

**Learning Outcomes based Curriculum Framework
(LOCF)**

For

**B.Sc. Mathematics
(Four Year Degree Programme)**

w.e.f. Session 2021-22



University School for Graduate Studies

Chaudhary Devi Lal University

Sirsa-125055

2021

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1. About the University School for Graduate Studies (USGS)

National Education Policy (NEP) -2020 has provided an impetus to the changing horizons of Higher Education. Chaudhary Devi Lal University Sirsa has recently established University School for Graduate Studies (USGS) in Teaching Block-IV (Dr. APJ Abdul Kalam Bhawan) of the university in order to start new programmes and courses for tuning ourselves to the latest state-of-the-art in Higher Education. The University School for Graduate Studies (USGS) will focus on strengthening graduate studies especially in the wake of NEP-2020 and will focus on designing, developing and execution of market/industry demand-oriented Four Year Degree Programmes (FYDP). To benefit students, society and faculty, the USGS is destined to start graduate programmes based on Learning Outcomes Curriculum Framework and as per NEP-2020 such as: (i) B.Com. Banking & Insurance, (ii) B.Com. Fintech & Financial Markets, (iii) B.Com. Derivatives & Risk Management, (iv) B.Sc. Data Science, (v) B.Sc. Mathematics, (vi) B.Sc. Physics, (vii) B.A. Economics & Finance. In addition, there is a 1-year programme namely (viii) Bachelor of Library & Information Science.

The holistic development of the students to compete the changing scenario of the world in the 21st century is of prime importance. The University School for Graduate Studies is committed to impart quality education comprising academic knowledge and technical skills to the students.

2. Learning Outcomes based Curriculum Framework

The Choice Based Credit Scheme (CBCS) evolved into learning outcome-based curriculum framework and provides an opportunity for the students to choose courses from the prescribed courses comprising core, elective/minor or skill-based courses. The courses can be evaluated following the grading system, which is considered to be better than the conventional marks system. Grading system provides uniformity in the evaluation and computation of the Cumulative Grade Point Average (CGPA) based on student's performance in examinations which enables the student to move across institutions of higher learning. The uniformity in evaluation system also enables the potential employers in assessing the performance of the candidates.

2.1 Objectives of the Programme

To inculcate:-

- deep knowledge in the core areas of Mathematics;
- capability to read and understand mathematical texts;
- abilities of critical thinking, logical reasoning and investigating problems;
- strong foundation in basic and applied aspects of Mathematics, so as to develop skills to solve mathematical problems having applications in other disciplines and/or in the real world and hence undergo research in different areas of mathematical sciences, jobs in scientific and various industrial sectors and/or teaching career in Mathematics.

2.2 Programme Outcomes (POs)

PO1	Knowledge	Capable of demonstrating comprehensive knowledge of Mathematics gained during the course of study.
PO2	Communication	Ability to communicate effectively various concepts of Mathematics using examples and their geometrical visualizations with the scientific community and with society at large.
PO3	Problem Solving using Modern Tools	Capability of applying knowledge to solve Mathematical, Scientific and other problems using techniques, skills and modern tools.
PO4	Investigation of Problems	Ability of critical thinking, analytical reasoning and research based knowledge including design of experiments, analysis and interpretation of data to provide conclusions.
PO5	Science and Society	Ability to apply reasoning to assess the different issues related to society and the consequent responsibilities relevant to the professional scientific practices.
PO6	Life-Long Learning	Aptitude to apply knowledge and skills that are necessary for participating in learning activities throughout the life.
PO7	Ethics	Apply ethical principles and professional responsibilities in scientific practices.
PO8	Project Management	Ability to demonstrate knowledge and understanding of the scientific principles and apply these to manage projects.

2.3 Programme Specific Outcomes (PSOs)

PSO1	Have basic understanding and knowledge in different core areas of Mathematics such as algebra, analysis, calculus, differential equations, mechanics, numerical analysis and in some of the other elective areas. Demonstrate understanding of the concepts /theories/methods from such areas of Mathematics.
PSO2	Have a broad background in Mathematics and develop the essential mathematical reasoning, knowledge, skills and aptitude to pursue further studies and research in Mathematics.
PSO3	Communicate mathematics effectively and precisely by written, computational and graphical means.
PSO4	Apply knowledge, understanding, methods, techniques and skills of Mathematics to analyse, evaluate and solve problems of Mathematics and/or the mathematical problems having applications in engineering/science/technology/life sciences/social sciences so as to enhance career prospects in different fields.

3 Programme Structure

B.Sc. (Mathematics) 4 year programme– eight semesters undergraduate programme is a 200 credits weightage programme consisting of Ability Enhancement Compulsory Courses, Generic Elective Courses, Core Courses, Discipline Specific Elective Courses and Skill Enhancement Courses.

