

**TS ECET-2018**  
**SYLLABUS FOR B.Sc (MATHEMATICS) GRADUATES**

**MATHEMATICS (100M)**

**Unit - I:**

Differential Equations of First Order and First Degree: Linear Differential Equations; Differential Equations Reducible to Linear Form; Exact Differential Equations; Integrating Factors; Change of Variables. Differential Equations of the First Order but not of the First Degree: Equations Solvable for  $p$ ; Equations Solvable for  $y$ , Equations Solvable for  $x$ ; Equations that do not Contain  $x$  (or  $y$ ); Equations Homogeneous in  $x$  and  $y$ ; Equations of the First Degree in  $x$  and  $y$ ; Clairaut's Equation

**Unit - II:**

Higher Order Linear Differential Equations: Solution of Homogeneous Linear Differential Equations of Order  $n$  with Constant Coefficients. Solution of the Non-homogeneous Linear Differential Equations with Constant Coefficients by means of Polynomial Operators.

(i) When  $Q(x) = bx^k$  and  $P(D) = D - a_0, a_0 \neq 0$

(ii) When  $Q(x) = bx^k$  and  $P(D) = a_0 D^n + a_1 D^{n-1} + \dots + a_n$

(iii) When  $Q(x) = e^{ax}$

(iv) When  $Q(x) = b \sin ax$  or  $b \cos ax$

(v) When  $Q(x) = e^{ax} V$  where  $V$  is a function of  $x$ .

(vi) When  $Q(x) = xV$  Where  $V$  is any function  $x$ .

**Unit - III:**

**Binary Operations:** Definition and Properties, Tables.

**Groups:** Definition and Elementary Properties; Finite Groups and Group Tables.

**Subgroups:** Subgroups; Cyclic Subgroups

**Permutations:** Functions and Permutations; Groups of Permutations, Cycles and Cyclic Notation, Even and Odd Permutations, The Alternating Groups

**Cyclic Groups:** Elementary Properties, The Classification of Cyclic Groups, Subgroups of Finite Cyclic Groups

**Isomorphism:** Definition and Elementary Properties, How to show that groups are Isomorphic, How to show that Groups are Not Isomorphic, Cayley's Theorem.

**Groups of Cosets:** Cosets, Applications, Lagrange's Theorem, Normalizer of an element of a group

**Normal Subgroups and Factor Groups:** Criteria for the Existence of a Coset Group; Inner Automorphisms and Normal Subgroups; Factor Groups; Simple Groups

**Homomorphisms:** Definition and Elementary Properties; The Fundamental Theorem on Homomorphism of groups; Applications.

**Unit - IV:**

**Vector Differentiation:** Differential Operator, Gradient, Divergence, Curl

**Vector Integration:** Theorems of Gauss, Green and Stokes and Problems related to them.

**Unit - V:**

**The Plane:** Every equation of the first degree in  $x, y, z$  represents a plane, Converse of the preceding Theorem; Transformation to the normal form, Determination of a plane under given conditions.

i) Equation of a plane in terms of its intercepts on the axes.

ii) Equations of the plane through three given points.

Systems of planes; Two sides of a plane; Length of the perpendicular from a given point to a given plane; Bisectors of angles between two planes; Joint equation of two planes;

Orthogonal projection on a plane; Volume of a tetrahedron in terms of the co-ordinates of its vertices; Equations of a line; Right Line; Angle between a line and a plane; The condition that a given line may lie in a given plane; The condition that two given lines are coplanar, The shortest distance between two lines. The length and equations of the line of shortest distance between two straight lines; Length of the perpendicular from a given point to a given line; Intersection of three planes; Triangular Prism.

**The Sphere:** Definition and equation of the sphere; Equation of the Sphere through four given points; Plane sections of a sphere. Intersection of two spheres; Equation of a circle. Sphere through a given circle; Intersection of a sphere and a line. Power of a point; Tangent plane. Plane of contact. Polar plane. Angle of intersection of two spheres. Conditions of two spheres. Conditions for two spheres to be orthogonal; Radical plane, coaxial system of spheres; Simplified form of the equation of two spheres.

#### **Unit - VI:**

**The Real Numbers:** The algebraic and Order Properties of  $\mathbb{R}$ ; Absolute Value and Real Line; The Completeness Property of  $\mathbb{R}$ ; Applications of the Supremum Property; Intervals.

**Sequences and Series:** Sequences and their Limits; Limits Theorems; Monotone Sequences; Subsequences and the Bolzano - Weierstrass Theorem; The Cauchy Criterion; Properly Divergent Sequences.

**Infinite series:** Introduction to series, Absolute convergence, Test for absolute convergence, test for non – absolute convergence.

**Limits:** Limits of Functions, Limits Theorems, Some Extensions of the Limit Concept.

**Continuous Functions:** Continuous Functions, Combinations of Continuous Functions; Continuous Functions on Intervals, Uniform Continuity, Definition, Non-Uniform Continuity Criteria, Uniform Continuity Theorem.

#### **Unit - VII:**

**Differentiation:** The derivative, The Mean Value theorem, L'Hospital Rules, Taylor's Theorem.

**The Riemann Integral:** The Riemann Integral, Riemann Integrable Functions, the Fundamental theorem.

#### **Unit - VIII:**

**Rings:** Definition and Basic Properties, Fields.

**Integral Domains:** Divisors of zero and cancellation laws, Integral domains, The Characteristic of a Ring, Some Non-Commutative Examples, Matrices over a field, The Quaternion's.

