

**BHARATI VIDYAPEETH**  
**(DEEMED TO BE UNIVERSITY), PUNE, INDIA**  
**PhD Entrance Test – 2023**  
**SECTION-II: Mechanical Engineering - 50 Marks**

UNIT No	Topics covered
<b>UNIT-I</b>	<p><b>Probability &amp; Statistics</b>  Measures of Central Tendency, Mean, Median, Mode, Measures of Variation, Range, Population Variance and Standard Deviation, Sample Variance and Standard Deviation, Variance and Standard Deviation for Grouped Data, Probability Distributions, Variance, Standard Deviation, and Expectation, The Binomial Distribution, Poisson Distribution, Normal Distributions, The Standard Normal Distribution. Practical examples based on these distributions.</p>
<b>UNIT-II</b>	<p><b>Numerical Methods</b>  <u>Roots of Equations</u>: Significant figures, Accuracy and Precision, Error definition, Round-Off errors, Truncation error, Total numerical error. Bracketing methods- Bisection and False position method. Open methods, Newton-Raphson method  <u>Linear Algebraic Equation</u>: Navie-Gauss elimination, pitfalls of Gauss Elimination, techniques of improving solutions.  <u>Numerical differentiation and Integration</u>: Trapezoidal rule, Simson's rules, integration with unequal segment, multiple integral, derivatives of unequally spaced data  <u>Ordinary Differential Equations</u>: Euler's method, improvement of Euler's method, Runge-Kutta method, system of equations.</p>
<b>UNIT-III</b>	<p><b>Manufacturing Engineering</b>  <u>Principles of metal cutting</u>: Mechanics of chip formation; Geometry of cutting tools and tool signatures; Orthogonal and oblique cutting; Metal cutting models: Merchant model, Lee-Shaffer model, Oxley model; Forces in metal cutting; Tribology in metal cutting; Surface roughness in machining; Thermal aspects of machining; Tool wear, tool life, tool materials, tool coatings and coating techniques; Economics of machining; Machinability; Cutting fluids: properties, types, application techniques.</p>
<b>UNIT-IV</b>	<p><b>Thermal Engineering</b>  <u>Fluid Mechanics</u>: The continuity equation, Stream function for uniform stream, two dimensional flow past solid bodies, velocity functions. Limiting cases of small viscosity, exact solution, theory of hydrodynamic lubrication.  <u>Heat Transfer</u>: Steady and transient Conduction, Principle of Fluid flow and Convective heat transfer. Concept of velocity and thermal boundary layers, Navier-Stokes equations and convection equation, Boundary layer approximations.</p>
<b>UNIT-V</b>	<p><b>Design Engineering</b>  <u>Vibration</u>: Basic concepts, Free vibration of single degree of freedom systems with and without damping, forced vibration of single DOF-systems, Natural frequency, Transient Vibration of single Degree-of freedom systems.  <u>Failure due to Fatigue</u>: High cycle and low cycle fatigue, Fatigue design models, Fatigue testing, Fatigue mechanisms, General S-N behavior, Factors influencing S-N behavior, S-N curve representation and approximations, Constant life diagrams, Fatigue life estimation using S-N approach, Modes of mechanical failure, Review of failure theories for ductile and brittle materials</p>
<b>Text Books/References:</b>	

1.	Allan G. Bluman, Elementary Statistics A Step by Step Approach, McGraw-Hill.
2.	<i>Numerical methods for engineers</i> / Steven C. Chapra, Raymond P. Canale
3.	G. Boothroyd and W. A. Knight, Fundamentals of Machining and Machine Tools, CRC-Taylor and Francis, 2006
4.	Fluid Mechanics. FM White. Boston: McGraw-Hill Book Company
5.	Fundamentals of Heat and Mass Transfer-5 <sup>th</sup> Ed. Frank P. Incropera. John Wiley
6.	Heat Transfer. J.P Holman McGraw-Hill Book Company
7.	Mechanical Vibration. G. K. Grover
8	Design of Machine Elements V. B. Bhandari

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