

Your Name and Surname: Muhammad Usama Nawaz

Grading system ⁽¹⁾: CGPA

DESCRIPTION OF ATTENDED COURSES ⁽²⁾

- a) Please provide **three courses at most in calculus and/or mathematical analysis.** If you attended more than three, please provide only three courses that are relevant to basic topics such as set theory, real numbers, functions of real variables, differential and integral calculus, multivariate calculus, sequences and infinite series, and ordinary differential equations.

Course Title ⁽³⁾	Main contents ⁽⁴⁾ [min. 100, max. 500 characters]	Books used ⁽⁵⁾	Hours ⁽⁶⁾	Grade ⁽⁷⁾
MATH-111 Calculus-I	Functions, graphs, transformations. Trigonometric functions, limits, continuity, asymptotes. Derivatives: definition, rules, implicit differentiation, applications. Mean Value Theorem, curve sketching, antiderivatives. Integrals: definite, indefinite, Fundamental Theorem of Calculus, substitution, area, volume. Arc length, surfaces of revolution. Inverse functions, logarithms, exponentials, L'Hôpital's rule. Inverse trigonometric and hyperbolic functions.	J. Hass, C. Heil and M. E. Weir, Thomas' Calculus, 14th Edition, Pearson, 2017.	3-0	B

Course Title ⁽³⁾	Main contents ⁽⁴⁾ [min. 100, max. 500 characters]	Books used ⁽⁵⁾	Hours ⁽⁶⁾	Grade ⁽⁷⁾
MATH-242 Real Analysis-I	Real & complete numbers, increasing & decreasing sequences, limit definitions, uniqueness, and infinite limits. Limit properties: sums, products, quotients, comparison & location theorems, subsequences. Tests: Bolzano–Weierstrass, Cauchy, convergence, integral, asymptotic, alternating series. Functions: continuity, limits, theorems, zero existence, compact intervals, uniform continuity. Derivatives, MVT, L'Hôpital's rule	Arthur Mattuck, Introduction to Analysis, 1999 Prentice Hall, New Jersey.	3-0	C+
MATH-251 Ordinary Differential Equations-I	Introduction, classification, and initial value problems. Mathematical modeling, separable variables, linear/exact equations, substitution methods, Bernoulli's equation. Linear and nonlinear models. Higher-order linear equations, IVPs, BVPs, undetermined coefficients, variation of parameters, Cauchy-Euler equations. Systems of ODEs, eigenvalues/eigenvectors, Fourier series, Sturm-Liouville problems.	Dennis G. Zill, Michael R. Cullen: Differential equations with boundary value problems, (7th Edition), 2009, Brooks/Cole Cengage Learning, Canada.	3-0	C

- b) Please provide one course in linear algebra. If you attended more than one, please provide one relevant concerning linear spaces, matrices, solutions of linear systems, eigenvalues, and eigenvectors.

Course Title ⁽³⁾	Main contents ⁽⁴⁾ [min. 100, max. 500 characters]	Books used ⁽⁵⁾	Hours ⁽⁶⁾	Grade ⁽⁷⁾
MATH-321 Linear Algebra	Solution of linear systems, Gaussian elimination, Gauss-Jordan method, matrix operations, echelon forms, matrix inverse. Determinants and their computation. Vector spaces, subspaces, linear dependence/independence, bases, dimension. Eigenvalues, eigenvectors, diagonalization, orthogonality, quadratic forms. Linear mappings, kernel, image, isomorphism, change of basis. Inner product spaces, norms, Cauchy-Schwarz inequality, Gram-Schmidt process, orthonormal bases.	W. K. Nicholson, Linear Algebra with Applications (third edition), (1995), PWS Publishing Company.	4-0	C

- c) Please provide no more than two additional mathematics courses, preferably in the areas of numerical analysis and/or probability. Please give priority to basic courses rather than to advanced ones.

Course Title ⁽³⁾	Main contents ⁽⁴⁾ [min. 100, max. 500 characters]	Books used ⁽⁵⁾	Hours ⁽⁶⁾	Grade ⁽⁷⁾
MATH-264 Introduction to Statistics	Sample mean, Central Limit Theorem, sample mean/variance distribution. Maximum Likelihood method. Point/interval estimation for mean/variance. Hypothesis testing, t-tests, equality of means tests. Analysis of variance (ANOVA), one-factor and two- factor ANOVA. Linear regression, hypothesis testing for parameters, coefficient of determination. Chi-squared tests, contingency tables. Quality control, X and S control charts, fraction defective charts.	Sheldon M. Ross, Introductory Statistics (3th Edition) Elsevier, 2010.	3-0	C+
MATH-332 Numerical Analysis-I	Round-off errors, binary/decimal machine numbers, finite digit arithmetic. Iterative methods: Bisection, Fixed-Point, Newton's, Secant, False Position, Muller's. Interpolation: Lagrange, Neville's, Newton's, Hermite. Cubic splines, numerical differentiation, Richardson's extrapolation. Numerical integration: Trapezoidal, Simpson's, Gaussian quadrature. Linear systems: Gaussian elimination, LU/Cholesky factorization. Norms, eigenvalues, eigenvectors, spectral radius.	Numerical Analysis by Richard L. Burden and J. Douglas Faires, 9th Edition, Publisher: Cengage Learning, 2010. (BF)	3-0	C

d) Please provide a **list of programming languages** you studied (no more than three). For each programming language, provide details of one course in which you learned how to use it.

Programming Language	Course Title ⁽³⁾	Books used ⁽⁵⁾	Hours ⁽⁶⁾	Grade ⁽⁷⁾
C	CS-110 Fundamentals of Computer Programming	Paul J. Deitel and Harvey M. Deitel, C: How to Program (8th Ed.), Pearson, 2012.	3-1	B
MATLAB	MATH-235 Mathematical Computing	Gilat, Amos. MATLAB: An intro with Appli. John Wiley & Sons, 2014.	3-1	B
Python	MATH-235 Mathematical Computing DS-402 Machine Learning for Data Analysis	Pine, David J. Introduction to Python for Science and Engineering. CRC Press, 2018.	3-1	B

I verify under my full responsibility that I have given correct and true information on all of the above.

Date and place

Signature

01-03-2025(Islamabad)