Table 1: Courses/Credit Scheme

Semesters	Ability Enhancement Compulsory Courses (AECC)		Core Courses (CC)		Generic Electives (GE)		Discipline Specific Elective Courses (DSC)		Skill Enhancement Courses (SEC)		Total Credits
	No. of Courses	Total Credits	No. of Courses	Total Credits	No. of Courses	Total Credits	No. of Courses	Total Credits	No. of Courses	Total Credits	
I	2	8	2	12	1	6	-	-	-	-	26
II	1	4	2	12	1	6	-	-	1	2	24
III	-	-	3	18	1	6	-	-	1	2	26
IV	-	-	3	18	1	6	-	-	1	2	26
V	-	-	2	12	-	-	2	12	1	2	26
VI	-	-	2	12	-	-	2	12	-	-	24
Total	3	12	14	84	4	24	4	24	4	8	152
%age	-	7.89	-	55.26	-	15.79	-	15.79	-	5.26	
VII	-	-	2	12			2	12			24
VIII	-	-	1	24	-	-	-	-	-	-	24
Total	AECC	12	Core	120	Generic	24	Disciplin	36	Skill	8	200
%age	Credits	6	Credits	60	Elective	12	e	18	Enhance	4	
					Credits		Specific		ment		
							Elective		Credits		
							Credits				

Tale 2: Detailed break-up of Credit Courses (Semester wise)

Semesters	Ability Enhancement Compulsory Courses AECC (1)	Core Courses CC (2)	Generic Electives GE (3)	Discipline Specific Elective Courses DSC (4)	Skill Enhancement Courses SEC (5)	Total Courses (1+2+3+4+5)
I	AECC1 AECC2	CC1 CC2	GEC1			05
II	AECC3	CC3 CC4	GEC2		SEC1	05
III		CC5 CC6 CC7	GEC3		SEC2	05
IV		CC8 CC9 CC10	GEC4		SEC3	05
V		CC11 CC12		Any two of the following: DSC1 DSC2 DSC3 DSC4	SEC4	05
VI		CC13 CC14		Any two of the following: DSC5 DSC6 DSC7 DSC8		05
VII		CC15 CC16		Any two of the following: DSC9 DSC10 DSC11 DSC12		04
VIII		CC17 Research (Dissertation/ Project/etc.)				01

Table 3: Course code and Title along with credits details

Course Code	Course Title	Credits			
		Lecture	Tutorial	Practical	Total
Semester I					
ENG/AECC1	Functional English	4	-	-	4
EVS/AECC2	Environmental Studies	4	-	-	4
BSc/Maths/1/CC1	Algebra	5	1	-	6
BSc/Maths/1/CC2	Calculus	5	1	-	6
...../1/GEC1	To be opted by student from Pool of Generic Elective Courses	-	-	-	6
Total					26
Semester II					
HIN/AECC3	Prayojanmoolak Hindi	4	-	-	4
BSc/Maths/2/CC3	Number Theory and Trigonometry	5	1	-	6
BSc/Maths/2/CC4	Ordinary Differential Equations	5	1	-	6
COMP/SEC1	Computer Skills	-	-	2	2
...../2/GEC2	To be opted by student from Pool of Generic Elective Courses	-	-	-	6
Total					24
Semester III					
BSc/Maths/3/CC5	--	5	1	-	6
BSc/Maths/3/CC6	--	5	1	-	6
BSc/Maths/3/CC7	--	5	1	-	6
...../3/GEC3	To be opted by student from Pool of Generic Elective Courses	-	-	-	6
BSc/Maths/3/SEC2	--	2	-	-	2
Total					26
Semester IV					
BSc/Maths/4/CC8	--	5	1	-	6
BSc/Maths/4/CC9	--	5	1	-	6
BSc/Maths/4/CC10	--	5	1	-	6
BSc/Maths/2/GEC4	To be opted by student from Pool of Generic Elective Courses	-	-	-	6
BSc/Maths/4/SEC3	--	2	-	-	2
Total					26
Semester V					
BSc/Maths/5/CC11	--	5	1	-	6
BSc/Maths/5/CC12	--	5	1	-	6
BSc/Maths/5/SEC4	--	-	-	2	2
Choose any two of the following:					
BSc/Maths/5/DSC1	--	5	1	-	6
BSc/Maths/5/DSC2	--	5	1	-	6
BSc/Maths/5/DSC3	--	5	1	-	6

BSc/Maths/5/DSC4	--	5	1	-	6
Total					26
Semester VI					
BSc/Maths/6/CC13	--	5	1	-	6
BSc/Maths/6/CC14	--	5	1	-	6
Choose any two of the following:					
BSc/Maths/6/DSC5	--	5	1	-	6
BSc/Maths/6/DSC6	--	5	1	-	6
BSc/Maths/6/DSC7	--	5	1	-	6
BSc/Maths/6/DSC8	--	5	1	-	6
Total					24
Semester VII					
BSc/Maths/7/CC15	--	5	1	-	6
BSc/Maths/7/CC16	--	5	1	-	6
Choose any two of the following:					
BSc/Maths/7/DSC9	--	5	1	-	6
BSc/Maths/7/DSC10	--	5	1	-	6
BSc/Maths/7/DSC11	--	5	1	-	6
BSc/Maths/7/DSC12	--	5	1	-	6
Total					24
Semester VIII					
Research (Any one of the following)					
Course Code	Course Title				Credits
BSc/Maths/8/CC17	--				24
Total					24
Grand Total					200

Table 4: Generic Elective Courses offered by Department of Mathematics for the Students of other departments		
Course Code	Course Title	Credits
Semester - I		
BSc/Maths/1/GEC1	Algebra	6
Semester - II		
BSc/Maths/2/GEC2	Calculus	6

Semester-I

ENG/AECC1- FUNCTIONAL ENGLISH

Credits: 2 (Theory)
Lectures: 30
Duration of Exam.: 2 Hrs.

Max. Marks: 50
Final Term Exam.: 30
Internal Assessment: 20

Objective: The course aims to introduce students to the theory, fundamentals and tools of communication and to develop in them effective communication skills which should be integral to personal, social and professional interactions. In addition, to develop in them the understanding of the English language.

Learning Outcomes: After completion of the course, learners will:

CO1: have the knowledge of communication.

CO2: have speaking skills in social interactions and communication in professional situations such as interviews, group discussions and office environments,

CO3: have the knowledge and understanding of the language of communication.

CO4: have reading, listening and writing skills.

***Note for the Paper Setter:** The question paper will consist of five questions in all. The first question will be compulsory and will consist of five short questions of 2 marks each covering the whole syllabus. In addition, four more questions will be set unit-wise comprising of two questions from each of the two units. The candidates are required to attempt two more questions selecting at least one question from each unit.*

Unit-I

Introduction: Definition and Theory of Communication, Types and modes of Communication. Language of Communication: Verbal and Non-verbal (Spoken and Written); Personal, Social and Business Barriers and Strategies; Intra-personal, Inter-personal and Group communication. Impact of communication on performance.

Unit-II

Speaking Skills: Monologue, Dialogue, Group Discussion, Effective Oral Communication, Miscommunication, Oral Presentation, Interview, Public Speech.

Unit-III

Remedial English: Parts of Speech, Sentences, Subject- Verb Agreement, Active and Passive Voice, Degrees of comparison, Direct and Indirect Speech, Question Tags.

Reading and Understanding: Close Reading, Comprehension, Summary, Paraphrasing, Analysis and Interpretation, Translation (from Indian language to English and vice-versa), Literary/Knowledge Texts.

Unit-IV

Writing Skills: Elements of writing, Documenting, Report Writing, Making notes, Letter writing, Business communications

Listening Skills: Listening and its types, Barriers of effective Listening, Barriers and Strategies for effective listening, Listening to complaints.

Suggested Readings:

- B.K. Das and A. David, A Remedial Course in English, Book 2, C.I.E.F.L. (O.U.P.) 1980.
- A.S. Hornby, Oxford Advanced Learner's Dictionary of Current English (O.U.P.) 3, A Textbook of English Phonetics for Indian Students by T. Balasubramanian.
- Fluency in English - Part II, Oxford University Press, 2006.
- Business English, Pearson, 2008.
- Language, Literature and Creativity, Orient Blackswan, 2013.

EVS/AECC2- ENVIRONMENTAL STUDIES

Credits: 2 (Theory)

Lectures: 30

Duration of Exam.: 2 Hrs.

Max. Marks: 50

Final Term Exam.: 30

Internal Assessment: 20

Course Objective: Students will understand how science and the scientific methods work to address environmental problems. The students will become familiar with the Earth's major systems, how they function and how they are affected by human?

Course Outcomes: After completing the course in Environmental Studies, students will be able to: Demonstrate an integrated approach to environmental issues with a focus on sustainability; Use critical thinking, and methodological approaches of the social sciences, natural sciences, and humanities in environmental problem solving.

Note for the Paper Setter: The question paper will consist of five questions in all. The first question will be compulsory and will consist of five short questions of 2 marks each covering the whole syllabus. In addition, four more questions will be set unit-wise comprising of two questions from each of the two units. The candidates are required to attempt two more questions selecting at least one question from each unit.

UNIT I

The multidisciplinary nature of environmental studies: Definition, Scope and importance need for public awareness. Natural Resources: Renewable and non-renewable resources: Natural resources and associated problems. Forest resources: Use and over-exploitation, deforestation, case studies. Timber extraction, mining, dams and their effects on forests and tribal people. Water resources: Use and over- utilization of surface and ground water, floods, drought, conflicts over water, dams-benefits and problems. Mineral resources: Use and exploitation, environmental effects of extracting and using mineral resources, case studies. Food resources: World food problems, changes caused by agriculture and overgrazing, effects of modern agriculture, fertilizer-pesticide problems, water logging, salinity, case studies. Energy resources; Growing energy needs, renewable and non-renewable energy sources, case studies. Land resources: Land as a resource, land degradation man induced landslides, soil erosion and desertification. Role of an individual in conservation of natural resources. Equitable use of resources for sustainable lifestyles.

UNIT II

Ecosystems: Concept of an ecosystem, Structure and function of an ecosystem. Producers, Consumers and decomposers. Energy flow in the ecosystem, Ecological succession, Food chains, food webs and ecological pyramids. Introduction, types, Characteristic features, structure and function of the following of the ecosystem: Forest ecosystem, Grass land ecosystem, desert ecosystem, Aquatic ecosystems (ponds, streams, lakes, rivers, oceans, estuaries).

Biodiversity and its conservation: Introduction-Definition: genetic, species and ecosystem diversity. Bio-geographical classification of India. Value of diversity: consumptive use, productive use, social, ethical; aesthetic and option calls. Biodiversity at global, National and local levels. India as a mega- diversity nation. Hot-spots of biodiversity. Threats to biodiversity: habitat loss, poaching of wildlife, man-wildlife conflicts. Endangered and endemics. Conservation of biodiversity: In-situ and Ex-situ, Conservation of biodiversity.

UNIT III

Environmental Pollution: Definition-Causes, effects and control measures of Air pollution, Water pollution, Soil pollution, Marine pollution, Noise pollution, Thermal pollution, Nuclear hazards, Solid waste Management: Causes, effects and control measures of urban and industrial wastes. Role of an individual in prevention of pollution. Pollution case studies. Disaster Management: floods, earthquake, cyclone and landslides.

Social Issues and the environment: From Unsustainable to Sustainable development. Urban problems related to energy. Water conservation, rain water harvesting, watershed management. Resettlement and rehabilitation of people; its problems and concerns. Case studies. Environmental ethics: Issues and possible solutions. Climate change, global warming, acid rain, ozone layer depletion, nuclear accidents and holocaust. Case studies. Wasteland reclamation. Consumerism and waste products. Air (prevention and Control of Pollution) Act. Water (prevention and control of pollution) Act. Wildlife Protection Act. Forest Conservation Act. Issues involved in enforcement of environmental legislation. Public awareness.

UNIT IV

Human Population and the Environment: Population growth, variation among nations. Population explosion- family Welfare Programme. Environment and human health. Human Rights. Value Education. HIV/AIDS. Women and child welfare, role of information technology in environment and human health, Case Studies.

Field work: Visit to a local area to document environmental assets: river/forest grass land/hill/mountain, Visit to a local polluted site-Urban/Rural/Industrial/ Agricultural, Study of common plants, insects, birds. Study of simple ecosystems pond, river, hill slopes, etc.

Suggested Readings:

1. Agarwal, K.C. 2001 *Environmental Biology*, Nidhi Publ. Ltd. Bikaner.
2. Bharucha Erach, *The Biodiversity of India*, Mapin Publishing Pvt. Ltd., Ahmedabad-380013, India.
3. Clerk R.S., *Marine Pollution*; Clarendon Press Oxford.
4. *Down to Earth*, Centre for Science and Environment.
5. Hawkins R.E., *Encyclopedia of Indian Natural History*, Bombay Natural History Society, Bombay.
6. Mhaskar A.K., *Matter Hazardous*, Techno-Science Publications.
7. Townsend C., Harper J, and Michael Begon, *Essentials of ecology*, Blackwell Science.
8. Trivedi R.K and P.K Goel, *Introduction to air pollution*, Techno-Science Publications.
9. Trivedi R.K, *Handbook of Environmental Laws, Rules, Guidelines Compliances and Standards, Vol I and II*, Envirol Media.
10. Wagner K.D., 1998. *Environmental Management*. W.B. Saunders Co. Philadelphia, USA.

BSc/Maths/1/CC1 - ALGEBRA

Marks (Theory): 70

Marks (Internal Assessment): 30

Credits: Th(5)+T(1) = 06

Marks (Total): 100

Time: 03 Hours

Course Outcomes: This course will enable the students to:

1. Determine rank of a matrix, eigen values, eigen vectors, characteristic equation and characteristic polynomial of square matrices. Understand unitary and orthogonal matrices and to solve related problems.
2. Find solution of homogeneous and non-homogeneous system of linear equations using matrices. Determine relation between roots and coefficients of a general polynomial equation.
3. Identify multiple roots. Application of Descartes's rule of sign. Solve cubic and biquadratic equations.
4. Understand the basic concepts of number theory and their applications in problem solving. Prove Fermat and Wilson's theorems and their applications.

***Note for the Paper Setter:** The question paper will consist of NINE questions in all. The first question will be compulsory and will consist of FIVE short questions of 2 marks each covering the whole syllabus. In addition, EIGHT more questions will be set unit-wise comprising of two questions from each of the four units. The candidates are required to attempt four more questions selecting at least one question from each unit.*

Unit-I

Symmetric, Skew-symmetric, Hermitian and skew Hermitian matrices. Elementary operations on matrices. Rank of a matrices. Inverse of a matrix. Linear dependence and independence of rows and columns of matrices. Row rank and column rank of a matrix. Eigenvalues, eigenvectors and the characteristic equation of a matrix. Minimal polynomial of a matrix. Cayley Hamilton theorem and its use in finding the inverse of a matrix.

Unit-II

Applications of matrices to a system of linear (both homogeneous and non-homogeneous) equations. Theorems on consistency of a system of linear equations. Unitary and Orthogonal Matrices, Bilinear and Quadratic forms.

Unit-III

Relations between the roots and coefficients of general polynomial equation in one variable. Solutions of polynomial equations having conditions on roots. Common roots and multiple roots. Transformation of equations.

Unit-IV

Nature of the roots of an equation, Descartes's rule of signs. Solutions of cubic equations (Cardon's method). Biquadratic equations and their solutions.

Recommended Books:

1. Shanti Narayan, A Text Book of Matrices.
2. Chandrika Prasad, Text Book on Algebra and Theory of Equations. Pothishala Private Ltd., Allahabad.
3. A.I. Kostrikin (1984). *Introduction to Algebra*. Springer Verlag.
4. Bernard Kolman & David R. Hill (2003). *Introductory Linear Algebra with Applications* (7th edition). Pearson Education Pvt. Ltd. India.
5. S. H. Friedberg, A. L. Insel and L.E. Spence (2004). *Linear Algebra*, Prentice Hall of India Pvt. Ltd.
6. David C. Lay, Steven R. Lay & Judi J. McDonald (2016). *Linear Algebra and its Applications* (5th edition). Pearson Education Pvt. Ltd. India.
7. H.S. Hall and S.R. Knight (2016). *Higher Algebra*, Arihant Publications.
8. Leonard Eugene Dickson (2009). *First Course in the Theory of Equations*. The Project Gutenberg EBook (<http://www.gutenberg.org/ebooks/29785>)

BSc/Maths/1/CC2 - CALCULUS

Marks (Theory): 70

Marks (Internal Assessment): 30

Credits: Th(5)+T(1) = 06

Marks (Total): 100

Time: 03 Hours

Course Outcomes: This course will enable the students to:

1. Calculate the limit of functions, examine the continuity of functions, understand differentiability of different type of functions, successive differentiation of functions and series expansions.
2. Understand concepts of tangents, normals, asymptotes, curvature, evolutes and involutes of a curve; the geometrical meanings of these terms and to solve related problems
3. Determine singular points of a curve and their types. To understand rectification of curves and to apply the reduction formulae.
4. Determine area bounded by curves and volumes and surface area of solids formed by revolution of curves

***Note for the Paper Setter:** The question paper will consist of NINE questions in all. The first question will be compulsory and will consist of FIVE short questions of 2 marks each covering the whole syllabus. In addition, EIGHT more questions will be set unit-wise comprising of two questions from each of the four units. The candidates are required to attempt four more questions selecting at least one question from each unit.*

Unit-I:

Definition of the limit of a function. Basic properties of limits, Continuous functions and classification of discontinuities. Differentiability. Successive differentiation. Leibnitz theorem. Maclaurin and Taylor series expansions.

Unit-II:

Asymptotes in Cartesian coordinates, intersection of curve and its asymptotes, asymptotes in polar coordinates. Curvature, radius of curvature for Cartesian curves, parametric curves, polar curves. Newton's method. Radius of curvature for pedal curves. Tangential polar equations. Centre of curvature. Circle of curvature. Chord of curvature, evolutes. Tests for concavity and convexity. Points of inflexion. Multiple points. Cusps, nodes & conjugate points. Type of cusps.

Unit-III:

Tracing of curves in Cartesian, parametric and polar co-ordinates. Reduction formulae. Rectification, intrinsic equations of curve.

Unit-IV:

Quadrature (area) Sectorial area. Area bounded by closed curves. Volumes and surfaces of solids of revolution. Theorems of Pappu's and Guilden.

Recommended Books:

1. Differential and Integral Calculus, Shanti Narayan.
2. Murray R. Spiegel, Theory and Problems of Advanced Calculus. Schaun's Outline series. Schaum Publishing Co., New York.
3. N. Piskunov, Differential and Integral Calculus. Peace Publishers, Moscow.

4. Howard Anton, I. Bivens & Stephan Davis (2016). *Calculus* (10th edition). Wiley India.
5. Gabriel Klambauer (1986). *Aspects of Calculus*. Springer-Verlag.
6. Wieslaw Krawcewicz & Bindhyachal Rai (2003). *Calculus with Maple Labs*. Narosa.
7. Gorakh Prasad (2016). *Differential Calculus* (19th edition). Pothishala Pvt. Ltd.
8. George B. Thomas Jr., Joel Hass, Christopher Heil & Maurice D. Weir (2018). *Thomas' Calculus* (14th edition). Pearson Education.
9. Monty J. Strauss, Gerald L. Bradley & Karl J. Smith (2011). *Calculus* (3rd edition). Pearson Education. Dorling Kindersley (India) Pvt. Ltd.

Semester-II

HIN/AECC3- प्रयोजनमूलक हिन्दी

क्रेडिट: 4
व्याख्यान: 60
परिक्षा अवधि: 3 घंटे

अधिकतम अंक: 100
अंतिम परिक्षा अंक: 70
आंतरिक मूल्यांकन: 30

नोट: प्रश्न पत्र में कुल 9 प्रश्न हैं। प्रथम प्रश्न अनिवार्य है, जिसमें समस्त पाठ्यक्रम से 2 अंक वाले 5 संक्षिप्त प्रश्न हैं। प्रश्न पत्र में 4 ईकाई है, जिसमें प्रत्येक ईकाई में 15 अंको वाले 2 प्रश्न हैं। विद्यार्थी को प्रत्येक ईकाई में से 1 प्रश्न करना अनिवार्य है।

ईकाई-I

पत्र-लेखन-सहकारी पत्र, परिपत्र, कार्यालय आदेश, शिकायत पत्र, आवेदन पत्र, मूलपत्र, पत्रोत्तर, पावती, अनुस्मारक, सरकारी पत्र, ईमेल-लेखन, शासकीय आदेश, अधिसूचना, पृष्ठांकन, प्रेस विज्ञापित, संक्षेपण लेखन- अर्थ परिभाषा प्रक्रिया, नियम (लेखन विधि)

ईकाई-II

अभिनव काव्य गरिमा (काव्य पुस्तक) संप्रसंग व्याख्या व प्रश्नोत्तर

ईकाई-III

कम्प्यूटर- परिभाषा स्वरूप, महत्व

पारिभाषिक शब्दावली - बैंकिंग , वाणिज्य, मंत्रालय, उपक्रमो, निगमों, ओद्योगिक क्षेत्रों व मीडिया क्षेत्र

अनुवाद लेखन - अर्थ परिभाषा, स्वरूप, महत्व, प्रक्रिया, प्रकार

टिप्पण लेखन - अर्थ परिभाषा, नियम, लेखन विधि, उदाहरण

ईकाई-IV

प्रयोजनमूलक हिन्दी - अर्थ, संरचनात्मक स्वरूप महत्व, हिन्दी भाषा की प्रयोजनीयता

प्रयोजनमूलक हिन्दी के विविध रूप

शब्द कोश का अर्थ, परिभाषा, उद्देश्य प्रकार क्षेत्र व उपयोगिता

सन्दर्भ पुस्तकें :

- 1 प्रयोजनमूलक हिन्दी: डॉ नरेशा मिश्रा (2017) राजपाल एण्ड सन्ज, कश्मीरी गेट, दिल्ली
- 2 हिंदी साहित्य का इतिहास: डॉ रामसजन पाण्डेय (2012) संजय प्रकाशन, दिल्ली
- 3 अभिनव काव्य गरिमा: डॉ नरेशा मिश्रा (2012) राजकमल प्रकाशन, दिल्ली
- 4 प्रयोजनमूलक हिन्दी: सिद्धांत और प्रयोग दंगल झाल्टे, वाणी प्रकाशन, दिल्ली
- 5 राजभाषा हिंदी: विवेचना और प्रयुक्ति: डा किशोर वासवानी, वाणी प्रकाशन, दिल्ली
- 6 राजभाषा हिंदी और उसका विकास: हीरालाल बाछोतिया, किताब घर प्रकाशन, दिल्ली
- 7 अनुवाद विज्ञान: सिद्धांत एवं प्रविधि, भोलानाथ तिवारी, किताब घर प्रकाशन, दिल्ली

BSc/Maths/2/CC3 - NUMBER THEORY AND TRIGONOMETRY

Marks (Theory): 70

Marks (Internal Assessment): 30

Credits: Th(5)+T(1) = 06

Marks (Total): 100

Time: 03 Hours

Course Outcomes: This course will enable the students to:

1. Understand the basic concepts of number theory and their applications in problem solving. Prove Fermat and Wilson's theorems and their applications.
2. Know residue system, Euler's ϕ function, Quadratic residues. Legendre symbols, Moebius function and Moebius inversion formula.
3. Understand De Moivre's Theorem and its Applications. Trigonometrical and hyperbolic functions along with their properties.
4. Know inverse circular and hyperbolic functions and their properties along with their related problems.

Note for the Paper Setter: The question paper will consist of NINE questions in all. The first question will be compulsory and will consist of FIVE short questions of 2 marks each covering the whole syllabus. In addition, EIGHT more questions will be set unit-wise comprising of two questions from each of the four units. The candidates are required to attempt four more questions selecting at least one question from each unit.

Unit-I:

Divisibility, G.C.D. (greatest common divisors), L.C.M. (least common multiple) Primes, Fundamental Theorem of Arithmetic. Linear Congruences, Fermat's theorem. Wilson's theorem and its converse. Linear Diophantine equations in two variables

Unit-II:

Complete residue system and reduced residue system modulo m . Euler's ϕ function Euler's generalization of Fermat's theorem. Chinese Remainder Theorem. Quadratic residues. Legendre symbols. Lemma of Gauss; Gauss reciprocity law. Greatest integer function $[x]$. The number of divisors and the sum of divisors of a natural number n (The functions $d(n)$ and $\sigma(n)$). Moebius function and Moebius inversion formula.

Unit-III:

De Moivre's Theorem and its Applications. Expansion of trigonometrical functions. Direct circular and hyperbolic functions and their properties.

Unit-IV:

Inverse circular and hyperbolic functions and their properties. Logarithm of a complex quantity. Gregory's series. Summation of Trigonometry series.

Recommended Books:

1. S.L. Loney, Plane Trigonometry Part – II, Macmillan and Company, London.
2. R.S. Verma and K.S. Sukla, Text Book on Trigonometry, Pothishala Pvt. Ltd. Allahabad.
3. Gareth A. Jones & J. Mary Jones (2005). *Elementary Number Theory*. Springer.
4. Neville Robbins (2007). *Beginning Number Theory* (2nd edition). Narosa.
5. I. Niven (2012). *An Introduction to the Theory of Numbers* (5th edition). John Wiley & Sons.
6. Ivan Niven and H.S. Zuckerman, An Introduction to the Theory of Numbers.

BSc/Maths/2/CC4 - ORDINARY DIFFERENTIAL EQUATIONS

Marks (Theory): 70

Marks (Internal Assessment): 30

Credits: Th(5)+T(1) = 06

Marks (Total): 100

Time: 03 Hours

Course Outcomes: The course will enable the students to:

1. Understand the basic concepts of ordinary differential equations and to learn various techniques of finding exact solutions of certain solvable first order differential equations.
2. Develop the skills of solving homogeneous and non-homogeneous second order linear ordinary differential equations with constant coefficients.
3. Know the skills of solving non-homogeneous second order linear ordinary differential equations with variable coefficients.
4. Develop the skills and methods of solving ordinary simultaneous differential equations with constant coefficients.

Note for the Paper Setter: The question paper will consist of NINE questions in all. The first question will be compulsory and will consist of FIVE short questions of 2 marks each covering the whole syllabus. In addition, EIGHT more questions will be set unit-wise comprising of two questions from each of the four units. The candidates are required to attempt four more questions selecting at least one question from each unit.

Unit-I

Geometrical meaning of a differential equation. Exact differential equations, integrating factors. First order higher degree equations solvable for x, y, p Lagrange's equations, Clairaut's equations. Equation reducible to Clairaut's form. Singular solutions.

Unit-II

Orthogonal trajectories: in Cartesian coordinates and polar coordinates. Self orthogonal family of curves. Linear differential equations with constant coefficients. Homogeneous linear ordinary differential equations. Equations reducible to homogeneous.

Unit-III

Linear differential equations of second order: Reduction to normal form. Transformation of the equation by changing the dependent variable/ the independent variable. Solution by operators of non-homogeneous linear differential equations. Reduction of order of a differential equation. Method of variations of parameters. Method of undetermined coefficients.

Unit-IV

Ordinary simultaneous differential equations. Solution of simultaneous differential equations involving operators (d/dx) or (d/dt) etc. Simultaneous equation of the form $dx/P = dy/Q = dz/R$. Total differential equations. Condition for $Pdx + Qdy + Rdz = 0$ to be exact. General method of solving $Pdx + Qdy + Rdz = 0$ by taking one variable constant. Method of auxiliary equations.

Recommended Books:

1. Erwin Kreyszig (2011). *Advanced Engineering Mathematics* (10th edition). J. Wiley & Sons
2. Shepley L. Ross (2007). *Differential Equations* (3rd edition). Wiley.
3. George F. Simmons (2017). *Differential Equations with Applications and Historical Notes* (3rd edition). CRC Press. Taylor & Francis.
4. D.A. Murray, *Introductory Course in Differential Equations*. Orient Longman(India). 1967
5. A.R.Forsyth, *A Treatise on Differential Equations*, Macmillan and Co. Ltd., London
6. E.A. Codrington, *Introduction to Differential Equations*.
7. B.Rai & D.P. Chaudhary, *Ordinary Differential Equations*, Narosa Publishing House Pvt. Ltd.

COMP/SEC1- COMPUTER SKILLS

Credits: 2 (Practical)

Duration of Exam.: 3 Hrs.

Max. Marks: 50

Final Term Exam.: 50

Objective: The course aims to provide practical computer knowledge and skills to students and to enhance the usefulness of information technology tools in various activities.

Learning Outcomes: After completion of the course, learners will be able to:

CO1: Know about Operating System, Overview of various Computer & Mobile Operating systems and Applications.

CO2: Perform various features of Word processing such that Table, Mail merge, Hyperlink, etc.

CO3: Prepare a business presentation on MS PowerPoint.

CO4: Perform various mathematical, logical, and other functions on a large set of data using MS Excel.

Unit-I

Windows: Installation of Windows, Windows Desktop, My computer, My documents, Network neighbourhood, Recycle Bin, Quick launch tool bar, System tray, Start menu, Task bar - System Tray - Quick launch tool bar - Start button - Parts of Windows, Keyboard Accelerators: Key board short keys or hotkeys, Working with Notepad & WordPad, Creating & Editing Images with Microsoft paint, using the Calculator, Personalising Windows.

MS-Word: Working with Documents, Formatting page & setting Margins, Converting files to different formats, Importing & Exporting documents, Formatting Documents - Setting Font styles, Font selection- style, Setting Paragraph style, Alignments, Indents, Line Space, Margins, Bullets & Numbering. Setting Page style - Formatting Page, Page tab, Margins, Layout settings, Border & Shading, Columns, Header & footer, Setting Footnotes & end notes, page break, Setting Document styles, Table of Contents, Index, Page Numbering, date & Time, Creating Tables- Table settings, Borders, Alignments, Insertion, deletion, Merging, Splitting, Sorting, Drawing - Inserting Clip Arts, Pictures/Files, Tools –Spell Checks, Mail merge, Templates, Printing Documents.

Unit-II

MS-Excel: Spread Sheet & its Applications, Opening Spreadsheet, Menus , Working with Spreadsheets- opening, Saving files, setting Margins, Spread sheet addressing - Rows, Columns & Cells, Referring Cells & Selecting Cells – Shortcut Keys. Entering & Deleting Data, Inserting Data, Insert Cells, Column, rows & sheets, Inserting Functions, Formula - finding total in a column or row, Mathematical operations (Addition, Subtraction, Multiplication, Division, Exponentiation), Formatting Spreadsheets- Labelling columns & rows, Formatting- Cell, row, column & Sheet, Category - Alignment, Font, Border & Shading, Hiding/ Locking Cells, Working with sheets – Sorting, Filtering, Creating Charts , Tools – Error checking, Spell Checks.

MS-Power-Point: Introduction to presentation – Opening new presentation, Different presentation templates, setting backgrounds, selecting presentation layouts. Creating a presentation-Setting Presentation style, Adding text to the Presentation. Formatting a Presentation-Adding style, Colour, Arranging objects, Adding Header & Footer, Slide Background, Slide layout. Adding Graphics to the Presentation- Inserting pictures, tables into presentation, Adding Effects to the Presentation-Setting Animation & transition effect. Practical Exercises:

Suggested Readings:

1. Bharihoka, D. (2012). Fundamentals of Information Technology. New Delhi: Excel Book.
2. Boockholdt, J. L. (1999). Accounting Information System: Transaction Processing and Control. Boston: Irwin McGraw Hill.
3. Gelinas, U. J., & Steve, G. S. (2002). Sutton, Accounting Information System. Mason: South Western Thomson Learning.
4. Hall, J. A. (2006). Accounting Information System. Nashville: South Western College Publishing. Rajaraman, V. (2018). Introduction to Information Technology. New Delhi: PHI Learning Pvt. Ltd.

Note: Open-Source Software or MS Excel, MS Access, and Tally may be used at appropriate places.

Generic Elective Courses

BSc/Maths/1/GEC1- ALGEBRA

Marks (Theory): 70

Marks (Internal Assessment): 30

Credits: Th(5)+T(1) = 06

Marks (Total): 100

Time: 03 Hours

Course Outcomes: This course will enable the students to:

1. Determine rank of a matrix, eigen values, eigen vectors, characteristic equation and characteristic polynomial of square matrices. Understand unitary and orthogonal matrices and to solve related problems.
2. Find solution of homogeneous and non-homogeneous system of linear equations using matrices. Determine relation between roots and coefficients of a general polynomial equation.
3. Identify multiple roots. Application of Descartes's rule of sign. Solve cubic and biquadratic equations.
4. Understand the basic concepts of number theory and their applications in problem solving. Prove Fermat and Wilson's theorems and their applications.

***Note for the Paper Setter:** The question paper will consist of NINE questions in all. The first question will be compulsory and will consist of FIVE short questions of 2 marks each covering the whole syllabus. In addition, EIGHT more questions will be set unit-wise comprising of two questions from each of the four units. The candidates are required to attempt four more questions selecting at least one question from each unit.*

Unit-I:

Symmetric, Skew-symmetric, Hermitian and skew Hermitian matrices. Elementary operations on matrices. Rank of a matrices. Inverse of a matrix. Linear dependence and independence of rows and columns of matrices. Row rank and column rank of a matrix. Eigenvalues, eigenvectors and the characteristic equation of a matrix. Minimal polynomial of a matrix. Cayley Hamilton theorem and its use in finding the inverse of a matrix.

Unit-II:

Applications of matrices to a system of linear (both homogeneous and non-homogeneous) equations. Theorems on consistency of a system of linear equations. Unitary and Orthogonal Matrices, Bilinear and Quadratic forms.

Unit-III:

Relations between the roots and coefficients of general polynomial equation in one variable. Solutions of polynomial equations having conditions on roots. Common roots and multiple roots. Transformation of equations.

Unit-IV:

Nature of the roots of an equation, Descartes's rule of signs. Solutions of cubic equations (Cardon's method). Biquadratic equations and their solutions.

Recommended Books:

1. Shanti Narayan, A Text Book of Matrices.
2. Chandrika Prasad, Text Book on Algebra and Theory of Equations. Pothishala Private Ltd., Allahabad.
3. A.I. Kostrikin (1984). *Introduction to Algebra*. Springer Verlag.
4. Bernard Kolman & David R. Hill (2003). *Introductory Linear Algebra with Applications* (7th edition). Pearson Education Pvt. Ltd. India.
5. S. H. Friedberg, A. L. Insel and L.E. Spence (2004). *Linear Algebra*, Prentice Hall of India Pvt. Ltd.
6. David C. Lay, Steven R. Lay & Judi J. McDonald (2016). *Linear Algebra and its Applications* (5th edition). Pearson Education Pvt. Ltd. India.
7. H.S. Hall and S.R. Knight (2016). *Higher Algebra*, Arihant Publications.
8. Leonard Eugene Dickson (2009). *First Course in the Theory of Equations*. The Project Gutenberg EBook (<http://www.gutenberg.org/ebooks/29785>)

BSc/Maths/2/GEC2 - CALCULUS

Marks (Theory): 70

Marks (Internal Assessment): 30

Credits: Th(5)+T(1) = 06

Marks (Total): 100

Time: 03 Hours

Course Outcomes: This course will enable the students to:

1. Calculate the limit of functions, examine the continuity of functions, understand differentiability of different type of functions, successive differentiation of functions and series expansions.
2. Understand concepts of tangents, normals, asymptotes, curvature, evolutes and involutes of a curve; the geometrical meanings of these terms and to solve related problems
3. Determine singular points of a curve and their types. To understand rectification of curves and to apply the reduction formulae.
4. Determine area bounded by curves and volumes and surface area of solids formed by revolution of curves

***Note for the Paper Setter:** The question paper will consist of NINE questions in all. The first question will be compulsory and will consist of FIVE short questions of 2 marks each covering the whole syllabus. In addition, EIGHT more questions will be set unit-wise comprising of two questions from each of the four units. The candidates are required to attempt four more questions selecting at least one question from each unit.*

Unit-I:

Definition of the limit of a function. Basic properties of limits, Continuous functions and classification of discontinuities. Differentiability. Successive differentiation. Leibnitz theorem. Maclaurin and Taylor series expansions.

Unit-II:

Asymptotes in Cartesian coordinates, intersection of curve and its asymptotes, asymptotes in polar coordinates. Curvature, radius of curvature for Cartesian curves, parametric curves, polar curves. Newton's method. Radius of curvature for pedal curves. Tangential polar equations. Centre of curvature. Circle of curvature. Chord of curvature, evolutes. Tests for concavity and convexity. Points of inflexion. Multiple points. Cusps, nodes & conjugate points. Type of cusps.

Unit-III:

Tracing of curves in Cartesian, parametric and polar co-ordinates. Reduction formulae. Rectification, intrinsic equations of curve.

Unit-IV:

Quadrature (area) Sectorial area. Area bounded by closed curves. Volumes and surfaces of solids of revolution. Theorems of Pappu's and Guilden.

Recommended Books:

1. Differential and Integral Calculus, Shanti Narayan.
2. Murray R. Spiegel, Theory and Problems of Advanced Calculus. Schaun's Outline series. Schaum Publishing Co., New York.
3. N. Piskunov, Differential and Integral Calculus. Peace Publishers, Moscow.
4. Howard Anton, I. Bivens & Stephan Davis (2016). *Calculus* (10th edition). Wiley India.
5. Gabriel Klambauer (1986). *Aspects of Calculus*. Springer-Verlag.
6. Wieslaw Krawcewicz & Bindhyachal Rai (2003). *Calculus with Maple Labs*. Narosa.
7. Gorakh Prasad (2016). *Differential Calculus* (19th edition). Pothishala Pvt. Ltd.
8. George B. Thomas Jr., Joel Hass, Christopher Heil & Maurice D. Weir (2018). *Thomas' Calculus* (14th edition). Pearson Education.
9. Monty J. Strauss, Gerald L. Bradley & Karl J. Smith (2011). *Calculus* (3rd edition). Pearson Education. Dorling Kindersley (India) Pvt. Ltd.