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GHS 31
Statics and Calculus - II
(Number of Teaching hours:80; Time: 3hrs; Marks:100)
(To answer five questions, choosing one out of two questions from each unit)

SECTION - A (Statics, 40 marks)

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UNIT I : Composition and resolution of forces; parallelogram of forces, Components and resolved parts, Coplanar forces: Equilibrium of concurrent forces, Triangle of forces, Lami's Theorem and its converse; Parallel forces; Moment of a force; Definition, geometrical representation of Moments, Varignon's Theorem. Couples; definition, equilibrium of Couples, Equivalence of two Couples, Resultant of Couples, Resultant of a couple and a force.

UNIT II : Reduction of coplanar forces, equilibrium of coplanar forces. Friction: laws of statical friction, laws of limiting friction, solution of problems on equilibrium of heavy bodies (such as uniform rods) resting on plane surfaces. Centre of gravity: centre of gravity of thin uniform rod, uniform lamina, triangular lamina and lamina in the form of a parallelogram and trapezium.

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SECTION - B (Calculus - II, 60 marks)

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UNIT III : Sequences of real numbers : definitions of bounded sequence, convergent sequence, limit of a sequence, monotonic sequence; examples; proof of the fact that monotonic and bounded sequences are convergent (using completeness of R as an axiom); Cauchy sequence; Cauchy's general principle of convergence; Infinite series of real numbers: partial sums, convergent series, comparison test, ratio test, Raabe's test, root test; absolute convergence; Leibnitz's theorem for alternating series; power Series; radius of convergence (without the notion of limit superior), standard examples of power series

UNIT IV : Application of differential calculus: Sign of the derivatives of a real valued function of a real variable, vanishing of f(x); Rolle's theorem; geometric interpretation, mean value theorems, applications of the mean value theorems: (i) increasing and decreasing functions, (ii) concavity upwards and downwards, (ili) points of inflections, multiple roots. Use of differentials in approximation and error estimates; maxima and minima; asymptotes, curvature of plane curves (Cartesian and parametric equations only), Real - valued functions of two or three variables: limits, continuity; partial derivatives of first and second orders, Schwarz's theorem (statement only); differentials; chain rules; Euler's theorem on homogeneous functions, proof upto three variable case. :

UNIT V : Location of roots of $f(x)$, proof of the fundamental theorem of integral calculus; Taylor's and Maclaurin's theorem with Cauchy's form of remainders;

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Taylor's and Maclaurin's series; expansion of standard functions such as e^x, $\sin x$, $\cos x$, $\log(1+x)$, $(1+x)^n$. Applications of integral calculus : determination of (i) areas under simple plane curves, (ii) lengths of simple plane curves, (iii) volume and surface areas of solids of revolution in standard cases. Evaluation of line integrals (in a plane); double integrals, change of order of integration; application in determination of area, volume (simple cases only).

Text books:
1. Das, B. C. and Mukherjee, B. N.: *Statics*, U. N. Dhar & Sons Publications, Kolkata, 2002.
2. Maity, K. C. and Ghosh, R. K.: *Differential Calculus*, New Cental Book Agency Pvt Ltd., 2002.
3. Maity, K. C. and Ghosh, R. K.: *Integral Calculus*, New Cental Book Agency Pvt. Ltd., 2002.

Reference Books:
1, Loney, S. L.: *An elementary treatise on the Dynamics of a particle and of rigid bodies*, New Age International Pvt. Ltd, 2016
2. Stewart, J.: *Essential Calculus Early Transcendentals*, Cengage India Pvt Ltd, 2017.
3. Bernside, W. S., and Panton, A. W.: *Theory of Equations*, Vol. I, S. Chand & Co., New Delhi,2000 4. Thomas, G. B., and Finney, R. L. : *Calculus and Analytic Geometry* (9th Edition), Pearson Education India, 2010.
5. Narayan S.: *A course of Mathematical Analysis*, S,Chand and Co., 2005.
6. Das, B.C. and Mukherjee B.N., *Differential Calculus* , UN Dhar and Sons Publisher, 52nd edition, 2012.