NILKANTHA MULTIPLE CAMPUS
Dhading, Nepal
Annual Teaching Plan
Academic Session: 2080/081

Level: B. Ed. Four

Subject: Calculus — Course No.: Math Ed.: 417

Subject teacher: Surendra Prasad Sah — Year: First

Time/ Teaching hrs.	Unit	Objectives	Methodology	Materials	Evaluation	Reference Books/Resources
6 hours	1.Limit and continuity 1.1 Use of $\varepsilon - \delta$ in finding limit 1.2 Continuity and discontinuity 1.3 Geometrical meaning of continuity and discontinuity	-To explain the limit and continuity interms of ε, δ.	-Students centered instructional techniques.	-Reference book	1.Define limit and continuity and discontinuity. 2.What is meaning of symbol ε and δ ?	-Maskey, S.M. Calculus. Kathmandu:Ratna pustak Bhandar (For units 1 to X)
8 hours	2: Higher Order Derivatives 2.1 Differentiation of hyperbolic and step functions 2.2 Definitions and notations of higher order derivatives 2.3 nth order derivative of the function as $x^m, (ax+b)^m, \sin(ax+b)$, $\log(ax+b)$ etc. 2.4 Leibnitz theorem	-To find the differential coefficient of different types of functions. -To explain the meaning of successive differentiation. -To find the higher order derivatives of some specific functions. -To state and prove Leibnitz Theorem.	-Lecture -Problem solving	-Text book And reference book. -Curriculum and syllabus	1.How can you denote the of 1st, 2nd …………., nth order derivatives of function y= f(x). 2.Find the nth derivative of $x^m, (ax+b)^m etc.$ 3. State Leibniz Theorem.	-Koirala S.P, Pandey U.N and Pahari N.P, A textbook on differential calculus, Kathmandu: Vidyarthi prakashan (for I to X)

12 hours	3: Expansion of functions 3.1 Roll's Theorem 3.2 Lagrange's mean value Theorem 3.3 Cauchy's mean value Theorem 3.4 Taylor's theorem with different form Of remainders 3.5 Maclaurin's Theorem 3.6 Verification of Roll's Theorem, Lagrange's mean value Theorem, and Cauchy's mean value Theorem 3.7 Expansion of functions $e^x, \sin x$, $\log x$, etc. in finite and infinite form Using Maclaurin's series	-To prove mean value theorem -To interpret Roll's theorem, Lagrange Mean value theorem and Cauchy Mean value theorem. -To prove Taylor's theorem in finite and infinite forms. -To expand some functions in finite and infinite forms by using Maclaurin's series.	-Lecture -Discussion -Demonstration -Problem solving	-Curriculum and syllabus -Text book and reference book.	1. State Roll's Theorem, Lagrange's mean value Theorem, Cauchy's mean value Theorem. 2. State Taylor's theorem and Maclaurin's theorem of finite and infinite theorem. 3. Write the finite and infinite series of functions $e^x, \sin x, \log x, etc.$	-Koirala S.P, Pandey U.N, Pahari N.P, and Pokharel P. A textbook on integral Calculus. Kathmandu: Vidyarthi Prakashan (For XI to xv) -A reference book on Integral Calculus and Differential equation. N.P Pahari.
5 hours	4: Indeterminate forms 4.1 Examples of various indeterminate forms. 4.2 L Hospital's theorem and its generalization. 4.3 Indeterminate forms: $\frac{\infty}{\infty}, \infty \times 0,$ $\infty - \infty, 1^{\circ}, 1^{\infty}, \infty^{\circ}$ 4.4 Limits of functions of Indeterminate forms.	-To prove and generalize L Hospital's theorem. -To find the limits of functions of different indeterminate forms.	-Inquiry and questions answer. -Discussion	-Reference books	1.Define indeterminate Forms. 2. What are indeterminate forms.? 3.State L Hospital's theorem.	-Integral Calculus and differential equation. Prof. G.D. Pant and G.S Shrestha.(2007)

