APMA 1090 (Section _) – Single Variable Calculus I Stewart's Calculus 6th Ed

Section	Topic	Problem On Final Exam	Wgt %	Average %	Proficiency Rating	Objectives/ Outcomes Evaluated
2	**Limits**					
2.1	The Tangent and Velocity Problems					
2.2	The Limit of a Function					
2.3	Calculating Limits Using the Limit Laws					
2.4	The Precise Definition of a Limit					
2.5	Continuity					
3	**Derivatives**					
3.1	Derivatives and Rates of Change					
3.2	The Derivative as a Function					
3.3	Differentiation Formulas					
3.4	Derivatives of Trigonometric Functions					
3.5	The Chain Rule					
3.6	Implicit Differentiation					
3.7	Rates of Changes in the Natural and Social Sciences					
3.8	Related Rates					
3.9	Linear Approximations and Differentials					
4	**Applications of Differentiation**					
4.1	Maximum and Minimum Values					
4.2	The Mean Value Theorem					
4.3	How Derivatives Affect the Shape of a Graph					
4.4	Limits at Infinity; Horizontal Asymptotes					
4.5	Summary of Curve Sketching					
4.7	Optimization Problems					
4.9	Newton's Method					
4.10	Antiderivatives					
5	**Integrals**					
5.1	Areas and Distances					
5.2	The Definite Integral					
5.3	The Fundamental Theorem of Calculus					
5.4	Indefinite Integrals and the Net Change Theorem					
5.5	The Substitution Rule					
6	**Applications of Integration**					
6.1	Areas Between Curves					
6.2	Volumes					
6.3	Volumes by Cylindrical Shells					
6.4	Work					
6.5	Average Value of a Function					
	Final Exam Average					
	Number of Students Who Passed Final Exam/Course	/				
	Number of Students Who Failed Final Exam/Course	/				

Excellent (≥ 90 %) Good (75 – 89 %) Fair (60 – 74 %) Poor (< 60 %)

APMA 1110 (Section _) – Single Variable Calculus II Stewart's Calculus 6th Ed

Section	Topic	Problem On Final Exam	Wgt %	Average %	Proficiency Rating	Objectives/ Outcomes Evaluated
7	**Inverse Functions**					
7.1	Inverse Functions					
7.2	Natural Logarithmic Function					
7.3	Natural Exponential Function					
7.4	General Logarithmic and Exponential Functions					
7.5	Exponential Growth and Decay					
7.6	Inverse Trigonometric Functions					
7.7	Hyperbolic Functions					
7.8	Indeterminate Forms and L'Hospital's Rule					
8	**Techniques of Integration**					
	Integration by Substitution					
8.1	Integration by Parts					
8.2	Trigonometric Integrals					
8.3	Trigonometric Substitution					
8.4	Integration of Rational Functions by Partial Fractions					
8.5	Strategy for Integration					
8.7	Approximate Integration					
8.8	Improper Integrals					
9	**Further Applications of Integration**					
9.1	Arc Length					
9.2	Area of a Surface of Revolution					
9.3	Applications to Physics & Engineering – Hydro Force					
9.3	Applications to Physics & Engineering – Moments					
6.4	Applications to Physics & Engineering – Work					
11	**Parametric Equations & Polar Equations**					
11.1	Curves Defined by Parametric Equations					
11.2	Calculus with Parametric Curves					
11.3	Polar Coordinates					
11.4	Areas & Lengths in Polar Coordinates					
11.5	Conic Sections					
11.6	Conic Sections in Polar Coordinates					
12	**Infinite Sequences & Series**					
12.1	Sequences					
12.2	Series – Geometric Series and Divergence Test					
12.3	Integral Test & p-Series					
12.4	Comparison Test					
12.5	Alternating Series					
12.6	Absolute Convergence and the Ratio & Root Tests					
12.7	Strategy for Testing Series					
12.8	Power Series					
12.9	Representation of Functions as Power Series					
12.10	Taylor and Maclaurin Series					
12.11	Applications of Taylor Polynomials					
	Final Exam Average					
	Number of Students Who Passed Final Exam/Course	/				
	Number of Students Who Failed Final Exam/Course	/				

Excellent (≥ 90 %) Good (75 – 89 %) Fair (60 – 74 %) Poor (< 60 %)

APMA 2120 (Section _) – Multivariable Calculus Stewart's Calculus 6th Ed.