**Sub – Rings, Ideals, Quotient Rings & Euclidean Rings:** Ideals, Principal Ideal, Quotient Rings and Euclidean Rings.

**Homomorphisms of Rings:** Definition and Elementary properties, Maximal and Prime Ideals, Prime Fields.

**Rings of Polynomials:** Polynomials in an Indeterminate, The Evaluation Homomorphism's.

**Factorization of Polynomials over a field:** The Division Algorithm in  $F[x]$ ; Irreducible polynomials, ideal structure in  $F[x]$ , Uniqueness of Factorization in  $F[x]$ .

#### **Unit - IX:**

**Vector Spaces:** Vector Spaces, Subspaces, General properties of vector spaces, Algebra of subspaces, linear combination of vectors. Linear span, linear sum of two subspaces, Linear Dependence and Linear Independence of vectors, Basis of vector space.

**Linear Transformation and Matrices:** Linear Transformations, Linear operators, Range and null space of linear transformation, Rank and nullity of linear transformations, Linear Transformations as vectors, Product of linear transformations, Invertible linear transformations. Transpose of linear

transformations, characteristic values and characteristic vectors, Cayley – Hamilton theorem, Diagonalizable operators.

**Inner Product Spaces:** Inner Product spaces, Euclidean and unitary spaces, Norm of a vector, Schwartz inequality, Orthogonality, Orthonormal set, complete orthonormal set, Gram – Schmidt orthogonalisation process.

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## **FOR B.Sc. (MATHEMATICS) GRADUATES**

### **ANALYTICAL ABILITY (50M)**

**1. Data Sufficiency:-** A question is given followed by data in the form of two statements labeled as I and II. If the data given in I alone is sufficient to answer the question then choice (1) is the correct answer. If the data given in II alone is sufficient to answer the question, then choice (2) is the correct answer. If both I and II put together are sufficient to answer the question by neither statement alone is sufficient, then Choice (3) is the correct answer. If both I and II put together are not sufficient to answer the question and additional data is needed, then choice (4) is the correct answer.

**2. a. Sequences and Series:** Analogies of numbers and alphabets completion of blank spaces following the pattern in A: b:: C:d relationship odd thing out; Missing number in a sequence or a series.

**b. Data Analysis:** The data given in a Table, Graph, Bar Diagram, Pie Chart, Venn diagram or a passage is to be analyzed and the questions pertaining to the data are to be answered.

**c. Coding and Decoding Problems:** A code pattern of English Alphabet is given. A given word or a group of letters are to be coded and decoded based on the given code or codes.

**d. Date, Time and Arrangement Problems:** Calendar problems, Clock Problems, Blood Relationship, Arrivals, Departures and Schedules; Seating Arrangements, Symbol and Notation Interpretation.

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**FOR B.Sc (MATHEMATICS) GRADUATES**

**COMMUNICATIVE ENGLISH (50 MARKS)**

1. Vocabulary
  - Antonyms – 5m
  - Synonyms -5 m
  - Single Word Substitute – 3m
  - Words often confused – 3m
  - Idioms & Phrasal Verbs – 2 m
2. Grammar
  - Tenses – 2m
  - Prepositions – 5m
  - Concord – 5m
  - Active & Passive Voice – 5m
3. Correction of Sentences – 5m
4. Spelling – 5m
5. Reading Comprehension – 5m

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**MODEL QUESTIONS**

**MATHEMATICS**

1. If  $1, \omega, \omega^2$  are the cube roots of unity then  $\begin{vmatrix} 1 & \omega & \omega^2 \\ \omega & \omega^2 & 1 \\ \omega^2 & 1 & \omega \end{vmatrix} =$   
1) 0                                  2) 1                                  3) 2                                  4) 3
2.  $\lim_{n \rightarrow \infty} \frac{1^2 + 2^2 + \dots + n^2}{n^3} =$   
1)  $\frac{1}{2}$                                   2)  $\frac{1}{3}$                                   3)  $\frac{1}{4}$                                   4)  $\frac{2}{3}$
3. The particular integral of  $(D^2 - 5D + 6)y = e^{4x}$  is  
1)  $\frac{e^{4x}}{2}$                                   2)  $2e^{4x}$                                   3)  $e^{4x}$                                   4)  $\frac{e^{4x}}{3}$

**ANALYTICAL ABILITY**

1. In which year was Rahul born?  
I. Rahul at present is 25 years younger to his mother.  
II. Rahul's brother, who was born in 1964, is 35 years younger to his mother.  
1) I alone is sufficient.                                  2) II alone is sufficient.  
3) Both I and II are sufficient.                                  4) Neither I nor II is sufficient.
2. The odd one in this series 8, 27, 64, 100, 125, 216, 343.  
1) 27                                  2) 100                                  3) 125                                  4) 343
3. If CERTAIN is coded as XVIGZRM, how can MUNDANE be coded.  
1) MFMXZMV                                  2) NFMWZMX                                  3) NFMWZMV                                  4) VMZWFMN
4. Introducing a boy, a girl said "He is the son of the daughter of the father of my uncle" How is the boy related to the girl?  
1) Brother                                  2) Nephew                                  3) Uncle                                  4) Son-in-law.

**COMMUNICATIVE ENGLISH**

1. Choose the correct antonym for 'Patience'  
1) Unpatience                                  2) Impatience                                  3) Nonpatience                                  4) Dispatience
2. Choose the correct synonym for 'often'  
1) Frequently                                  2) Seldom                                  3) Rare                                  4) Regularly
3. Choose the correct single word substitute for the phrase 'a man who loves mankind'  
1) Misanthropist                                  2) Philanthropist                                  3) Misogynist                                  4) Psychopath

4. Choose the correct spelling  
1) Tommorow      2) Toomorow      3) Tomorrow      4) Tomarrow

5. Fill in the blank using the right preposition  
I want to discuss \_\_\_\_\_ the current events.  
1) About      2) Along      3) Of      4) On

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