10 hours	5: Partial differentiation 5.1. Limits and continuity of functions of two variables. 5.2 Definition of partial derivatives and interpretation of first order. 5.3 Partial derivatives of higher order. 5.4 Homogeneous functions and Euler's theorem on two and three variables with its converse. 5.5 Theorems on total differentials. 5.6 Theorem on the derivatives of composite functions 5.7 Differentiation of implicit functions	-To define partial derivatives w.r.t x, y and z. -To interpret geometrical the partial derivatives of first order of two variables. -To find partial derivatives of higher order. -To state and prove Euler's theorem on homogeneous functions and verify the theorem. -To Explain total differentials. -To find $\frac{dy}{dx}$ of implicit functions using partial derivatives.	-Instructional, discussion and problem solving	-curriculum and syllabus. -Recommended books.	1.Define partial derivatives, homogeneous function. 2.What is differentiate between $\frac{dy}{dx}$ and $\frac{\partial y}{\partial x}$? 3.State Euler's theorem of two and three independent variables. 4.State the derivatives of composite and implicit functions.	-Differential Calculus, Das, B.C. and Mukerjee, B.N,(2007), Culcutta: UN Dhur and sons (pvt) Ltd. India.
10 hours	**6: Tangent and Normal** 6.1 Equation of tangent and normal. 6.2 problems on tangent and normal. 6.3 Angle of intersection of the Curves in cartesian and polar forms. 6.4 Length of tangent, normal, Subtangent, subnormal in Cartesian and polar forms. 6.5 Derivative of arc length (cartesian and polar form) 6.6 Angle between radius vector and tangent.	-To define tangent and normal to the curve. -T0 derive equation of tangent and normal of curves in explicit, implicit and parametric forms. -To find the length of tangent, normal, sub-tangent and sub-normal in cartesian and normal forms. -To find the derivative of arc-length in cartesian and polar forms. -Derive the angle between	-Lecture and discussion. -Problem solving	Recommended and References books	1.Define tangent and normal. 2.Find the equation of tangent and normal of $x^2 + x^2 = 25$ at $(3, -4)$, Y(x-2)(x-3)-x+7=0 at the point where it crosses the axis of x. 3.If lx+my=1 is a normal to the parabola $y^2 = 4ax$, prove that $al^3 + 2alm^2$ =m^2	-Integral Calculus, Das, B.C and Mukerjee, B.N, (2007), Culcutta: UN Dhur and sons (pvt.) Ltd. India

	6.7 Pedal equation of cartesian And polar curves.	the radius vector and tangent. -To find the pedal equation of the curves in cartesian and polar form.			4.Find the pedal equation of the curves a)$i)\ y^2 = 4a(x+a)$ ii) $r = a(1+\cos\theta)$	
10 hours	**7: Maxima and Minima** 7.1 Definition of increasing and decreasing functions, concavity, convexity, point of inflection, stationary point and saddle point. 7.2 Conditions for concavity And convexity. 7.3 Necessary and sufficient condition for maximum and minimum of one, two or three variables. 7.4 Extreme values under subsidiary conditions. 7.5 Lagrange's method of Undetermined multipliers. 7.6 Problems on maxima and Minima of two or three Variables.	-To define increasing and decreasing functions, concavity, convexity, point of inflection, stationary point, and saddle point. -To derive necessary and sufficient conditions for maximum and minimum. -To determine the conditions for maximum and minimum of functions of two and three variables. -To solve the problems on maximum and minimum	-Lecture -Discussion -problem solving	-Recommended books and reference books	1.Find the maximum and minimum value of functions $i)\ x+\frac{1}{x}$ $ii)\ \sin x\ and\ \cos x$ Iii)$f = x^3 - x^2 - y^2 + xy$ 2.Show that of all rectangles of given area, the square has the smallest perimeter. 3. Find the extreme values of xy^2, when x +y = 1 4. Find the maximum and minimum value of $x^2+y^2+z^2$, when $\frac{1}{x}+\frac{1}{y}+\frac{1}{z}=1$	-An introduction to analysis-differential calculus part I, (9th ed.), Ghosh, R.K. and Maity K.C. India: New central book agency (pvt.), Ltd.
10 hours	**8: Curvature** 8.1. Definition of curvature and its intuitive meaning .	-To give the meaning of curvature	-Lecture -Discussion -Demonstration	-Recommended books and reference books	1. What do you mean by curvature	-An introduction to analysis-differential calculus part II,

