos^n \theta$ and $\sin^m \theta \cos^n \theta$ in a series of sines or cosines multiple of θ. Exponential and circular function of complex variable. Hyperbolic function and its identities. Problems on real and imaginary parts of circular and Hyperbolic function. Logarithm of complex numbers. Summation of trigonometric series in 'C+iS' form.

(20 hrs)

Reference Books:
1. **Advanced Calculus**: B.R.Takur, G.P.Shrivastva & Bhanu Tripati.
2. **Real Analysis :** Hari Kishan, Pragati Publication.
3. **Real Analysis:** M. L. Khanna.
4. **Differential Calculus** : Shanti Narayan , & P.K. Mittal,(S.Chand & Co.).
5. **Higher Trigonometry** : M. K. Singal & Asha Rani Singal.
6. **Trigonometry :** M.D. Raisighania, H.C, Sexena and H.K Das.
7. **Plane Trigonometry II :** S.L. Loney, Arihant, 2016.
8. **Trigonometry :** M.L Khanna.
9. **A Course in B.Sc. Mathematics :** Prof. Bhoosnurmath, C S Salimath & V S Shetiya.
10. **College Mathematics for B.Sc.**: Dr. N. Rudraiah.
11. **A Text Book of B.Sc.Mathematics :** G K Ranganath.

Karnatak University Dharwad

Graduate Programme, B.Sc. (CBCS)

B.Sc – IV Semester,   Proposed new syllabus: 2021-22 onwards

[BMDSC] Paper-4.1: Sequences and Series

1. **Unit I: Sequences:** Sequences. Bounded and unbounded sequences. Monotonic Sequences. Limit points of a sequence. Convergent, divergent and oscillatory sequences. Algebra of convergent sequences. Limit superior and limit inferior of sequences. Cauchy's first and second theorem on limits.   Cauchy's general principle for convergence of a sequence. Subsequence.   **(20hrs)**

2. **Unit II: Infinite Series:** Partial sums and behavior of an infinite series. Convergence and divergence of series. Cauchy's general principle of convergence. Series of non-negative terms. Necessary and sufficient condition for convergence. Geometric series,

    P-series(Harmonic series). Comparison tests for positive term series. D'Alembert's ratio test, Raabe's ratio test. Cauchy's Root test and Integral test. Logarithmic test, DeMorgan's & Bertrand's test**.** Alternating series. Leibnitz's theorem. Absolute convergence and conditional convergence of a series.   **(25 hrs)**

Reference Books:

1. **First Course in Real Analysis**: M.K. Singal and Asha Rani
2. **Advanced Calculus**: B.R.Takur, G.P.Shrivastva & Bhanu Tripati
3. **First Course in Real Analysis** : S.L. Gupta and Nisha Rani:
4. **Principles of Real Analysis** : S.L. Gupta and N.R. Gupta: - Pearson Education
5. **Real Analysis :** Hari Kishan, Pragati Publication.
6. **A Course in B.Sc. Mathematics :** Prof. Bhoosnurmath, C S Salimath & V S Shetiya
7. **College Mathematics for B.Sc.:**Dr. N. Rudraiah
8. **A Text Book of B.Sc.Mathematics :**G K Ranganath
9. **Fundamental Real Analysis**: S.L. Gupta and Nisha Rani, Vikash Publishers, 2004.

[BMDSC] Paper 4.2: Vector Calculus and Differential Equations

Unit 1: Vector Calculus:

(Recapitulation of Dot and cross product of vectors). Ordinary derivatives of vectors. Condition for a vector function to be constant, to have constant magnitude and constant direction. Derivatives of sum, dot product, cross product and triple products of vectors. Vector differential operator del. Gradient of scalar point function, divergence and curl of vector point function. Solenoidal and irrotational vectors. **(15 hrs)**

Unit 2: Differential Equations:

(Recapitulation of Linear and Homogeneous Differential equations). Non-homogeneous , exact equations, integrating factors found by inspection, the determination of integrating factor, equations reducible to exact and Bernoulli's equations. Simple equations of the first order and higher degree. Equations solvable for p, x, y. Clairaut's equations. Linear differential equations of the nth order with constant coefficients. Particular Integrals when the RHS is of the from e^{ax+b}, $\sin(ax+b)$, $\cos(ax+b)$, x^n, $e^{ax} \cdot V$, $x \cdot V$, where V is a function of x. Reduction of homogeneous equations. Linear equations with variable coefficient, Exact differential equations of nth order. **(30 hrs)**

Reference Books:

1. **Vector Calculus** : Shanti Narayan and J.N Kapur, S. Chand, 1987.
2. **Vector Calculus** : J N Sharma A R Vasishta, Krishna's Series, 2015.
3. **Vector Calculus** : M. L. Khanna, Krishna's Series.
4. **Differential equations** : D.A. Murray
5. **Introductory Course on Differential equations** : H.T.H. Piaggio, 2018.
6. **Differential Equations** : Ayres- Schaum Series.
7. **Differential Equations** : A.R.Vasishtha & Dr. S.K. Sharma
8. **Differential Equations** : M.L. Khanna
9. **A Course in B.Sc. Mathematics :** Prof. Bhoosnurmath, C S Salimath &
   i. V S Shetiya
10. **College Mathematics for B.Sc.**:Dr. N. Rudraiah
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Karnatak University Dharwad

Graduate Programme, B.Sc. (CBCS)

B.Sc – V Semester,   Proposed new syllabus: 2022-23 onwards

<u>**Group 1**</u>

[BMDSE] Paper - 5.1 A : Real Analysis

Unit 1: The Riemann Integration: The upper and lower Darboux sums. Riemann integral. Necessary and sufficient conditions for integrability. Algebra of integrable functions. Integral as the limit of a sum. Integrability of continuous and monotonic functions. Fundamental theorem of Integral calculus. The first and second mean value theorems of integral calculus.   **(20 hrs)**

Unit 2: Improper integrals. Improper integrals of the first, second and third kind. Improper integral as the limit of a proper integral. Comparison tests. Abel's test and Dirichlet's test for the convergence of the integral of a product of two functions.

Double integrals and Triple integrals**:** Double integrals with change of order, change of variables, changing into polar coordinates and Triple integrals. Applications to find area and volumes.

Differentiation under integral sign. Leibnitz's rule and problems, Beta and Gamma functions: Properties, transformations, relation between Beta and Gamma functions. Duplication formula.   **(25 hrs)**

Reference Books:

1. **A course of Mathematical Analysis**: Shantinarayan (S. Chand & Co.)
2. **Fundamental Real Analysis** : S. L. Gupta and Nisha Rani
3. **Advanced Calculus**: B.R.Takur, G.P.Shrivastva & Bhanu Tripati
4. **Real Analysis** : Sharma & Vasishta
5. **Real Analysis** : Hari Kishan, Pragati Publication.
6. **Higher Engineering Mathematics**: Dr.B.S.Grewal, Khanna Publisher, 2019.
7. **A Course in B.Sc. Mathematics :** Prof. Bhoosnurmath, C S Salimath & V S Shetiya
8. **College Mathematics for B.Sc.:**Dr. N. Rudraiah
9. **A Text Book of B.Sc.Mathematics :**G K Ranganath

[BMDSE] Paper-5.1B: Numerical Analysis

Unit 1 : Solution of algebraic and transcendental equations: Absolute error, Relative error, Percentage error. Interval halving method, Regula-falsi method, Secant method and Newton's method. Fixed point iteration method, Rate of convergence. Error analysis for these iterative methods.

(25 hrs)

Unit 2: Numerical solution of system of linear equations: Gauss elimination method, Gauss-Jordan elimination, Jacobi's method, Gauss-Seidel method.

Numerical solution of initial value problems: Taylor's series method, Euler's method, Modified Euler's method and Runge-Kutta method.

(20 hrs)

Reference Books:
1. **1. Introductory methods of Numerical Analysis**: S. S Shastry Prentice Hall of India, 2012.
2. **Numerical methods for Sc. & Eng** : M. K. Jain,New Age International, 2007.
3. **3. Finite Differences & Numerical Analysis** :   H. C. Saxena, S. Chand & Co., 1988.
4. **A Course in B.Sc. Mathematics :** Prof. Bhoosnurmath, C S Salimath & V S Shetiya
5. **College Mathematics for B.Sc.:**Dr. N. Rudraiah
6. **A Text Book of B.Sc. Mathematics :**G K Ranganath
7. **Numerical Analysis**: Richard L. Burden, Douglas J. Faires, Annette M. Burden, Cengage Learning, 10 Edition.

[BMDSE] Paper-5.2A : Laplace Transforms and Fourier Analysis

Unit 1: Laplace Transforms: Basic Properties. Laplace transforms of some common functions. Laplace transform of Periodic functions. Laplace transform of derivative and integral of a function. Heaviside function. Dirac-delta function. Convolution theorem. Inverse Laplace transforms and its properties. Method of solving differential equation of first and second order with constant coefficients using Laplace transforms.

(25 hrs)

Unit 2: Fourier series and Transforms: Periodic functions. Fourier Coefficients. Fourier series of functions with period 2π and period 2L. Fourier series of even and odd functions. Half range Cosine and Sine series. Finite Fourier transforms. Finite Fourier Cosine and Sine transforms of some common functions. Transforms of derivates.

(20 hrs)

Reference Books:
1. **Fourier Series and Fourier Transform:** Murry R & Spiegal, Schaum's, 2011.
2. **Fourier Series & Boundary value problem:** Churchill R.V & Brown J.W, McGraw-Hill, 1978.
3. **Higher Engineering Mathematics**: B.S.Grewal, Khanna Publisher, 2019.
4. **Laplace and Fourier Transforms:** J K Goyal & K P Gupta, Pragati Edition, 2016.
5. **Laplace Transform Theory**: M. G. Smith, (Van Nostrand), New University Mathematics, 1966.
6. **A Course in B.Sc. Mathematics:** Prof. Bhoosnurmath, C S Salimath & V S Shetiya
7. **College Mathematics for B.Sc.:**Dr. N. Rudraiah
8. **A Text Book of B.Sc.Mathematics :**G K Ranganath

[BMDSE] Paper-5.2B: Finite difference based Numerical Methods

Unit 1: Finite Differences: Definition and properties of forward difference operator Δ, backward difference operator ∇, shift operator E and central difference operator δ. Relations among them. The nth forward difference of a polynomial. Factorial notations. Separation of symbols. Interpolation. Newton-Gregory forward and backward interpolation formulae. Lagrange's interpolation formula for unequal intervals.

(25 hrs)

Unit 2: Numerical differentiation of first and second order using Newton's forward and Newton's backward interpolation formulae. Numerical integration. Newton-Cote's Quadrature formula, Trapezoidal Rule, Simpson's one-third rule and Simpson's three-eighth rule.