Section	Topic	Problem On Final Exam	Wgt %	Average %	Proficiency Rating	Objectives/ Outcomes Evaluated
13	**Vectors and the Geometry of Space**					
13.1	3-D Coordinate System					
13.2	Vectors					
13.3	Dot Product					
13.4	Cross Product					
13.5	Equations of Lines and Planes					
13.6	Cylinders & Quadric Surfaces					
14	**Vector Functions**					
14.1	Vector Functions & Space Curves					
14.2	Derivatives & Integrals of Vector Functions					
14.3	Arc Length & Curvature					
14.4	Motion in Space: Velocity & Acceleration					
15	**Partial Derivatives**					
15.1	Functions of Several Variables					
15.2	Limits & Continuity					
15.3	Partial Derivatives					
15.4	Tangent Planes & Linear Approximations					
15.5	Chain Rule					
15.6	Directional Derivatives & Gradients					
15.7	Max & Min Values					
15.8	Lagrange Multipliers					
16	**Multiple Integrals**					
16.1	Double Integrals over Rectangles					
16.2	Iterated Integrals					
16.3	Double Integrals over General Regions					
16.4	Double Integrals over polar Coordinates					
16.5	Applications of Double Integrals					
16.6	Triple Integrals					
16.7	Triple Integrals in Cylindrical Coord.					
16.8	Triple Integrals in Spherical Coord.					
16.9	Change of Variables in Multiple Integrals					
17	**Vector Calculus**					
17.1	Vector Fields					
17.2	Line Integrals					
17.3	The Fundamental Theorem for Line Integrals					
17.4	Green's Theorem					
17.5	Curl and Divergence					
17.6	Parametric Surfaces and Their Areas					
17.7	Surface Integrals					
17.8	Stokes' Theorem					
17.9	The Divergence Theorem					
	Final Exam Average					
	Number of Students Who Passed Final Exam/Course	/				
	Number of Students Who Failed Final Exam/Course	/				

Excellent (≥ 90 %) Good (75 – 89 %) Fair (60 – 74 %) Poor (< 60 %)

APMA 2130 (Section _) – Ord. Diff. Eqn.s Boyce & DiPrima's Elem Diff Eqn.s & BVPs 8th Ed

Section	Topic	Problem On Final Exam	Wgt %	Average %	Proficiency Rating	Objectives/ Outcomes Evaluated
2	**First Order Differential Equations**					
2.1	Linear Equations					
2.2	Separable Equations					
2.3	Modeling with First Order Equations					
2.4	Differences between Linear and Nonlinear Equations					
2.5	Autonomous Equations					
2.6	Exact Equations					
2.7	Numerical Approximations: Euler's Method					
2.9	Miscellaneous Problems: First Order Equations					
8	**Numerical Methods**					
8.1	The Euler or Tangent Line Method					
8.2	Improvements on the Euler Method					
8.3	The Runge-Kutta Method					
3 & 4	**Higher Order Linear Equations**					
4.1	General Theory of nth Order Linear Equations					
3.1, 4.2	Homogeneous Equations with Constant Coefficients					
3.2	Fundamental Solutions of Linear Homogeneous Equations					
3.3	Linear Independence and the Wronskian					
3.4	Complex Roots of the Characteristic Equation					
3.5	Repeated Roots; Reduction of Order					
3.6, 4.3	Method of Undetermined Coefficients					
3.7, 4.4	Variation of Parameters					
3.8	Mechanical and Electrical Vibrations					
3.9	Forced Vibrations					
5	**Series Solutions of Second Order Linear Equations**					
5.5	Euler Equations					
6	**The Laplace Transform**					
6.1	Definition of the Laplace Transform					
6.2	Solution of the Initial Value Problem					
6.3	Step Functions					
6.4	Diff. Equations with Discontinuous Forcing Functions					
6.5	Impulse Functions					
6.6	The Convolution Integral					
7	**Systems of First Order Linear Equations**					
7.1	Introduction					
7.2	Review of Matrices					
7.3	Systems of Linear Algebraic Equations					
7.4	Basic Theory of Systems of First Order Linear Equations					
7.5	Homogeneous Linear Systems with Constant Coefficients					
7.6	Complex Eigenvalues					
7.7	Fundamental Matrices					
7.8	Repeated Eigenvalues					
7.9	Nonhomogeneous Linear Systems					
	Final Exam Average					
	Number of Students Who Passed Final Exam/Course	/				
	Number of Students Who Failed Final Exam/Course	/				

Excellent (≥ 90 %) Good (75 – 89 %) