

## GE 1.3 CALCULUS (except mathematics hons.)

FULL MARKS: 80

TIME: 3 hours

*Eight* questions will be set out of which candidates are required to answer *four* questions.

Question number **1** is compulsory consists of *ten* short answer type questions each of *two* marks covering entire syllabus uniformly

### UNIT I

Limit and Continuity ( $\epsilon$  and  $\delta$  definition), Types of discontinuities, Differentiability of functions, Successive differentiation, Leibnitz's theorem, Partial differentiation, Euler's theorem on homogeneous functions.

(2 questions)

### UNIT II

Tangents and normals, Curvature, Asymptotes, Singular points, Tracing of curves. Parametric representation of curves and tracing of parametric curves, Polar coordinates and tracing of curves in polar coordinates.

(2 questions)

### UNIT III

Reduction formulae, length of curves, volume and area of surface of revolution

(2 questions)

Vector differentiation, curl, divergence and gradient.

(1 question)

### Books Recommended

1. G.B. Thomas and R.L. Finney, *Calculus*, 9th Ed., Pearson Education, Delhi, 2005.
2. M.J. Strauss, G.L. Bradley and K. J. Smith, *Calculus*, 3rd Ed., Dorling Kindersley (India) P. Ltd. (Pearson Education), Delhi, 2007.
3. H. Anton, I. Bivens and S. Davis, *Calculus*, 7th Ed., John Wiley and Sons (Asia) P. Ltd., Singapore, 2002.
4. R. Courant and F. John, *Introduction to Calculus and Analysis* (Volumes I & II), Springer-Verlag, New York, Inc., 1989.

## GE2.3 Differential equations (except mathematics honrs.)

FULL MARKS: 80

TIME: 3 hours

*Eight* questions will be set out of which candidates are required to answer *four* questions.  
Question number 1 is compulsory consists of *ten* short answer type questions each of *two* marks covering entire syllabus uniformly

### UNIT I

First order exact differential equations. Integrating factors, rules to find an integrating factor. First order higher degree equations solvable for  $x$ ,  $y$ ,  $p$ . Methods for solving higher-order differential equations. Basic theory of linear differential equations, Wronskian, and its properties. Solving a differential equation by reducing its order.

(2 questions)

### UNIT II

Linear homogenous equations with constant coefficients, Linear non-homogenous equations, The method of variation of parameters, The Cauchy-Euler equation, Simultaneous differential equations, Total differential equations.

(3 questions)

### UNIT III

Order and degree of partial differential equations, Concept of linear and non-linear partial differential equations, Formation of first order partial differential equations, Linear partial differential equation of first order, Lagrange's method, Charpit's method.

(2 questions)

### Books Recommended

1. Shepley L. Ross, *Differential Equations*, 3rd Ed., John Wiley and Sons, 1984.
2. I. Sneddon, *Elements of Partial Differential Equations*, McGraw-Hill, International Edition, 1967.

**GE 3.3 Real analysis (except mathematics hons.)**

**FULL MARKS: 80**

**TIME: 3 hours**

*Eight* questions will be set out of which candidates are required to answer *four* questions.  
Question number 1 is compulsory consists of *ten* short answer type questions each of *two* marks covering entire syllabus uniformly

**UNIT I**

Finite and infinite sets, examples of countable and uncountable sets. Real line, bounded sets, suprema and infima, completeness property of  $\mathbb{R}$ , Archimedean property of  $\mathbb{R}$ , intervals. Concept of cluster points and statement of Bolzano-Weierstrass theorem.

(2 questions)

**UNIT II**

Real Sequence, Bounded sequence, Cauchy convergence criterion for sequences. Cauchy's theorem on limits, order preservation and squeeze theorem, monotone sequences and their convergence (monotone convergence theorem without proof).

(2 questions)

**UNIT III**

Infinite series. Cauchy convergence criterion for series, positive term series, geometric series, comparison test, convergence of p-series, Root test, Ratio test, alternating series, Leibnitz's test (Tests of Convergence without proof). Definition and examples of absolute and conditional convergence.

(3 questions)

**Books Recommended**

1. T. M. Apostol, *Calculus* (Vol. I), John Wiley and Sons (Asia) P. Ltd., 2002.
2. R.G. Bartle and D. R Sherbert, *Introduction to Real Analysis*, John Wiley and Sons (Asia) P. Ltd., 2000.
3. E. Fischer, *Intermediate Real Analysis*, Springer Verlag, 1983.
4. K.A. Ross, *Elementary Analysis- The Theory of Calculus Series-* Undergraduate Texts in Mathematics, Springer Verlag, 2003.

GE 4.3 Algebra (except mathematics hons.)

FULL MARKS: 80

TIME: 3 hours

*Eight* questions will be set out of which candidates are required to answer *four* questions.

Question number 1 is compulsory consists of *ten* short answer type questions each of *two* marks covering entire syllabus uniformly

**UNIT I**

Definition and examples of groups, examples of abelian and non-abelian groups, the group  $Z_n$  of integers under addition modulo  $n$  and the group  $U(n)$  of units under multiplication modulo  $n$ . Cyclic groups from number systems, complex roots of unity, circle group, the general linear group  $GL_n(n, R)$ .

(2 questions)

**UNIT II**

Subgroups, cyclic subgroups, the concept of a subgroup generated by a subset and the commutator subgroup of group, examples of subgroups including the center of a group. Cosets, Index of subgroup, Lagrange's theorem, order of an element, Normal subgroups: their definition, examples, and characterizations, Quotient groups.

(3 questions)

**UNIT III**

Definition and examples of rings, examples of commutative and non-commutative rings: rings from number systems,  $Z_n$  the ring of integers modulo  $n$ , ring of real quaternions, rings of matrices, polynomial rings, and rings of continuous functions. Subrings and ideals, Integral domains and fields, examples of fields:  $Z_p$ ,  $Q$ ,  $R$ , and  $C$ .

(2 questions)

**Books Recommended**

1. John B. Fraleigh, *A First Course in Abstract Algebra*, 7th Ed., Pearson, 2002.
2. M. Artin, *Abstract Algebra*, 2nd Ed., Pearson, 2011.
3. Joseph A Gallian, *Contemporary Abstract Algebra*, 4th Ed., Narosa, 1999.
4. George E Andrews, *Number Theory*, Hindustan Publishing Corporation, 1984.