GULBARGA UNIVERSITY
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ಸಂ.ಗುವಿಕ/ವಿಮವಿ/ಬಿ.ಓಎಸ್/2018–19/709 ದಿನಾಂಕ: 5-7-18

ಅಧಿಸೂಚನೆ

ವಿಷಯ: ಬಿ.ಎಸ್ಸಿ ಗಣಿತ ಕೋರ್ಸಿಗಾಗಿ ಸಿಬಿಸಿಎಸ್ ಪದ್ಧತಿಯನ್ನು ಅಳವಡಿಸಿಕೊಂಡು ಅದಕ್ಕನುಗುಣವಾಗಿ ಪಠ್ಯಕ್ರಮವನ್ನು ಜಾರಿಗೊಳಿಸಿದ ಬಗ್ಗೆ.

ಉಲ್ಲೇಖ: 1) ಸ್ನಾತಕ ಅಧ್ಯಯನ ಮಂಡಳಿಯ ಸಭೆಯ ದಿನಾಂಕ: 11.06.2018.
2) ವಿಜ್ಞಾನ ಮತ್ತು ತಂತ್ರಜ್ಞಾನ ನಿಕಾಯದ ಸಭೆ ದಿನಾಂಕ: 14.06.2018.
3) ವಿದ್ಯಾವಿಷಯಕ ಪರಿಷತ್ ಸಭೆಯ ಗೊತ್ತುವಳಿ ಸಂಖ್ಯೆ 11 ದಿನಾಂಕ.26.06.2018.

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ಉಲ್ಲೇಖ (3) ರಲ್ಲಿನ ವಿದ್ಯಾವಿಷಯಕ ಪರಿಷತ್‌ನ ಸಭೆಯ ಗೊತ್ತುವಳಿ ಸಂಖ್ಯೆ 11 ನ್ನು ಅನುಷ್ಠಾನಗೊಳಿಸುತ್ತ; ಬಿ.ಎಸ್ಸಿ ಗಣಿತ I ರಿಂದ VIನೇ ಸೆಮೆಸ್ಟರ ಪಠ್ಯಕ್ರಮವನ್ನು ಅಧ್ಯಯನ ಮಂಡಳಿಯು ಪರಿಷ್ಕರಿಸಿ ಅನುಮೋದಿಸಿರುತ್ತದೆ. ದಿನಾಂಕ 14.06.2018. ರಂದು ಜರುಗಿದ ವಿಜ್ಞಾನ ಮತ್ತು ತಂತ್ರಜ್ಞಾನ ನಿಕಾಯದ ಸಭೆಯಲ್ಲಿ ಸದರಿ ಪಠ್ಯಕ್ರಮವನ್ನು 2018–19ನೇ ಸಾಲಿನಿಂದ ಅನ್ವಯವಾಗುವಂತೆ ಜಾರಿಗೊಳಿಸಲು ಶಿಫಾರಸ್ಸು ಮಾಡಲಾಗಿದೆ.

ಅದರಂತೆ, 2018–19ನೇ ಸಾಲಿನಿಂದ ಅನ್ವಯವಾಗುವಂತೆ ಬಿ.ಎಸ್ಸಿ ಗಣಿತ ಸ್ನಾತಕ ಕೋರ್ಸಿನ I ರಿಂದ VIನೇ ಸೆಮೆಸ್ಟರ ಪಠ್ಯಕ್ರಮವನ್ನು ಪರಿಷ್ಕರಿಸಿ ಜಾರಿಗೊಳಿಸಲಾಗಿದೆ.

ಈ ಮಾಹಿತಿಯನ್ನು ಸಂಬಂಧಪಟ್ಟ ಶಿಕ್ಷಕರ ಹಾಗೂ ವಿದ್ಯಾರ್ಥಿಗಳ ಗಮನಕ್ಕೆ ತರಲು ಸೂಚಿಸಲಾಗಿದೆ. ಪಠ್ಯಕ್ರಮದ ವಿವರವನ್ನು ಗುಲಬರ್ಗಾ ವಿಶ್ವವಿದ್ಯಾಲಯದ ವೆಬ್‌ಸೈಟ್ www.gug.ac.in ದಿಂದ ಪಡೆಯಬಹುದು.

ಕುಲಸಚಿವರು
ಗುಲಬರ್ಗಾ ವಿಶ್ವವಿದ್ಯಾಲಯ, ಕಲಬುರಗಿ

ಗೆ,

1. ಮುಖ್ಯಸ್ಥರು, ಗಣಿತ ಅಧ್ಯಯನ ವಿಭಾಗ, ಗು.ವಿ.ಕಲಬುರಗಿ.
2. ಎಲ್ಲಾ ಪದವಿ ಮಹಾವಿದ್ಯಾಲಯಗಳ ಪ್ರಾಂಶುಪಾಲರಿಗೆ.

ಪ್ರತಿಗಳು:

1. ಡೀನ್‌ರು, ವಿಜ್ಞಾನ ಮತ್ತು ತಂತ್ರಜ್ಞಾನ ನಿಕಾಯ, ಗು.ವಿ.ಕಲಬುರಗಿ ರವರ ಮಾಹಿತಿಗಾಗಿ.
2. ಕುಲಸಚಿವರು (ಮೌಲ್ಯಮಾಪನ), ಗುಲಬರ್ಗಾ ವಿಶ್ವವಿದ್ಯಾಲಯ, ಕಲಬುರಗಿ ರವರ ಮಾಹಿತಿಗಾಗಿ.
3. ನಿರ್ದೇಶಕರು, ಯೋಜನೆ, ಮೇಲ್ವಿಚಾರಣೆ ಹಾಗೂ ಮೌಲ್ಯಮಾಪನ ಮಂಡಳಿ, ಗು.ವಿ.ಕಲಬುರಗಿ.
4. ಗ್ರಂಥಪಾಲಕರು, ಗು.ವಿ.ಕಲಬುರಗಿ ರವರ ಮಾಹಿತಿಗಾಗಿ
5. ವಿಜ್ಞಾನ ಮತ್ತು ತಂತ್ರಜ್ಞಾನ ನಿಕಾಯದ ಎಲ್ಲಾ ವಿಭಾಗಗಳ ಮುಖ್ಯಸ್ಥರಿಗೆ
6. ಮುಖ್ಯಸ್ಥರು, ಗಣಕಕೇಂದ್ರ, ಗು.ವಿ.ಕಲಬುರಗಿ ಇವರಿಗೆ ಸದರಿ ಪಠ್ಯಕ್ರಮವನ್ನು ವಿಶ್ವವಿದ್ಯಾಲಯದ ವೆಬ್ ಸೈಟ್ ನಲ್ಲಿ ಪ್ರಕಟಿಸಲು ತಿಳಿಸಲಾಗಿದೆ.
7. ಕುಲಪತಿಗಳ ಆಪ್ತ ಕಾರ್ಯದರ್ಶಿ / ಕುಲಸಚಿವರ ಆಪ್ತ ಸಹಾಯಕರ ಮಾಹಿತಿಗಾಗಿ.