(20 hrs)

Reference Books:
1. **Introductory methods of Numerical Analysis**: S. S. Shastry Prentice Hall of India, 2012.
2. **Numerical methods for Sc. & Eng** : M. K. Jain, New Age International, 2007.
3. **Finite Differences & Numerical Analysis** : H. C. Saxena, S. Chand & Co., 1988.
4. **A Course in B.Sc. Mathematics :** Prof. Bhoosnurmath, C S Salimath & V S Shetiya
5. **College Mathematics for B.Sc.:** Dr. N. Rudraiah
6. **A Text Book of B.Sc. Mathematics :** G K Ranganath
7. **7. Numerical Analysis**: Richard L. Burden, Douglas J. Faires, Annette M. Burden, Cengage Learning, 10 Edition.

Karnatak University Dharwad
Graduate Programme, B.Sc. (CBCS)
B. Sc – VI Semester   Proposed new syllabus: 2022-23 onwards
<u>Group 1</u>

[BMDSE]   PAPER-6.1A: Differential Equations

Unit 1 : Simultaneous differential equations with two and more than two variables. Condition of integrability of Pdx+Qdy+Rdz=0. Partial differential equations of the first order and classifications of first order. Integral of the linear equation Pp+Qq=R. Special methods of solution applicable to standard forms. Charpit's method. Partial differential equations of the second order. **(25 hrs)**

Unit 2 : Series solution of differential equation: Ordinary differential equation with variable coefficients, Ordinary point, Regular-Singular points, Power Series solution, Frobenius Series solution. Legendre and Bessel equations and their properties. **(20 hrs)**

Reference Books:
1. **Differential Equations**.: D. A. Murray
2. **Differential Equations** : J. N. Sharma and R. K. Gupta
3. **Differential Equations.** : P. N. Chatterjee
4. **Ordinary and partial Differential equations** : Raisinghania M.D. (S. Chand & Co.), 2016.
5. **Higher Engineering Mathematics**: B.S.Grewal, Khanna Publisher, 2019.
6. **Ordinary Differential equation** :Theory and Applications, Charlton, (Von-Norstand), 1965.
7. **A Course in B.Sc. Mathematics :** Prof. Bhoosnurmath, C S Salimath & V S Shetiya
8. **College Mathematics for B.Sc.**:Dr. N. Rudraiah
9. **A Text Book of B.Sc.Mathematics :** G K Ranganath.

[BMDSE] Paper-6.1B: Modern Algebra

Unit 1 : Rings and Fields: Definition, examples. Abelian Ring. Ring with unity and without unity. Finite and infinite rings(Only definitions).Units in a ring. Zero divisors in a ring. Ring without zero divisor. Properties of ring. Division ring. Integral domain and field definitions. Theorems (i) A finite integral domain is a field (ii) Every field is an integral domain.

(20 hrs)

Unit 2: Polynomial rings, Divisibility, Irreducible polynomials, Eisensten's Criterion of Irreducibility, Quotient rings, homomorphism. Ideals: Definition, theorems, examples. Maximal Ideal, Prime Ideal.

(25 hrs)

Reference Books:
1. **Topics in Algebra** : I. N. Herstein, Wiley, 2006.
2. **A First course in Abstract Algebra** : Fraleigh JB, Pearson, 2013.
3. **Elements of Modern Algebra and Topology** : Sampathkumar & K. S. Amur.
4. **Modern Algebra** : P.N Chatterjee, Anu Books, 2019.
5. **Introduction of Mathematical Analysis**-: Shanti Narayan (S.Chand & Co.)
6. **A Course in Abstract Algebra** : Vijay K Khanna and Bambari, Vikash Publisher, 2017.
7. **Modern Algebra** : M. L Khanna, Jai Prakash Nath and Co., 2012.
8. **A Course in B.Sc. Mathematics :** Prof. Bhoosnurmath, C S Salimath & V S Shetiya
9. **College Mathematics for B.Sc.:**Dr. N. Rudraiah
10.**A Text Book of B.Sc.Mathematics :**G K Ranganath

Group 2

[BMDSE] PAPER-6.2A : Topology and Complex Analysis

Unit 1: Topology: Topological Spaces. Open sets. Closed sets. Usual topology, Closure, Neighborhood, Limit points and derived sets. Interior, exterior and boundary of a topological space. Bases and Sub bases of a topological space. Subspaces. T_0, T_1 and T_2 spaces.

(15 hrs)

Unit 2 : Complex Analysis: Limits , continuity and differentiability of complex valued function. Analytical functions. Cauchy - Riemann Equations. Necessary and sufficient condition for a function to be analytic. Harmonic functions. Construction of analytic functions. Complex Integration. Cauchy theorem. Cauchy integral formula. Morera's theorem. Cauchy's inequality. Liouville's theorem. Taylor's theorem. Laurent's theorem. Singularities. Poles. Residues. Cauchy residue theorem. Contour integration. Evaluation of

(i) $\int_0^{2\pi} f(sin\theta, cos\theta)d\theta$ or $\int_{-\pi}^{\pi} f(sin\theta, cos\theta)d\theta$

(ii) $\int_a^{\infty} \frac{P(x)}{Q(x)} dx$, where (x) , $Q(x)$ are polynomials , $Q(x) \neq 0$ for any real x and $\deg(Q(x)) \geq \deg(P(x))+2$

(iii) $\int_{-\infty}^{\infty} \frac{P(x)}{Q(x)} sinax dx$ or $\int_{-\infty}^{\infty} \frac{P(x)}{Q(x)} cosax dx$

where (x) , $Q(x)$ are polynomials , $Q(x) \neq 0$ for any real x and $\deg(Q(x)) \geq \deg(P(x))+1$ using contour integration

(30 hrs)