	8.2. Radius of curvature of different type of curves. 8.3. Curvature at the origin. 8.4. Chord of curvature through the origin. 8.5. Centre of curvature. 8.6. Circle of curvature. 8.7. Centre of curvature and its property.	-To find radius of curvature of different curves. -To find radius of curvature at the origin. -To deduce the chord of curvature through the origin. -To define center of curvature, circle of curvature, evolutes, involutes. -To deduce the expression for center of curvature.	-Problem solving		and radius of curvature? 2. Find the radius of curvature of the following curves… i) $y^2 = 4ax$ ii) $y = c\cosh\frac{x}{c}$, etc. 3. Show that the radius of curvature for the curve $r^m = a^m \cos m\theta$ is $\frac{a^m}{(m+1)r^{m-1}}$.	Ghosh, R.K., and Maity, K.C. (2002), India: New central Book agency (Pvt.) Ltd.
6 hours	**9: Asymptotes** 9.1. Definition of asymptotes with illustration in figure. 9.2. Asymptotes parallel and non- parallel to the axis. 9.3. Asymptotes of algebraic curves.	-To define asymptotes. -To find asymptotes parallel to x-axis and y-axis. -To find oblique asymptotes. -To find asymptotes of curves in polar form.	-Demonstration and presentation. -Lecture -problem solving	-Reference books and charts. -problem solving.	1. Define the asymptote, asymptote parallel to x-axis, y-axis and oblique asymptotes. 2. What is the relation between degree of curve and number of asymptotes.	-Differential Calculus, Narayan, S. (1998). New Delhi: Shyam Lal Charitable Trust.
6 hours	**10: Curve tracing.** 10.1 Rules for tracing cartesian and polar curves. 10.2. Tracing curves of some well known curves.	-To describe rules for tracing curves in cartesian and polar forms. -To Trace some well-known curves in cartesian and polar forms.	-Lecture -Demonstration -problem solving	-Chart of different types of curves. -Reference books	1. What are the rules of tracing for the curves in cartesian and polar forms 2. Trace the curves i) $x^2y^2 = x^2 - 1$ ii) $r = a(1 - \cos\theta)$	-Calculus (9th ed.). Thomas, G.B. and Finney, R.L. (2004). Delhi: Pearson Education.

6 hours	**11: Envelop** 11.1 Envelop and its examples 11.2 Envelop of straight lines 11.3 Envelop of two parametric family of curves	-To define envelop -To give analytical definition of envelop of one parameter family of curves -To determine envelop of one parameter family of curve-To define two parameter family of curves -To determine envelop of two parameter family of curves	-Lecture -Demonstration -problem solving	-Charts -reference books	1.Define envelop 2. Define envelop of one and two parameter family of curves 3. What is envelop of straight lines.	-Differential calculus. Upreti, K.N. (2007)
6 hours	**12: infinite integral** 12.1 Integration of some Standard integrals	-T0 Integrate different types of functions of standard forms by different methods.	-Lecture -problem solving	-Reference books	1.Define infinite integral 2.Integrate: i) $\int_0^\infty \frac{dx}{9+x^2}$ ii) $\int_0^1 \log x\, dx$ .etc	
6 hours	**13: Definite integral** 13.1 Integration as the limit of a sum 13.2 Geometrical interpretation of $\int_a^b f(x)dx$ 13.3 General properties of definite integral 13.4 Method of evaluating infinite or improper integrals	-To define integration as the limit of a sum -To give the geometrical interpretation of $\int_a^b f(x)dx$ -To state and prove the theorems and properties of definite integral -To solve the problems of definite by definition and using properties -To find the integration of infinite or improper integrals -	-Lecture -Discussion -problem solving	Recommended books	1.Evaluate the $\int_0^1 x^2 dx$ by method of summation. 2. State the general properties of definite integral 3.Integrate:$\int \frac{dx}{e^x+1} dx$	

10 hours	**14: Reduction formulae, and Beta and gamma functions** 14.1 Reduction formulae for some special functions 14.2 Definition of Beta and Gamma functions 14.3 Properties of Beta and Gamma functions	-To find the reduction formula for some standard integrals. -To define Beta and Gamma function. -To prove the properties of Beta and Gamma functions. -To apply the properties of Beta and Gamma functions to evaluate some integrals.	-Lecture -Discussion -Demonstration -Problem solving	-Recommended books -Reference books -Charts	1.Define Beta and Gamma functions. 2. State the properties of Beta and Gamma functions. 3. Reduce the formula for $\int x^n e^{ax} dx$ 4. Reduce the formula for $\int_0^{\pi/2} sin^n x\, dx$	
16 hours	**15: Quadrature, Rectification, Volume and surface area of Revolution** 15.1 Area in cartesian Coordinates. 15.2 Area in polar coordinates 15.3 Area between two curves. 15.4 Length of the arc of curve In cartesian and polar Equations. 15.5 Intrinsic equations from Cartesian and polar Equations. 15.6 Volume of solids of Revolution. 15.7 Surface area of solids of Revolution (the axes being x-axis, y-axis or any line)	-To find area of the curves in Both cartesian and polar Forms. -To find the sectorial area of Plane regions. -To find the length of arc of Curve in both cartesian and Polar form. -To find the intrinsic equation From cartesian, polar and Pedal equations. -To find the surface area and Volume of revolution: the Axes of revolution being the x-axes, y-axes or any line in in the plane.	-Lecture -Discussion -Demonstration -problem solving	-Charts of loops of curves -Recommended books -Reference books	1. Find the area included between two parabolas $y^2 = 4ax$ and $x^2 = 4ay$ 2. Find the area bounded by cardioids $r = a(1 + \cos\theta)$ 3. Find the circumference of the $x^2 + y^2 = a^2$ 4. Find the intrinsic equation of the catenary $y = c\cosh\frac{x}{c}$ 5. Prove that the volume and surface	

					of a sphere of radius 'a' is $\frac{4}{3}\pi r^3$ 6. Find the surface area of the solid generated by the revolution about initial line $r = a(1 + \cos\theta)$.	
15 hours	**16. Differential equations.** 16.1 Ordinary differential equation of first degree. 16.1.1 Meaning concept and definitions. 16.1.2 Concept of ordinary differentiation equation. 16.1.3 General and particular solution. 16.1.4 Change of variable 16.1.5 Homogeneous equations. 16.1.6 Equations reducible to homogeneous equations. 16.1.7 Linear differential equation. 16.1.8 Equations reducible to linear form. 16.1.9 Concepts and types of orthogonal and oblique trajectories. 16.2 Linear differential equations with constant coefficients. 16.2.1 Equation of 2^{nd} order	-To form the family of curves in terms of differential equation of and interpret geometrically the meaning of differential equation. -To solve equation of the 1^{st} order and 1^{st} degree homogeneous linear equations. -To solve equations of first order but not of the first degree solvable for p, x or y. -To solve linear differential equations with constant coefficients. -To solve homogeneous linear equations.	-Lecture -Demonstration -Discussion -problem solving	-Charts -Recommended books -Reference books	1. Write the order and degree of $\frac{d^2x}{dx^2} = cos2x + sin2x$ 2. Define ordinary and partial differential equation. 3. Find the general and particular solution of $\log\left(\frac{dy}{dx}\right) = 3x + 4y$ given that y=o when x=0. 4. Define homogeneous differential equation with examples. 5. Solve the differential equation $\frac{dy}{dx} = \frac{y}{x} + \tan\frac{y}{x}$ 6.Define linear differential equation with examples.	

	16.2.2 Auxiliary equations and their roots, complimentary functions. 16.2.3 Particular integral. 16.2.4 Method of finding particular integral.				7. Solve the differential equation $(1+x^2)\frac{dy}{dx}+2xy=4x^2$ 8. Find general and singular solution of $y=px+\frac{a}{p}$ 9. Find C.F and general solution of $(D^2-3D+2)y=e^{5x}$	