GULBARGA UNIVERSITY, KALABURAGI
DEPARTMENT OF MATHEMATICS

PROPOSED SYLLSBUS OF

MATHEMATICS

FOR SIX SEMESTER B. Sc. DEGREE COURSE

UNDER

CHOICE BASED CREDIT SYSTEM (CBCS)

WITH EFFECT FROM 2018-19 AND ONWARDS

GULBARGA UNIVERSITY, KALABURAGI

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

Gulbarga University is proposed to introduce Choice Based Credit System (CBCS) for B. Sc. Programme from the academic year 2018 proposed syllabus has been prepared as per the guidelines issued by PMEB. The UG Board of Studies in Mathematics has prep approved this syllabus in its meeting held on 11.06.2018.

B.Sc. Mathematics Programme Course Matrix for Semester I–IV

Semester	Course Code	Title of the Course	Type of instruction & hours per week/course	Credits	Hours of Exam(SEE) per Course/Sem.	Max. Marks for I.A/ Course/Sem.	Max. Marks for SEE per Course/Sem.	Max Marks per Course/Sem.
I	BMDSC1T	Algebra-I and Calculus-I	T 4	4	3	20	80	100
	BMDSC1P	Practical-1	P 4	2	3	10	40	50
II	BMDSC2T	Real analysis-I and Calculus-II	T 4	4	3	20	80	100
	BMDSC2P	Practical -2	P 4	2	3	10	40	50
III	BMDSC3T	Algebra-II, Real Analysis-II and Calculus-III	T 4	4	3	20	80	100
	BMDSC3P	Practical -3	P 4	2	3	10	40	50
IV	BMDSC4T	Differential Equations	T 4	4	3	20	80	100
	BMDSC4P	Practical -4	P 4	2	3	10	40	50

BMDSC : B.Sc. Mathematics Discipline Specific Course

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B.Sc. Mathematics Programme Course Matrix for semester V-VI

Discipline Specific Electives (DSE)
(Choose any One for each Semester)

Semester	Course code	Code and Title	Type of instruction & hours per week/course	Credits	Hours of Exam(SEE) per Course/Sem.	Max. Marks for I.A/ Course/Sem.	Max. Marks for SEE per Course/Sem.	Max Marks per Course/Sem.
V	BMDSE5A	BMDSE5AT – Complex Analysis	T 4	4	3	20	80	100
		BMDSE5AP – Practical-5 (A)	P 4	2	3	10	40	50
	BMDSE5B	BMDSE5BT – Graph Theory-I	T 4	4	3	20	80	100
		BMDSE5BP – Practical-5 (B)	P 4	2	3	10	40	50
	BMDSE5C	BMDSE5CT – Numerical Analysis- I	T 4	4	3	20	80	100
		BMDSE5CP – Practical-5 (C)	P 4	2	3	10	40	50
VI	BMDSE6A	BMDSE6AT – Mathematical Analysis	T 4	4	3	20	80	100
		BMDSE6AP – Practical-6 (A)	P 4	2	3	10	40	50
	BMDSE6B	BMDSE6BT – Graph Theory-II	T 4	4	3	20	80	100
		BMDSE6BP – Practical-6 (B)	P 4	2	3	10	40	50
	BMDSE6C	BMDSE6CT – Numerical Analysis- II	T 4	4	3	20	80	100
		BMDSE6CP – Practical-6 (C)	P 4	2	3	10	40	50

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Skill Enhancement Course (SEC)
(Choose any Two for each Semester)

Sem.	Course code	Title	Type of instruction & hours per week/course	Credits	Hours of Exam(SEE) per Course/Sem.	Max. Marks for I.A/ Course/Sem.	Max. Marks for SEE per Course/Sem.	Max Marks per Course/Sem.
V	BMSEC5A	Linear Programming Problems	T 2	2	1 hr 30 min	10	40	50
	BMSEC5B	Laplace Transforms	T 2	2	1 hr 30 min	10	40	50
	BMSEC5C	Linear Algebra	T 2	2	1 hr 30 min	10	40	50
	BMSEC5D	Calculus of Variations	T 2	2	1 hr 30 min	10	40	50
VI	BMSEC6A	Transportation and Assignment Problems	T 2	2	1 hr 30 min	10	40	50
	BMSEC6B	Fourier Series & Harmonic Analysis	T 2	2	1 hr 30 min	10	40	50
	BMSEC6C	Boolean Algebra & Lattices	T 2	2	1 hr 30 min	10	40	50
	BMSEC6D	Vector Calculus	T 2	2	1 hr 30 min	10	40	50

Note: For practical's: Number of Students per batch per teacher : 15 ; Two teachers for a batch of 25 students

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Course: BMDSC1T

ALGEBRA-I AND CALCULUS-I

Credits: 4 **Max. Marks: 100 (SEE-80 + I.A.- 20)** **Total Lecture Hours: 60**

Unit-1: Matrices

Recapitulation of Matrices, Symmetric and skew-symmetric matrices, Hermitian, Skew-Hermitian matrices, Orthogonal and unitary matrices and their properties, Rank of a Matrix, Reducing the matrix to the Echelon and normal form by using Elementary row and column operations. (Lecture hours-15)

Unit-2 :System of linear equations

System of 'm' linear equations in 'n' unknowns, Consistency Criterion, Existence of non-trivial solutions of homogeneous system, Criterion for existence and uniqueness of solution of non-homogeneous systems.

Cayley Hamilton Theorem, Verification of Cayley-Hamilton Theorem and determination of A^{-1}, A^2, A^3.

(Lecture hours-15)

Unit-3: Successive Differentiation

Successive differentiation, Formula for n^{th} derivative of the following functions e^{ax}, $(ax+b)^n$, $\log(ax+b)$, $\sin(ax+b)$, $\cos(ax+b)$, $e^{ax}\sin(bx+c)$ and $e^{ax}\cos(bx+c)$, Leibnitz's theorem and applications.

Limits, continuity and bounds of a function, Algebra of continuous functions, Theorems on continuous functions (Every continuous function is bounded, Intermediate value theorem).

(Lecture hours-15)

Unit-4 : Differentiability of functions

Differentiability of functions, Standard theorems including (Every differentiable function is continuous but not conversely), Rolle's theorem, Lagrange's Mean value theorem and Cauchy's Mean value theorem , Taylor's Theorem , Taylor's and Maclaurin's Series and related examples. Indeterminate forms (L-Hospital rule).

(Lecture hours-15)

Books for Reference :

1) Matrices by Shanti Narayan
2) Matrices by M. Pille .
3) Differential Calculus by Shanthi Narayan (S.Chand& Co.)
4) Advanced Calculus by Murry R Spiegal (Schaum Series)

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5) Mathematical Analysis by S.C. Malik (Wiley Eastern)
6) Modern College Calculus by D.C. Pavate
7) UG Mathematics – I by Mahantesh S. Swamy

Course: BMDSC1P

PRACTICALS-1

Credits: 2 **Max. Marks: 50 (SEE-40 + IA-10)** **Practical Hours: 4 /week**

- Introduction to SciLab/ Maxima and commands related to the topic.

1. Computation of Sum, Difference and Product of two Matrices.
2. Computation of trace and transpose of matrices.
3. Computation of rank of matrix and row reduced echelon form.
4. Computation of inverse of a matrix using Cayley-Hamilton theorem.
5. Solution of system of equations (Homogeneous).
6. Solution of system of equations (Non-homogeneous).
7. Finding n^{th} derivative of e^{ax}, hyperbolic functions and trigonometric functions.
8. Finding n^{th} derivative of algebraic functions.
9. Finding n^{th} derivative of Logarithmic function.
10. Finding n^{th} derivative of $e^{ax}\sin(ax+b)$, $e^{ax}\cos(ax+b)$.
11. Examples on Rolles theorm, Lagranges and Cauchy's theorem.
12. Taylores and Maclaurin's series expansion of a given function.

Note: Use the **MAXIMA/SciLab** Open-source Software to execute the Practical problems and verify manually.

SciLab: It can be downloaded from http://www.scilab.org/download. some materials for scilab can be found on http://wiki.scilab.org/Tutorialsarchives.

MAXIMA: MAXIMA is an open source computer algebra system for solving typical calculaus problems. The latest version of this document can be found at http://maxim.sourceforge.net/documentation.html.

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Course: BMDSC2T

REAL ANALYSIS-I AND CALCULUS-II

Credits: 4 **Max. Marks: 100 (SEE-80 + I.A.- 20)** **Total Lecture Hours: 60**

Unit-1: Sequences

Bounded and Unbounded sequences, Convergent, divergent and oscillatory sequences, Monotonic Sequences, Theorems on sequences (Every convergent sequence has unique limit) , If $\{x_n\}$ converges to l then $\{|x_n|\}$ converges to $|l|$, Every convergent sequence is bounded, Sum, Difference, Product and Quotient of two convergent sequences is convergent, $(1+1/n)^n$ sequence converges the limit e.

(Lecture hours-15)

Unit-2: Infinite Series

Series of non-negative terms, geometric and p- series, Comparison test, De-Alembert's Ratio test, Raabe's test and Cauchy's root test. Alternating series, Leibnitz's test (without proof), Summation of series : exponential, logarithmic and binomial series and related examples.

(Lecture hours-15)

Unit-3: Functions of two and three variables

Limit and continuity, partial derivatives, homogenous functions, Euler's theorem (up to second order), Total derivatives, Jacobian's, Maxima and Minima for two variables.

(Lecture hours-15)

Unit-4: Integral Calculus

Reduction formula for $\sin^n x$, $\cos^n x$, $\tan^n x$, $Sin^m x.Cos^n x$ *and and* $x^m .(\log x)^n$ and examples with limits. Applications of integration for finding length of arc for the curves (i) Parabola from y = 0 to 2a, (ii) Astroid, (iii) Cardiod from 0 to π, (iv) Cycloid from 0 to π, finding surface area and volume of solid of revolution for standard curves :Parabola, Astroid, Cardiod, Cycloid and Sphere . (Lecture hours-15)

Books for Reference :

1) Modern Algebra : Vashistha
2) A Course in Abstract Algebra : Vijay K. Khannan and S.K. Bhambri, Vikas Publishing House Pvt. Ltd.
3) Real Analysis : M. P. Bali
4) Real Analysis : Arora
5) Mathematical Analysis (Wiley. Eastern) : S.C. Malik

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6) Introduction to Real Analysis ; S Narayan and Raisighaniya

7) An Introduction to Sequences, Series ; O.E. Stanitics

8) Infinite Series, Mc. Millan Co. ; Eral d. Rainville

9) Differential calculus by Shanti Narayan (S.Chand& Co.)

10) Integral Calculus by Shanti Narayan (S.Chand& Co.)

11) UG Mathematics – II by Mahantesh S. Swamy

Course: BMDSC2P

PRACTICALS-2

Credits: 2 **Max. Marks: 50 (SEE-40 + IA-10)** **Practical Hours: 4 /week**

- Recaptulation of SciLab/ Maxima commands related to the topic.

1. Examining the convergence of sequences.
2. Example on $\lim_{n\to\infty}\left(1+\frac{1}{n}\right)^n = e$
3. Verification of exponential series.
4. Verification of Logarithmic series.
5. Verification of binomial series.
6. Example on convergence of series of positive terms.
7. Examples on Cauchy's Root test, Raabe's and Ratio test .
8. Examples on convergence of alternating series using Leibnitz theorem.
9. Computation of arc length (Cartesian, Parametric and Polar form).
10. Computation of surface area(Cartesian, Parametric and Polar form).
11. Computation of Volume(Cartesian, Parametric and Polar form).
12. Evaluation of definite integrals and Reduction formulae.

Note: Use the **MAXIMA/SciLab** Open-source Software to execute the Practical problems and verify manually.

SciLab: It can be downloaded from http://www.scilab.org/download. some materials for scilab can be found on http://wiki.scilab.org/Tutorialsarchives.

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Course: BMDSC3T

ALGEBRA-II, REAL ANALYSIS-II AND CALCULUS-III

Credits: 4 **Max. Marks: 100 (SEE-80 + I.A.- 20)** **Total Lecture Hours: 60**

Unit-1: Groups

Definition of Groups and Sub-group and properties, Necessary and sufficient condition for a sub-group, Order of an element, Classification of sub-groups (i) Cyclic sub-groups, (ii) Co-sets, (iii) normal sub-groups, Standard Theorems (Every cyclic group is abelian, Lagrange's theorem, Euler's theorem, Fermat's theorem, Necessary and sufficient condition for normal sub-group).

Homomorphism, Isomorphism, Kernel of homomarphism with examples

(Lecture hours-15)

Unit-2: Riemann Integration

Lower and upper Riemann sums, Lower and upper Riemann integrals, Necessary and sufficient conditions for Riemann Intigrability, Riemann integrals, Properties of Riemann-integrable functions ((i) Upper R-Integral exceeds the lower R-Integral (ii) R-Integral lies between $m(b-a)$ and $M(b-a)$), R-Integrability of (i) continuous function (ii) monotonic function.

(Lecture hours-15)

Unit- 3 : Fundamentals of Reimann Integral

Fundamental theorem of integral calculus, First and second mean value theorem of integral calculus. Leibnitz's result to evaluate the examples of differentiation under the integral sign.

(Lecture hours-15)

Unit-4: Theory of Plane Curves

Polar co-ordinates, Angle between the radius vector and the tangent to the curves, length of the perpendicular from the pole to the tangent to the curve, pedal equation of the curves, whose equation is given in polar form with examples.

Curvature, Radius of curvature, Centre of curvature, Circle of curvature, Evolute and Involute, Envelops with related examples.

(Lecture hours-15)

Books for Reference :

1) Mathematical Analysis (Wiley. Eastern) : S.C. Malik .
2) Higher Algebra (S. Chand & Co.) : Ray &Sharma.
3) Differential calculus : Shanti Narayan (S.Chand& Co.)
4) College Mathematics Vol. I by N. Rudraiah (Sapna, Bangalore)

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5) Reimann Integration : Arora
6) Modern Algebra : Vasishta and Sharma
7) Modern Algebra : I. N. Herstein.
8) UG Mathematics – III by Mahantesh S. Swamy

Course: BMDSC3P

PRACTICALS-3

Credits: 2 **Max. Marks: 50 (SEE-40 + IA-10)** **Practical Hours: 4 /week**

1. Computing the Identity and Inverse element of a Group.
2. Verifying the binary operations
3. Finding order of element of groups.
4. Finding the generator of a cyclic subgroup.
5. Verification of Lagrenges theorem,
6. Verification of Homomarphism and Isomarphism of Groups
7. Verification of Upper and lower Sums
8. Verification of Riemann integrals
9. Verification of Continuous functions.
10. Computation of angle between the radius vector and the tangent.
11. Tracing of Standard curves in 2D.
12. Tracing of Standard curves in 3D.

Note: Use the **MAXIMA/SciLab** Open-source Software to execute the Practical problems and verify manually.

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Course: BMDSC4T

DIFFERENTIAL EQUATIONS

Credits: 4 **Max. Marks: 100 (SEE-80 + I.A.- 20)** **Total Lecture Hours: 60**

Unit-1: Ordinary Differential Equations

Differential equations of first order and higher degree: Equations solvable for p, x, y and Clairault's equations-General and singular solutions.

Higher order differential equations: Linear Differential Equation with constant coefficients, finding Complementary function and Particular integral (When RHS function is of the form e^{ax}, x^n, $\sin ax$, $\cos ax$, $e^{ax}V$, where V is a function of x). (Lecture hours-15)

Unit-2 : Linear Differential Equations

Linear Differential Equation with variable coefficients: Cauchy-Euler Differential Equations, Legendre-Linear differential equations.Solution of Second order Linear differential equations with variable coefficients by the method of Variation of parameters.

(Lecture hours-15)

Unit-3: Total Differential equations

Integrability, Necessary condition for integrability, Conditions for exactness, Solution by inspection method. Simultaneous Differential Equations $\frac{dx}{P} = \frac{dy}{Q} = \frac{dz}{R}$.

(Lecture hours-15)

Unit-4: Partial Differential Equations

Formation of partial differential equations, Lagrange's equation $Pp+Qq = R$, First order non-linear partial differential equations and finding their complete integral by reducing to standard forms $f(p,q)=0$, $f(p,q,z)=0$, $f(x,p)=g(y,q)$, Clairaut's form, Charpit's method (without proof).

(Lecture hours-15)

Books for Reference :

1) Introductory Course in Differential Equations : Daniel Morray
2) Engineering Mathematics : B. S. Grewal
3) Ordinary Differential Equation (Von-Norstand) : Charlton
4) Ordinary and Partial Differential Equation (S.Chand& Co) : Raisinghania M.D.)
5) Differential Equation (TMH) : Simmons G.F.
6) Elements of Partial Differential Equations (McGraw Hill) : I.N. Sneddean
7) UG Mathematics – IV by Mahantesh S. Swamy
8) Differential Equations : F. Arays (Shaum Series)

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Course: BMDSC4P

PRACTICALS-4

Credits: 2 **Max. Marks: 50 (SEE-40 + IA-10)** **Practical Hours: 4 /week**

1. Solution of Differential equations which are solvable for x, y, p.
2. To find singular solution by using Clairaut's form.
3. Finding the C. F. of Linear differential equations with constant coefficients and plot the solutions
4. Finding C.F. of homogeneous linear differential equation and plot the solutions.
5. Finding the P.I. of differential equations up to second order and plot the solutions.
6. Verify Cauchy-Euler Differential Equations.
7. Solution to the Total and simultaneous differential equations and plot the solutions.
8. Verification of exactness of a Differential Equations.
9. Verify Linear partial differential equation of the form $Pp+Qq=R$.
10. Verifying first order non-linear partial differential equations (of the form $f(p,q)=0$, $f(p,q,z)=0$, $f(x,p)=g(y,q)$,Clairaut's form)
11. Verifying non-linear partial differential equation by Charpit's method.
12. Solutions to standard forms $f(p,q)=0$,$f(p,q,z)=0$, $f(x,p)=g(y,q)$.

Note: Use the **MAXIMA/SciLab** Open-source Software to execute the Practical problems and verify manually.

SciLab: It can be downloaded from http://www.scilab.org/download. some materials for scilab can be found on http://wiki.scilab.org/Tutorialsarchives.

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Course: BMDSE5AT

COMPLEX ANALYSIS

Credits: 4 **Max. Marks: 100 (SEE-80 + I.A.- 20)** **Total Lecture Hours: 60**

Unit-1: Complex variables

De-Moivre's Theorem, Expansion of sine and cosine of multiple angles and powers of sin and cosine functions, Exponential form of complex numbers, Hyperbolic functions, Logarithms of complex quantities, Separation of expressions into real and imaginary parts .

(Lecture hours-15)

Unit-2: Functions of Complex Variables

Limits, Continuity, Differentiability. Analytic functions, Cauchy-Riemann Equations (Necessary condition only), Polar form of C-R equations, Harmonic functions, Harmonic conjugate, Construction of analytic function by Milne-Thomson method and related examples.

(Lecture hours-15)

Unit-3: Complex Integration

Basic definitions, Cauchy's integral theorem with examples, Cauchy's integral formula, Evaluation of Contour Integrals by Cauchy's integral formula, Derivatives of analytic function (Statements only), Cauchy's Inequality, Liouville's theorem

(Lecture hours-15)

Unit-4: Calculus of Residues

Residue at a pole, Residue at a pole of order $m > 1$, Cauchy's Residue Theorem, Evaluation of Contour Integrals by using Cauchy's Residue Theorems.

Billinear transformations by using Cross-ratio property with examples.

(Lecture hours-15)

Books for Reference :

1) Complex Analysis : J.N. Sharma.

2) Foundations of Complex Analysis,: Ponnausamy, Narosa Publishing House

3) Complex Analysis : B.S. Tyagi

4) Complex Analysis : Dennis Zill and Patrick D.S.

5) Complex analysis : F. Ayres (Schaum's Series)

5) UG Mathematics –V by Mahantesh S. Swamy

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Course: BMDSE5AP

PRACTICALS-5(A)

Credits: 2 **Max. Marks: 50 (SEE-40 + IA-10)** **Practical Hours: 4 /week**

1. Tracing of circles and straight lines.
2. Construction of analytic function when the real part of $f(z)$ is given.
3. Construction of analytic function when the imaginary part of $f(z)$ is given.
4. Construction of analytic function by Milne-Thomson method.
5. Verifying real and imaginary parts of analytic function being harmonic (i.e u and v satisfying the Laplace's equation).
6. Evaluation of contour integral by Cauchy's integral formula and plot the solutions.
7. Evaluation of complex integrals when the point lies outs side the cantor and plot the solution.
8. Computation of residues with simple poles.
9. Computation of residues when the pole m>1.
10. Evaluation of contour integrals by using Cauchy residue theorem – I
11. Evaluation of contour integrals by using Cauchy residue theorem – II
12. Evaluation of bilinear transform using cross-ratio property.

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Course: BMDSE5BT

GRAPH THEORY-I

Credits: 4 **Max. Marks: 100 (SEE-80 + I.A.- 20)** **Total Lecture Hours: 60**

Unit-1: Basic Concepts of Graphs

Introduction, graphs, finite and null graphs, loops, multi graphs, pseudo graph, simple graph, degree of a vertex, isolated and pendent vertices, connectedness and complete graphs, regular and complementary graphs, minimum and maximum degree, $\sum deg(v_i) = 2q$. The number of vertices of odd degree is even. Isomorphism, line and total graphs (definitions and examples only).

(Lecture hours-15)

Unit-2: Sub-graphs

Sub-graphs, spanning and induced sub-graphs, walk, trial, path, cycle, the shortest path problems, bipartite graph. Characterization of bipartite graphs in terms of its cycles.

(Lecture hours-15)

Unit-3 : Matrix Representation of Graph and Connectivity

Adjacency matrix, Incidence matrix and cycle matrices and rank of matrix, examples thereon. Verification of isomorphism by matrix method. Definition of a path of a matrix and examples.

Connectivity : Vertex and Edge connectivity – Separability, Whitney's Inequality $K(G) \leq \lambda(G) \leq \delta(G)$: Menger's Theorem (Statement only).

(Lecture hours-15)

Unit-4: Trees

Cut Vertex, Bridge, Block, Trees, Spanning Tree, Rooted and Binary Trees, properties of trees and characterizations, forests, centres and centroids.

(Lecture hours-15)

Books for Reference :

1) Introduction to Graph Theory: U.K. : Robin J. Wilson , Longman (London),
2) Graph Theory and Applications : Narsing Deo, (PHI), India.
3) Graph Theory: Frank Harrary, Narosa Publications
4) Graph Theory and Its Applications : D.S.Chandrashekharaiah.
5) Graph Theory and Its Applications :Vasudev.
6) Graph Theory : V. R. Kulli, Vishwa International Publications.

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Course: BMDSE5BP

PRACTICALS-5(B)

Credits: 2 **Max. Marks: 50 (SEE-40 + IA-10)** **Practical Hours: 4 /week**

1. Drawing of Simple, Pseudo and multiple graphs
2. Drawing of regular connected complete, complementary graphs.
3. Drawing of sub-graphs, Induced sub-graphs and spanning sub-graphs.
4. Drawing of bipartite, complete bipartite graphs.
5. Drawing of Walk, Trail, Path and Cycle.
6. Drawing of graph for Adjacency matrix and vise-versa.
7. Drawing of graph for Incidence matrix and vise-versa.
8. Drawing of graph for Cycle matrix.
9. Finding the isomorphism of two graphs
10. Verification of graphs isomorphism by matrix method.
11. Draw Line graph for given graph.
12. Draw Total graph for given graph.

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Course: BMDSE5CT

NUMERICAL ANALYSIS-I

Credits: 4 **Max. Marks: 100 (SEE-80 + I.A.- 20)** **Total Lecture Hours: 60**

Unit-1: Solution of non-linear equations

Definition and Types of errors. Solution of non-linear equations: method of successive bisection, method of false position, Newton-Raphson's iterative method, Secant method.

(Lecture hours-15)

Unit-2: Solution of linear System of equations

Solution of system of equations: Gauss Elimination method, Jacobi's method, Gauss-Seidel method.

(Lecture hours-15)

Unit-3: Finite Differences

Forward difference, backward difference, Shifting operator, Relation between Δ, ∇, E. Difference table and n^{th} differences of a polynomial.

(Lecture hours-15)

Unit-4: Interpolation

Interpolation with equal intervals: Newton-Gregory forwarded and backward interpolation formulae, Interpolation with unequal intervals: Lagrange's and Newton's divided difference interpolation formula.

(Lecture hours-15)

Books for Reference :

1) Numerical Analysis (Prentice Hall of India) : Shastry S.S.
2) Numerical Analysis (Schaum's Series) : Shield P.
3) Numerical Analysis : P.N. Chaterjee.
4) Computer Oriented Numerical Methods : (Prentice Hall of India), Rajaram V.
5) Numerical Methods : (Tata McGraw Hill), Balaguruswamy E.
6) Numerical Methods : (New Age Int), M.K. Jain, S.R.K. Iyangar& R.K. Jain.
7) Mathematics-VI : Mahantesh S. Swamy.

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Course: BMDSE5CP

PRACTICALS-5(C)

Credits: 2 **Max. Marks: 50 (SEE-40 + IA-10)** **Practical Hours: 4 /week**

1. Finding real roots by Bisection method correct up to three decimal places.
2. Finding real roots by method of false position correct up to three decimal places.
3. Finding real roots by Secant method correct up to three decimal places.
4. Finding real roots by Newton-Raphson method correct up to three decimal places.
5. Solution of system of equations by Gauss elimination method .
6. Solution of system of equation by Jacobi's method.
7. Solution of system of equation by Gauss-Seidal method.
8. Construction of difference table (forward, backward and central difference table).
9. Interpolation by using Newton-Gregories forward interpolation formula.
10. Interpolation by using Newton-Gregories backward interpolation formula.
11. Interpolation by using Divided differences interpolation formula.
12. Interpolation by using Lagrange's interpolation formula.

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Course: BMSEC5A

Linear Programming Problems

Credits: 2 **Max. Marks: 50 (SEE-40 + I.A.- 10)** **Total Lecture Hours: 30**

Unit -1: Scope of O.R. and L.P.P.

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 hyper planes, simplex.

(Lecture hours-15)

Unit -2: Solution of LPP

Graphical method, Simplex method, slack and surplus variables, Big-M method, duality in linear programming problem.

(Lecture hours-15)

Books for Reference :

1) Operation Research :S.D. Sharma.
2) Operation Research : Hamdy A Taha, PHI (2006)
3) Operation Research : Kanti Swaroop, P.K. Gupta and Manmohan, S.Chand & Son's (1994)

Course: BMSEC5B

Laplace Transforms

Credits: 2 **Max. Marks: 50 (SEE-40 + I.A.- 10)** **Total Lecture Hours: 30**

Unit -1: Introduction to Laplace transform

Definition of LT, Linearity Property, Laplace Transform of some standard functions - Properties of Laplace transforms. First shifting property, second shifting property, Inverse Laplace Transformation, computation of inverse Laplace Transformation by Partial fractions.

(Lecture hours-15)

Unit-2 :Applications of Laplace transform.

Convolution theorem (only statement) and related examples. Laplace Transform of derivatives, applications of Laplace transforms to solve differential equations up to second order.

(Lecture hours-15)

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Books for Reference :

1) Laplace Transform : (Schaum's Series), Murry R. Spiegal L.
2) Laplace Transforms : Goel and Gupta.
3) Mathematical Physics : B.D. Gupta.
4) Mathematical Physics : Satya Prakash.
5) Higher Engineering Mathematics : B.S. Grewal
6) Mathematics-IV : Mahantesh S. Swamy :

Course: BMSEC5C

Linear Algebra

Credits: 2 **Max. Marks: 50 (SEE-40 + I.A.- 10)** **Total Lecture Hours: 30**

Unit -1: Vector Space

Definition of Vector space, properties and examples of vector space, Vector subspace. Linear combination and Linear span of a set, Linear dependence and Linear independence. Basis and Dimension.

(Lecture hours-15)

Unit-2: Linear transformation

Linear transformation, properties of linear transformation, range, null space, rank and nullity theorem and related examples.

(Lecture hours-15)

Books for Reference :

1) Topics in Algebra : I.N. Herstein.
2) A. First course in Abstract Algebra : Fraleigh J.B.
3) Linear Algebra : (Schaum's Series), Lipsclitz S.
4) Topics in Algebra : Vijaykumar and Bambari
5) Mathematics-IV : Mahantesh S. Swamy

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Course: BMSEC5D

Calculus of Variations

Credits: 2 **Max. Marks: 50 (SEE-40 + I.A.- 10)** **Total Lecture Hours: 30**

Unit-1 :

Variation of a function $f = f(x, y, y')$ – variation of the corresponding functional extermal of a functional – variational problem. Euler's equation and its particular forms – Examples.

(Lecture hours-15)

Unit-2:

Standard problems like geodesics minimal surface of revolution, hanging chine – Brachistochrone problem – Isoperimetric problems.

(Lecture hours-15)

Books for Reference :

1) Calculus of Variations : G.K. Ranganath

2) Mathematical Physics : B.D. Gupta

3) Mathematics-VI : Mahantesh S. Swamy.

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Course: BMDSE6AT

Mathematical Analysis

Credits: 4 **Max. Marks: 100 (SEE-80 + I.A.- 20)** **Total Lecture Hours: 60**

Unit-1: Line and Multiple Integrals

Line integrals along plane and space curves, Double integrals, Change of order, Change of variables, changing into polar coordinates, Triple integrals, over the given region.

(Lecture hours-15)

Unit-2: Improper Integrals

Improper Integrals of the first and second kinds, Convergence (simple examples), Beta and Gamma functions, Applications to evaluate the standard integrals, relations between Beta and Gamma functions, Duplication formula, Sterling formula (statements only)

(Lecture hours-15)

Unit-3: Legendre Differential Equation :

Legendre Polynomials $P_n^{(x)}$ as a solution., Rodrigue's Formula – generating function, Orthogonal property and basic recurrence relation and examples related to the recurrence relations

(Lecture hours-15)

Unit-4: Bessel's Differential Equation:

Bessel's Differential Equation, Bessel function, $J_n(x)$ as a solution – generating formula – integral formula for $J_n(x)$, Orthogonal property – basic recurrence relation and examples related to the recurrence relations.

(Lecture hours-15)

Books for Reference :

1) Real Analysis: Sharma and Vasistha, (Krishna PrakashanMandir, Merruit).

2) Mathematical Analysis : Shantinarayan, (S.Chand& Co.) .

3) Ordinary Differential Equation : Charlton, (Von-Norstand).

4) Ordinary and Partial Differential Equation : Raisinghania M.D, (S.Chand& Co).

5) Differential Equation : Simmons G.F., : (TMH).

6) Higher Engineering Mathematics : B.S. Grewal.

7) S.P. Series-Mathematics –V : Mahantesh S. Swamy.

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Course: BMDSE6AP

PRACTICALS-6(A)

Credits: 2 **Max. Marks: 50 (SEE-40 + I.A.- 10)** **Total Lecture Hours: 30**

1. Evaluation of double integrals with constant limits over the given region when the integrand is unity (i.e., finding the area).
2. Evaluation of double integrals with variable limits over the given region when the integrand is unity (i.e., finding the area).
3. Evaluation of triple integrals with constant limits over the given region when the integrand is unity (i.e., finding the volume).
4. Evaluation of triple integrals with variable limits over the given region when the integrand is unity (i.e., finding the volume).
5. Verification of given integral for its convergence – Algebraic function.
6. Verification of given integral for its convergence – Logarithmic and exponential function.
7. Verification of given integral for its convergence – Trigonometric function.
8. Evaluation of $\Gamma(n)$ for n is integer.
9. Evaluation of $\Gamma(n)$ for n is non-integer.
10. Evaluation of $\beta(m,n)$ for any m and n> 0.
11. Recurrence relation for Legendre's function.
12. Recurrence relation for Bessel's function.

Note: Use the **MAXIMA/SciLab** Open-source Software to execute the Practical problems and verify manually.

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Course: BMDSE6BT

GRAPH THEORY-II

Credits: 4 **Max. Marks: 100 (SEE-80 + I.A.- 20)** **Total Lecture Hours: 60**

Unit-1: Eulerian and Hamiltonian Graphs :

Introduction. The Konigsberg Bridge problem and traveling salesman problem.

Characterization of Eulerian Graph and properties of Hamiltonian graphs. Some applications of graphs in electric networks.

(Lecture hours-15)

Unit-2: Planar Graphs

Plane and Planar graphs, Euler's formula, outer planar graphs, Kuratowski's Theorem - Other characterization of planar graphs – Crossing numbers (examples)

(Lecture hours-15)

Unit-3: Colorability

Introduction, coloring of a graph, chromatic numbers of some of the familiar graphs, Four color conjecture.

(Lecture hours-15)

Unit-4 : Directed Graphs :

Digraphs, Eulerian digraphs, kinds of digraphs, strong and weak digraphs, condensation of digraphs, tournaments.

(Lecture hours-15)

Books for Reference :

1) Introduction to Graph Theory : Longman (London), U.K., Robin J. Wilson.

2) Graph Theory and Applications : (PHI), India, Narsing Deo.

3) Graph Theory : Narosa Publications , Frank Harrary.

4) Graph Theory and Its Applications : DSC

5) Graph Theory with Applications : New Age International Publishers, C. Vasudev.

6) Graph Theory: Vishwa International Publications, V.R. Kulli.

7) Graph Theory and its applications : Balkrishan.

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Course: BMDSE6BP

PRACTICALS-6(B)

Credits: 2 **Max. Marks: 50 (SEE-40 + I.A.- 10)** **Total Lecture Hours: 30**

1. Drawing different types of trees, spanning tree rooted and binary trees.
2. Determination of the cut-vertex, bridge and blocks.
3. Determination of vertex connectivity.
4. Determination of edge connectivity.
5. Verification of Whitney's inequality for different graphs.
6. Drawing of Eulerian graphs.
7. Drawing of non-Eulerian graphs.
8. Drawing of Hamiltonian graphs.
9. Drawing of non-Hamiltonian graphs.
10. Drawing of planar and non-planar graphs.
11. Colorability of graphs.
12. Finding chromatic number for a given graphs.

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Course: BMDSE6CT

NUMERICAL ANALYSIS-II

Credits: 4 **Max. Marks: 100 (SEE-80 + I.A.- 20)** **Total Lecture Hours: 60**

Unit-1: Numerical Differentiation

Numerical differentiation using forwarded and backward difference formulae – computation of first and second derivatives.

(Lecture hours-15)

Unit-2:Numerical integration

General Quadrature formula - Trapezoidal rule, Simpsons 1/3 rd and $3/8^{th}$ rules, Weddles Rule

(Lecture hours-15)

Unit-3: Solution of IVP

Solutions of initial value problem for ordinary linear first order differential equations by Picard's, Taylor's, Euler's, Euler's modified method, and Runge - Kutta Methods of order 2 and 4. (Lecture Hours – 15)

Unit-4: Predictor-correcter methods :

Adams-Bashforth Predictor-Corrector method and Milne Predictor-Corrector method. Finite difference method, shooting method

(Lecture hours-15)

Books for Reference :

1) Numerical Analysis : Shastry S.S., (Prentice Hall of India).

2) Numerical Analysis : Shield P. , (Schaum's Series).

3) Numerical Analysis : P.N. Chaterjee.

4) Computer Oriented Numerical Methods : Rajaram V., (Prentice Hall of India).

5) Numerical Methods : Balaguruswamy E., (Tata McGraw Hill).

6) Numerical Methods : M.K. Jain, S.R.K. Iyangar& R.K. Jain., (New Age Int.).

7) Mathematics-VI :: Mahantesh S. Swamy.

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Course: BMDSE6CP

PRACTICALS-6(C)

Credits: 2 **Max. Marks: 50 (SEE-40 + I.A.- 10)** **Practical Hours: 4/Week**

1. Determination of derivative of a function at the given point using numerical differentiation formula.
2. Numerical integration by - Trapezoidal rule.
3. Numerical integration by – Simpson's 1/3 rule.
4. Numerical integration by – Simpson's 3/8 rule.
5. Numerical integration by – Weddle's rule.
6. Solution of Initial Value Problem by Picard's method.
7. Solution of Initial Value Problem by Taylor's method.
8. Solution of Initial Value Problem by Euler's modified method.
9. Solution of Initial Value Problem by R-KSecond order method.
10. Solution of Initial Value Problem by R-K Fourth order method.
11. Solution of Initial Value Problem by Adams-Bashforth Predictor-Corrector method.
12. Solution of Initial Value Problem by Milne's Predictor-Corrector method.

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Course: BMSEC6A

TRANSPORTATION AND ASSIGNMENT PROBLEMS

Credits: 2 **Max. Marks: 50 (SEE-40 + I.A.- 10)** **Total Lecture Hours: 30**

Unit-1 ; Transportation problems

Introduction, Mathematical formation, existence of feasible solutions, transportation table, initial basic feasible solution: North-west corner method , row minimamethod, coloumn minima method, matrix minima method, Vogel's approximation method, transportation algorithm.

(Lecture hours-15)

Unit-2 : Assignment problem

Assignment problem introduction, mathematical formulation of assignment problem, assignment problem as a special case of transportation problem, assignment algorithm, routing problem, travelling salesman problem.

(Lecture hours-15)

Books for Reference :

1) Operation Research : S.D. Sharma.
2) Operation Research : KantiSwaroop.
3) Operations research : Hamdy A Taha, Macmillan (1998)

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Course: BMSEC6B

FOURIER SERIES AND FOURIER TRANSFORMS

Credits: 2 **Max. Marks: 50 (SEE-40 + I.A.- 10)** **Total Lecture Hours: 30**

Unit-1 : Fourier's Series

Introduction, period functions, Trigonometric series, Euler's formula, Fourier's series of period 2Π, 2L and arbitrary period. Fourier series of even and odd functions. Half range Fourie series.

(Lecture hours-15)

Unit-2 :Fourier Transforms

Definition of FT,Inverse Fourier Transforms, Fourier Sine and Cosine Transforms, Inverse Fourier Sine and Cosine Transforms, Properties, Fourier Transforms of derivatives.

(Lecture hours-15)

Books for Reference :

1) Fourier Series and Fourier transform : (Schaum's sereis), Murry R &Spiegal.

2) Fourier Series & Boundary Value Problem : (McGrew Hill), Churchil R. V & Brown J.W.

3) S.P. Series-Mathematics-IV : Mahantesh S. Swamy.

4) Higher Engineering Mathematics : B.S. Grewal.

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Course: BMSEC6C

LATTICES AND BOOLEAN ALGEBRA

Credits: 2 **Max. Marks: 50 (SEE-40 + I.A.- 10)** **Total Lecture Hours: 30**

Unit-1 : Lattices

Definition, Properties, Bounded Lattices, Sub-lattices, Distributive Lattices, Complements, Complemented Lattices, Isomorphism and Isomorphic Lattices.

(Lecture hours-15)

Unit-2 : Boolean Algebra

Introduction, operator, definition, principle of Duality, fundamental theorems on Boolean Algebra, relation, Boolean function, Disjunctive normal form, Conjuctive normal form, Conversion.

Switching Circuits : Switching and Boolean function.

(Lecture hours-15)

Books for Reference :

1) Elements of discrete Mathematics : Liu C.L.

2) Discrete Mathematical Structures : M.K. Sen and B.C. Chakraborthy , Books and Allied Pvt Ltd., Kolkata, (2002)

3) Discrete Mathematics : S. Lipschutz and M. Lipson.

3) S.P. Series-Mathematics-II : Mahantesh S. Swamy.

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Course: BMSEC6D

VECTOR CALCULUS

Credits: 2 **Max. Marks: 50 (SEE-40 + I.A.- 10)** **Total Lecture Hours: 30**

Unit-1 : Vector Differentiation

Scalar point function, Scalar field, Vector point function, Vector field, gradient of scalar point function, gradient in terms of position vectors, divergences and curl of a vector field, solenoidal and irrotational vector, Laplacian of a scalar field.

(Lecture hours-15)

Unit-2 : Vector Integration :

Green's theorem in the plane, direct consequences of the theorem, the Gauss divergence theorem (without proof), direct consequences of the theorem, the Stoke's theorem (Statement only), direct consequences of the theorem.

(Lecture hours-15)

Books for Reference :

1) Vector Analysis : (Schaum's Series), Murry R &Spiegal L.

2) Vector Analysis : Spain B .

3) Vector Algebra : N.P. Bali.

3) S.P. Series-Mathematics-IV : Mahantesh S. Swamy

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Question Paper Pattern for all the Semester

Max. Marks : 80 Time : 3 Hrs

I. Answer any ten questions	10 x 2 =20
Question No.	Unit
1-3	Unit-1
4-6	Unit-2
7-9	Unit-3
10-12	Unit-4
II. Answer any three questions	3 x 5 =15
1-4	Unit-1
III. Answer any three questions	3 x 5 =15
1-4	Unit-2
IV Answer any three questions	3 x 5 =15
1-4	Unit-3
V. Answer any three questions	3 x 5 =15
1-4	Unit-4

Question Paper Pattern for V & VI Semester

Max. Marks : 40 Time : 1 hr 30 min

I. Answer any five questions	5 x 2 =10
Question No.	Unit
1-3	Unit-1
4-6	Unit-2
II. Answer any three questions	3 x 5 =15
1-4	Unit-1
III. Answer any three questions	3 x 5 =15
1-4	Unit-2

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