Reference Books:
1. **Elements of Modern Algebra and Topology** : Sampathkumar & K. S. Amur.
2. **Topology** : J. N. Sharma - Krishna Prakashan, Meerut, 2019.
3. **General Topology**-: S. Lipschutz (Schaum's Series), 2011.
4. **Complex Variables** : J. N. Sharma - Krishna Prakashan, 1991.
5. **Complex Variables** : Spiegel (Schaum's Series), 2017.
6. **A Course in B.Sc. Mathematics :** Prof. Bhoosnurmath, C S Salimath & V S Shetiya
7. **College Mathematics for B.Sc.:** Dr. N. Rudraiah
8. **A Text Book of B.Sc.Mathematics :** G K Ranganath
9. **General Topology**: S. R. Malaghan, Serial Publications

[BMDSE] Paper-6.2B: Linea Algebra

Unit 1 : Vector Space: Definition with examples, properties, Vector Subspace. Linear independence and dependence of vectors. Linear span of a set. Base for vector space and dimension.

(20 hrs)

Unit 2: Linear transformation: properties, range, null space, rank and nullity theorem, Linear maps as matrices-change of basic and effect of associated matrices, eigenvalues and eigenvectors of a linear transformation**.** **(25 hrs)**

Reference Books:
1. **Topics in Algebra** : I. N. Herstein, Wiley, 2006.
2. **A First course in Abstract Algebra** : Fraleigh JB, Pearson, 2013.
3. **Linear Algebra** : Lipsclitz S, Schaum's, 2017.
4. **Elements of Modern Algebra and Topology** : Sampathkumar & K. S. Amur.
5. **Modern Algebra** : P.N Chatterjee, Anu Books, 2019.
6. **Introduction of Mathematical Analysis**-: Shanti Narayan (S.Chand & Co.)
7. **A Course in Abstract Algebra** : Vijay K Khanna and Bambari, Vikash Publisher, 2017.
8. **Modern Algebra** : M. L Khanna, Jai Prakash Nath and Co., 2012.
9. **A Course in B.Sc. Mathematics :** Prof. Bhoosnurmath, C S Salimath & V S Shetiya
10. **College Mathematics for B.Sc.:**Dr. N. Rudraiah
11. **A Text Book of B.Sc.Mathematics :**G K Ranganath

Karnatak University Dharwad

Graduate Programme, B.Sc. (CBCS)

B. Sc – V Semester   Proposed new syllabus: 2022-23 onwards

<u>Skill Enhancement Course (SEC)</u>
<u>Group 1</u>
[BMSEC]-Paper 5.1A: Difference equation

Unit I:(*Recap basics of Finite Difference*), Definition- Difference equations, order and solution. Solution of simple Difference equations, First order and higher order Homogeneous linear equations, non- homogeneous linear equation, Method of evaluating $\frac{1}{f(E)} \varphi(x)$ for first order non-homogeneous linear equations and first and higher order homogeneous linear equations.

(**15 hrs)**

Unit II: First order linear equation with variable coefficients, equation homogeneous in $u(x)$. Equations reducible to linear equations. Solution of second order difference equations by matrix method. Solution of system of linear difference equations by matrix method

(**15 hrs)**

Reference Books:
1. **Advance topics in Difference equation:** Agarwal R.P , Wong, Patricia J. Y, Springer, 1997.
2. **The Calculus of finite Differences and Difference equation**: M.R.Spiegel, Schaum's, 1971.
3. **The Calculus of finite Differences**: L.M Milne & Thomson, AMS, 2000.

[BMSEC]-Paper 5.1B: Applications of Calculus

Unit I: Line, Surface and Volume integrals of vector functions. **(15 hrs)**

Unit II: Green's theorem in the plane (statement and proof) – Direct consequences of the theorem – The Divergence theorem (statement only) – Direct consequences of the theorem – The Stoke's theorem (statement only) – Direct consequences of the theorem. **(15 hrs)**

Reference Books:
1. **Text book of B.Sc. Mathematics**: G.K. Ranganath and others
2. **Higher Engineering Mathematics**: Dr.B.S.Grewal, Khanna Publications, 2019.
3. **Differential and Integral Calculus**: N. Piskunov , Mir Pub, 1996.

Group 2

[BMSEC]-Paper 5.2A: Statics

Unit I: Couple. Moment of a couple, Varignon's theorem. Resultant of coplanar couples. Resultant of a force and a couple. Resultant of a system of coplanar forces acting at different points of a rigid body. Conditions of equilibrium. Finding the equation of the line of action of the resultant.

(**20 hrs)**

Unit II: Catenary and common catenary. **(10 hrs)**

Reference Books:
1. **Statics** : M. Ray and P. T. Chandi
2. **A Course in B.Sc. Mathematics :** Prof. Bhoosnurmath, C S Salimath & V S Shetiya.
3. **College Mathematics for B.Sc.**: Dr. N. Rudraiah

[BMSEC]-Paper 5.2B: Dynamics

Unit I : Motion in a plane curve: Velocity and acceleration of a particle along a plane curve. Radial and transverse components of velocity and acceleration. Tangential and Normal components of velocity and acceleration.

Projectiles: Motion of a projectile and its trajectory. (To find the latus rectum, the vertex, the focus and height of the directrix of the trajectory). To find (i) time of flight (ii) the horizontal range (iii) the maximum horizontal range (iv) the greatest height attained and related problems.
                                                                    (15 hrs)

 Unit II: Impact: Direct and oblique impacts (Collision of elastic bodies). Direct impact of two spheres. Loss of kinetic energy by direct impact. Oblique impact of two spheres. Loss of kinetic energy by oblique impact and related problems.
 Central orbits: Central force and central orbits. Differential equation of a central orbit in polar and pedal form - simple problems.
                                                                    (15 hrs)

 Reference Books:
1. **A text Book of Dynamics**: M. Ray, S. Chand, 2005.
2. **Text Book of Dynamics** : F. Charlton- (Van Nostrand), 1964.
3. **A Course in B.Sc. Mathematics :** Prof. Bhoosnurmath, C S Salimath & V S Shetiya
4. **College Mathematics for B.Sc.**: Dr. N. Rudraiah

Karnatak University Dharwad
Graduate Programme, B.Sc. (CBCS)
B. Sc – VI Semester   Proposed new syllabus: 2022-23 onwards
Skill Enhancement Course (SEC)
<u>Group 1</u>
[BMSEC]-Paper 6.1A: Calculus of Variations

Unit I: Variation of function f= f(x,y,y'), variation of the corresponding functional, extremal of a functional, variational problem. Euler's equations and its particular forms – examples.

(15 hrs)

Unit II: Geodesics, Geodesics on some standard surfaces like the plane, the sphere, the right circular cylinder and right circular cone. Curve with minimal surface of revolution, hanging chine (freely suspended cable) – Brachistochrone problem—Isoperimetric problems.

(15 hrs)

References Books:
1. **Calculus of variations**: G.K. Ranganath, S.Chand.
2. **Mathematical Physics**: B.D. Gupta, Vikas Publishing, 2017.
3. **A First Course in the Calculus of variations**: Mark Kot, Univ. Of Washington, AMS, 2014.
4. **Calculus of Variation**: R Weinstock, Dover, 1970.
5. **Methods in Applied Mathematics**: F B Hildebrand, 1952.

[BMSEC]-Paper 6.1B: Linear Programming Problems

Unit I: Definition of OR, scope and application of OR, models of OR. Definition of LPP, formulation of LPP, standard mathematical model of LPP, basic feasible solutions, degenerate and non-degenerate basic feasible solution, examples of basic solutions which are not feasible, convex sets, supporting and separating hyperplanes.

(**15 hrs)**

Unit II: Solution of LPP
Graphical method, Simplex method, slack and surplus variables, Big-M method, Duality in linear programming problem.

(**15 hrs)**

Reference Books:
1. **Operation research**: S.D. Sharma, Kedar Nath Ram Nath, 2010.
2. **Operation research**: Hamdy A Taha, PHI(2006)
3. **Operation research**: Kanti Swaroop, P. K. Gupta and Manmohan, S. Chand & Son's(2010).

Group 2
[BMSEC]-Paper 6.2A: Graph Theory

Unit I: Basics of Graph theory: Basic Definitions, Types of graphs, Degree, Subgraphs, Operations on graphs, walks, Paths, Circuits, Connected and disconnected graphs, Euler graphs, Hamiltonian graphs, Trees and Basic properties, Distance, Eccentricity, Centre, Spanning trees.

(15 hrs)

Unit II: Cut-sets, Cut-vertices and Planar Graphs : Cut-sets, fundamental circuits, Fundamental cut-sets, Connectivity, Separability, cut-vertex, Network flows, 1- and 2- Isomorphisms, Planar and non planar graphs, Euler's formula.

(15 hrs)

Reference Books:
1. **Graph theory**: F Harary, Addison Wesley, Reading Mass,1969.
2. **Graph theory with application to engineering and computer Science**: N Deo,Prentice Hall of India, 1987.
3. **Introduction to Graph Theory**: D B West Pearson. Education inc., 2001, 2nd Ed.
4. **Graph theory with applications:** J A Bondy & U S R Murthy, Elsevier, 1976.
5. **College Graph Theory**: V. R. Kulli, Vishwa International Publications, 2012.

[BMSEC]-Paper 6.2B: Lattice and Boolean Algebra

Unit I: Lattices: Definition, properties, bounded lattices, distributive lattices, complements, complimented lattices, Isomorphism and Isomorphic lattices.

(15 hrs)

Unit II: Boolean Algebra. Introduction, operator , definition, principle of duality, fundamental theorems on Boolean Algebra, relation, Boolean function, Disjunctive normal form , Conjunctive normal form, conversion.
Switching circuits: Switching and Boolean function.

(15 hrs)

Reference Books:
 1. **Elements of Discrete Mathematics** : Liu C.L, McGraw-Hill, 2017.
 2. **Discrete Mathematical structure:** M.K. Sen and B.C. Chakraborthy, Books & Allied Ltd, 2012.
 3. **Discrete Mathematics:** S. Lipschutz and M. Lipson, Schaum's, 2017.

FIRST SEMESTER
[BMDSC] Paper 1.1: Differential Calculus-I

QUESTION NUMBERS	TOPICS & NUMBER OF SUB DIVISIONS TO BE SET IN THE TOPICS		NUMBER OF SUBDIVISION TO BE ANSWERED	MARKS FOR EACH SUB DIVISION	MAX.MARKS FOR THE QUESTION
I	TOPIC-1: 5 TOPIC-2: 3	TOTAL-08	5	2	10
II	TOPIC-1: 5 TOPIC-2: 5	TOTAL-10	6	5	30
III	TOPIC-1: 2 TOPIC-2: 2	TOTAL-04	2	10	20
				TOTAL MARKS	60

FIRST SEMESTER
[BMDSC] Paper 1.2 : Algebra

QUESTION NUMBERS	TOPICS & NUMBER OF SUB DIVISIONS TO BE SET IN THE TOPICS		NUMBER OF SUBDIVISION TO BE ANSWERED	MARKS FOR EACH SUB DIVISION	MAX.MARKS FOR THE QUESTION
I	TOPIC-1: 5 TOPIC-2: 3	TOTAL-08	5	2	10
II	TOPIC-1: 6 TOPIC-2: 4	TOTAL-10	6	5	30
III	TOPIC-1: 3 TOPIC-2: 1	TOTAL-04	2	10	20
				TOTAL MARKS	60

SECOND SEMESTER
[BMDSC] Paper 2.1: Differential Calculus-II

QUESTION NUMBERS	TOPICS & NUMBER OF SUB DIVISIONS TO BE SET IN THE TOPICS		NUMBER OF SUBDIVISION TO BE ANSWERED	MARKS FOR EACH SUB DIVISION	MAX.MARKS FOR THE QUESTION
I	TOPIC-1: 3 TOPIC-2: 5		5	2	10
	TOTAL-08				
II	TOPIC-1: 4 TOPIC-2: 6		6	5	30
	TOTAL-10				
III	TOPIC-1: 1 TOPIC-2: 3		2	10	20
	TOTAL-04				
				TOTAL MARKS	60

SECOND SEMESTER
[BMDSC]   Paper- 2.2: INTEGRAL CALCULUS AND GEOMETRY

QUESTION NUMBERS	TOPICS & NUMBER OF SUB DIVISIONS TO BE SET IN THE TOPICS		NUMBER OF SUBDIVISION TO BE ANSWERED	MARKS FOR EACH SUB DIVISION	MAX.MARKS FOR THE QUESTION
I	TOPIC-1: 3 TOPIC-2: 5		5	2	10
	TOTAL-08				
II	TOPIC-1: 4 TOPIC-2: 6		6	5	30
	TOTAL-10				
III	TOPIC-1: $1\frac{1}{2}$ TOPIC-2: $2\frac{1}{2}$		2	10	20
	TOTAL-04				
				TOTAL MARKS	60

THIRD SEMESTER
[BMDSC] Paper - 3.1 : Number Theory and Group Theory

QUESTION NUMBERS	TOPICS & NUMBER OF SUB DIVISIONS TO BE SET IN THE TOPICS	NUMBER OF SUBDIVISION TO BE ANSWERED	MARKS FOR EACH SUB DIVISION	MAX.MARKS FOR THE QUESTION
I	TOPIC-1: 4 TOPIC-2: 4 TOTAL-08	5	2	10
II	TOPIC-1: 5 TOPIC-2: 5 TOTAL-10	6	5	30
III	TOPIC-1: $1\frac{1}{2}$ TOPIC-2: $2\frac{1}{2}$ TOTAL-04	2	10	20
			TOTAL MARKS	60

THIRD SEMESTER
[BMDSC] Paper-3.2 : Analysis and Trigonometry

QUESTION NUMBERS	TOPICS & NUMBER OF SUB DIVISIONS TO BE SET IN THE TOPICS	NUMBER OF SUBDIVISION TO BE ANSWERED	MARKS FOR EACH SUB DIVISION	MAX.MARKS FOR THE QUESTION
I	TOPIC-1: 4 TOPIC-2: 4 TOTAL-08	5	2	10
II	TOPIC-1: 6 TOPIC-2: 4 TOTAL-10	6	5	30
III	TOPIC-1: $2\frac{1}{2}$ TOPIC-2: $1\frac{1}{2}$ TOTAL-04	2	10	20
			TOTAL MARKS	60

FOURTH SEMESTER
[BMDSC] Paper-4.1: Sequences and Series

QUESTION NUMBERS	TOPICS & NUMBER OF SUB DIVISIONS TO BE SET IN THE TOPICS		NUMBER OF SUBDIVISION TO BE ANSWERED	MARKS FOR EACH SUB DIVISION	MAX.MARKS FOR THE QUESTION
I	TOPIC-1: 4 TOPIC-2: 4		5	2	10
	TOTAL-08				
II	TOPIC-1: 4 TOPIC-2: 6		6	5	30
	TOTAL-10				
III	TOPIC-1: $1\frac{1}{2}$ TOPIC-2: $2\frac{1}{2}$		2	10	20
	TOTAL-04				
				TOTAL MARKS	60

FOURTH SEMESTER
[BMDSC] Paper 4.2: Vector Calculus and Differential Equations

QUESTION NUMBERS	TOPICS & NUMBER OF SUB DIVISIONS TO BE SET IN THE TOPICS		NUMBER OF SUBDIVISION TO BE ANSWERED	MARKS FOR EACH SUB DIVISION	MAX.MARKS FOR THE QUESTION
I	TOPIC-1: 3 TOPIC-2: 5		5	2	10
	TOTAL-08				
II	TOPIC-1: 4 TOPIC-2: 6		6	5	30
	TOTAL-10				
III	TOPIC-1: 1 TOPIC-2: 3		2	10	20
	TOTAL-04				
				TOTAL MARKS	60

FIFTH SEMESTER (Group 1)
[BMDSE] Paper - 5.1A : Real Analysis

QUESTION NUMBERS	TOPICS & NUMBER OF SUB DIVISIONS TO BE SET IN THE TOPICS	NUMBER OF SUBDIVISION TO BE ANSWERED	MARKS FOR EACH SUB DIVISION	MAX.MARKS FOR THE QUESTION
I	TOPIC-1: 3 TOPIC-2: 5 TOTAL-08	5	2	10
II	TOPIC-1: 5 TOPIC-2: 5 TOTAL-10	6	5	30
III	TOPIC-1: $1\frac{1}{2}$ TOPIC-2: $2\frac{1}{2}$ TOTAL-04	2	10	20
			TOTAL MARKS	**60**

FIFTH SEMESTER (Group 1)
[BMDSE] Paper-5.1B: Numerical Analysis

QUESTION NUMBERS	TOPICS & NUMBER OF SUB DIVISIONS TO BE SET IN THE TOPICS	NUMBER OF SUBDIVISION TO BE ANSWERED	MARKS FOR EACH SUB DIVISION	MAX.MARKS FOR THE QUESTION
I	TOPIC-1: 5 TOPIC-2: 3 TOTAL-08	5	2	10
II	TOPIC-1: 5 TOPIC-2: 5 TOTAL-10	6	5	30
III	TOPIC-1: $2\frac{1}{2}$ TOPIC-2: $1\frac{1}{2}$ TOTAL-04	2	10	20
			TOTAL MARKS	**60**

FIFTH SEMESTER (Group 2)
[BMDSE] Paper-5.2A : Laplace Transforms and Fourier analysis.

QUESTION NUMBERS	TOPICS & NUMBER OF SUB DIVISIONS TO BE SET IN THE TOPICS	NUMBER OF SUBDIVISION TO BE ANSWERED	MARKS FOR EACH SUB DIVISION	MAX.MARKS FOR THE QUESTION
I	TOPIC-1: 5 TOPIC-2: 3 TOTAL-08	5	2	10
II	TOPIC-1: 5 TOPIC-2: 5 TOTAL-10	6	5	30
III	TOPIC-1: $2\frac{1}{2}$ TOPIC-2: $1\frac{1}{2}$ TOTAL-04	2	10	20
			TOTAL MARKS	**60**

FIFTH SEMESTER (Group 2)
[BMDSE] Paper-5.2B: Finite difference based Numerical Methods

QUESTION NUMBERS	TOPICS & NUMBER OF SUB DIVISIONS TO BE SET IN THE TOPICS	NUMBER OF SUBDIVISION TO BE ANSWERED	MARKS FOR EACH SUB DIVISION	MAX.MARKS FOR THE QUESTION
I	TOPIC-1: 5 TOPIC-2: 3 TOTAL-08	5	2	10
II	TOPIC-1: 5 TOPIC-2: 5 TOTAL-10	6	5	30
III	TOPIC-1: $2\frac{1}{2}$ TOPIC-2: $1\frac{1}{2}$ TOTAL-04	2	10	20
			TOTAL MARKS	**60**

SIXTH SEMESTER (Group 1)
[BMDSE]   PAPER-6.1A: Differential Equations

QUESTION NUMBERS	TOPICS & NUMBER OF SUB DIVISIONS TO BE SET IN THE TOPICS		NUMBER OF SUBDIVISION TO BE ANSWERED	MARKS FOR EACH SUB DIVISION	MAX.MARKS FOR THE QUESTION
I	TOPIC-1: 5 TOPIC-2: 3		5	2	10
	TOTAL-08				
II	TOPIC-1: 5 TOPIC-2: 5		6	5	30
	TOTAL-10				
III	TOPIC-1: $2\frac{1}{2}$ TOPIC-2: $1\frac{1}{2}$		2	10	20
	TOTAL-04				
				TOTAL MARKS	**60**

SIXTH SEMESTER (Group 1)
[BMDSE] Paper-6.1B: Modern Algebra

QUESTION NUMBERS	TOPICS & NUMBER OF SUB DIVISIONS TO BE SET IN THE TOPICS		NUMBER OF SUBDIVISION TO BE ANSWERED	MARKS FOR EACH SUB DIVISION	MAX.MARKS FOR THE QUESTION
I	TOPIC-1: 3 TOPIC-2: 5		5	2	10
	TOTAL-08				
II	TOPIC-1: 5 TOPIC-2: 5		6	5	30
	TOTAL-10				
III	TOPIC-1: $1\frac{1}{2}$ TOPIC-2: $2\frac{1}{2}$		2	10	20
	TOTAL-04				
				TOTAL MARKS	**60**

SIXTH SEMESTER (Group 2)
[BMDSE] PAPER-6.2A : TOPOLOGY AND COMPLEX ANALYSIS

QUESTION NUMBERS	TOPICS & NUMBER OF SUB DIVISIONS TO BE SET IN THE TOPICS		NUMBER OF SUBDIVISION TO BE ANSWERED	MARKS FOR EACH SUB DIVISION	MAX.MARKS FOR THE QUESTION
I	TOPIC-1: 3 TOPIC-2: 5		5	2	10
	TOTAL-08				
II	TOPIC-1: 4 TOPIC-2: 6		6	5	30
	TOTAL-10				
III	TOPIC-1: $1\frac{1}{2}$ TOPIC-2: $2\frac{1}{2}$		2	10	20
	TOTAL-04				
				TOTAL MARKS	60

SIXTH SEMESTER (Group 2)
[BMDSE] Paper-6.2B: Linear Algebra

QUESTION NUMBERS	TOPICS & NUMBER OF SUB DIVISIONS TO BE SET IN THE TOPICS		NUMBER OF SUBDIVISION TO BE ANSWERED	MARKS FOR EACH SUB DIVISION	MAX.MARKS FOR THE QUESTION
I	TOPIC-1: 3 TOPIC-2: 5		5	2	10
	TOTAL-08				
II	TOPIC-1: 5 TOPIC-2: 5		6	5	30
	TOTAL-10				
III	TOPIC-1: $1\frac{1}{2}$ TOPIC-2: $2\frac{1}{2}$		2	10	20
	TOTAL-04				
				TOTAL MARKS	60

