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**Syllabus 2023-24**  
**Panjab University**

**BA/BSc**  
**(MATHS)**

**FOURTH SEMESTER**

SCO 80-81, Sec.15D, Chandigarh  
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**MATHEMATICS****B.A./B.Sc. (GENERAL) SECOND YEAR EXAMINATION, 2023-2024****SEMESTER-IV****Paper I: ADVANCED CALCULUS II**

Max. Marks	:	30
Time	:	3 Hours

- Note:**
1. The syllabus has been split into two Units: Unit-I and Unit-II. Four questions will be set from each Unit.
  2. A student will be asked to attempt five questions selecting at least two questions from each Unit. Each question will carry 6 marks.
  3. The teaching time shall be five periods (45 minutes each) per paper per week including tutorial.
  4. If internal assessment is to be conducted in the form of written examinations, then there will be only one written examination per paper in a Semester

**Unit-I**

Definition of a sequence, Bounds of a sequence, Convergent, divergent and oscillatory sequences, Algebra of limits, Monotonic Sequences, Cauchy's theorems on limits, Subsequences, Bolzano-Weirstrass Theorem, Cauchy's convergence criterion.

Sequential continuity and Uniform continuity of functions of single variable.

**Unit-II**

Series of non-negative terms. P-Test. Comparison tests. Cauchy's integral test. Cauchy's Root test. Ratio tests : Kummer's Test, D'Alembert's test, Raabe's test, De Morgan and Bertrand's test, Gauss Test, Logarithmic test. Alternating series. Leibnitz's theorem. Absolute and conditional convergence, Rearrangement of absolutely convergent series, Riemann's rearrangement theorem

**References:**

1. D. Soma Sundaram and B. Choudhary : A First Course in Mathematical Analysis, Narosa Publishing House, New Delhi 1997.
2. P. K. Jain and S. K. Kaushik : An Introduction to Real Analysis, S. Chand & Co., New Delhi 2000.
3. Murray R. Spiegel : Theory and Problems of Advanced Calculus, Schaum Publishing Co., New York.
4. S.C.Malik : Mathematical Analysis, Wiley Eastern Ltd., New Delhi.
5. O.E.Stanaitis : An Introduction to Sequences, Series and Improper Integrals, Holden – Dey, Inc., San Francisco, California.
6. Earl D. Rainville : Infinite Series, The Macmillan Company, New York.
7. N. Piskunov : Differential and Integral Calculus, Peace Publishers, Moscow.

**Paper II : DIFFERENTIAL EQUATIONS- II**

Max. Marks	: 30
Time	: 3 Hours
Int. Assesment	: 3 Marks

- Note:**
1. The syllabus has been split into two Units: Unit-I and Unit-II. Four questions will be set from each Unit.
  2. A student will be asked to attempt five questions selecting at least two questions from each Unit. Each question will carry 6 marks.
  3. The teaching time shall be five periods (45 minutes each) per paper per week including tutorial.
  4. If internal assessment is to be conducted in the form of written examinations, then there will be only one written examination in a Semester.

**Unit-I**

Series solution of differential equations-Power Series method, Bessel and Legendre equations.

Bessel functions of First and Second kind. Legendre function. Generating function. Recurrence relation and orthogonality of Bessel and Legendre function.

Partial Differential Equations: Origin of first order Partial Differential Equations, Linear Equation of first order, Integral surfaces passing through a given curve, surfaces orthogonal to a given system of surfaces.

**Unit-II**

Inverse Laplace transforms- Linearity property, Shifting properties, Change of Scale Property. Inverse Laplace transforms of derivatives and integrals, Convolution theorem.

Applications of Laplace Transforms - Solution of differential equations with constant coefficients, Solution of differential equations with variable coefficients, Solution of simultaneous differential equations.

Laplace Transformation-Linearity of the Laplace transformation. Existence theorem for Laplace transformations, Shifting Theorems, Laplace transforms of derivatives and integrals, Multiplication of  $t^m$ , Division by  $t$ .

**References:**

1. Erwin Kreyszig : Advanced Engineering Mathematics, John Wiley & Sons Inc., New York, 1999.
2. D.A. Murray : Introductory Course on Differential Equations, Orient Longmen, (India) 1967.
3. A.R. Forsyth : A Treatise on Differential Equations, Macmillan and Co. Ltd., London.
4. Sneddon, I.N. : Elements of Partial Differential Equations, McGraw Hill, 1957.
5. J. D. Murray & M. R. Spiegel : Schaum Series, Laplace Transforms.

6. Ross, S.L. : Differential Equations, John Willey & Sons, 2004.  
 7. Earl D. Rainville : Infinite Series, The Macmillan Company, New York.  
 8. N. Piskunov : Differential and Integral Calculus, Peace Publishers, Moscow.

**Paper III : DYNAMICS**

Max. Marks : 30  
 Time : 3 Hours

- Note:**
1. The syllabus has been split into two Units: Unit-I and Unit-II. Four questions will be set from each Unit.
  2. A student will be asked to attempt five questions selecting at least two questions from each Unit. Each question will carry 6 marks.
  3. The teaching time shall be five periods (45 minutes each) per paper per week including tutorial.
  4. If internal assessment is to be conducted in the form of written examinations, then there will be only one written examination per paper in a Semester

**Unit-I**

Motion of a particle with constant acceleration, acceleration of falling bodies, motion under gravity, motion of a body projected vertically upwards: Newton's Laws of Motion, Motion of two particles connected by a string, motion along a smooth inclined plane, constrained motion along a smooth inclined plane. Variable acceleration: Simple harmonic motion, elastic string.

**Unit-II**

Curvilinear motion of a particle in a plane: Definition of velocity and acceleration, projectiles, motion in a circle.

Work, power, conservative fields and the potential energy, work done against gravity, potential energy of a gravitational field.

Relative motion, relative displacement, velocity and acceleration, motion relative to a rotating frame of reference.

Linear momentum, angular momentum, conservation of angular momentum, impulsive forces, principle of impulse and momentum, motion with respect to centre of mass of a system of particles, collisions of elastic bodies, loss of energy during impact.

**References:**

1. S.L. Loney : An Elementary Treatise on the Dynamics of a Particle and of Rigid bodies, Cambridge University Press, 1956.
2. K.R.Chaudhery and A.C.Aggarwal : Elements of Mechanics, Statics and Dynamics. S Chand and Company
3. S. L. Loney : The elements of Statics and Dynamics, 5th edition, Cambridge University Press, 1947.
4. Donald T. GreenWood : Principles of Dynamics, Second Edition, Prentice Hall of India.
5. M . Ray : A Text Book on Dynamics , S. Chand and Company- 1989

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**Semester I to VI**



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