FIFTH SEMESTER (Group 1)
[BMSEC]-Paper 5.1A: Difference equation

QUESTION NUMBERS	TOPICS & NUMBER OF SUB DIVISIONS TO BE SET IN THE TOPICS	NUMBER OF SUBDIVISION TO BE ANSWERED	MARKS FOR EACH SUB DIVISION	MAX.MARKS FOR THE QUESTION
I	TOPIC-1: 3 TOPIC-2: 2 TOTAL-05	3	2	6
II	TOPIC-1: 3 TOPIC-2: 3 TOTAL-6	4	5	20
III	TOPIC-1: 2 TOPIC-2: 2 TOTAL-04	2	7	14
			TOTAL MARKS	**40**

FIFTH SEMESTER (Group 1)
[BMSEC]-Paper 5.1B: Applications of Calculus

QUESTION NUMBERS	TOPICS & NUMBER OF SUB DIVISIONS TO BE SET IN THE TOPICS	NUMBER OF SUBDIVISION TO BE ANSWERED	MARKS FOR EACH SUB DIVISION	MAX.MARKS FOR THE QUESTION
I	TOPIC-1: 3 TOPIC-2: 2 TOTAL-05	3	2	6
II	TOPIC-1: 3 TOPIC-2: 3 TOTAL-6	4	5	20
III	TOPIC-1: 2 TOPIC-2: 2 TOTAL-04	2	7	14
			TOTAL MARKS	**40**

FIFTH SEMESTER (Group 2)
[BMSEC]-Paper 5.2A: Statics

QUESTION NUMBERS	TOPICS & NUMBER OF SUB DIVISIONS TO BE SET IN THE TOPICS	NUMBER OF SUBDIVISION TO BE ANSWERED	MARKS FOR EACH SUB DIVISION	MAX.MARKS FOR THE QUESTION
I	TOPIC-1: 3 TOPIC-2: 2 TOTAL-05	3	2	6
II	TOPIC-1: 4 TOPIC-2: 2 TOTAL-6	4	5	20
III	TOPIC-1: 3 TOPIC-2: 1 TOTAL-04	2	7	14
			TOTAL MARKS	40

FIFTH SEMESTER (Group 2)
[BMSEC]-Paper 5.2B: Dynamics

QUESTION NUMBERS	TOPICS & NUMBER OF SUB DIVISIONS TO BE SET IN THE TOPICS	NUMBER OF SUBDIVISION TO BE ANSWERED	MARKS FOR EACH SUB DIVISION	MAX.MARKS FOR THE QUESTION
I	TOPIC-1: 3 TOPIC-2: 2 TOTAL-05	3	2	6
II	TOPIC-1: 3 TOPIC-2: 3 TOTAL-6	4	5	20
III	TOPIC-1: 2 TOPIC-2: 2 TOTAL-04	2	7	14
			TOTAL MARKS	40

SIXTH SEMESTER (Group 1)
[BMSEC]-Paper 6.1 A   : Calculus of variations

QUESTION NUMBERS	TOPICS & NUMBER OF SUB DIVISIONS TO BE SET IN THE TOPICS	NUMBER OF SUBDIVISION TO BE ANSWERED	MARKS FOR EACH SUB DIVISION	MAX.MARKS FOR THE QUESTION
I	TOPIC-1: 3 TOPIC-2: 2 TOTAL-05	3	2	6
II	TOPIC-1: 3 TOPIC-2: 3 TOTAL-6	4	5	20
III	TOPIC-1: 2 TOPIC-2: 2 TOTAL-04	2	7	14
			TOTAL MARKS	40

SIXTH SEMESTER (Group 1)
[BMSEC]-Paper 6.1B   : Linear Programming Problems.

QUESTION NUMBERS	TOPICS & NUMBER OF SUB DIVISIONS TO BE SET IN THE TOPICS	NUMBER OF SUBDIVISION TO BE ANSWERED	MARKS FOR EACH SUB DIVISION	MAX.MARKS FOR THE QUESTION
I	TOPIC-1: 3 TOPIC-2: 2 TOTAL-05	3	2	6
II	TOPIC-1: 3 TOPIC-2: 3 TOTAL-6	4	5	20
III	TOPIC-1: 2 TOPIC-2: 2 TOTAL-04	2	7	14
			TOTAL MARKS	40

SIXTH SEMESTER (Group 2)
[BMSEC]-Paper 6.2A : Graph Theory

QUESTION NUMBERS	TOPICS & NUMBER OF SUB DIVISIONS TO BE SET IN THE TOPICS	NUMBER OF SUBDIVISION TO BE ANSWERED	MARKS FOR EACH SUB DIVISION	MAX.MARKS FOR THE QUESTION
I	TOPIC-1: 3 TOPIC-2: 2 TOTAL-05	3	2	6
II	TOPIC-1: 3 TOPIC-2: 3 TOTAL-6	4	5	20
III	TOPIC-1: 2 TOPIC-2: 2 TOTAL-04	2	7	14
			TOTAL MARKS	**40**

SIXTH SEMESTER (Group 2)
[BMSEC]-Paper 6.2B : Lattice and Boolean Algebra

QUESTION NUMBERS	TOPICS & NUMBER OF SUB DIVISIONS TO BE SET IN THE TOPICS	NUMBER OF SUBDIVISION TO BE ANSWERED	MARKS FOR EACH SUB DIVISION	MAX.MARKS FOR THE QUESTION
I	TOPIC-1: 3 TOPIC-2: 2 TOTAL-05	3	2	6
II	TOPIC-1: 3 TOPIC-2: 3 TOTAL-6	4	5	20
III	TOPIC-1: 2 TOPIC-2: 2 TOTAL-04	2	7	14
			TOTAL MARKS	**40**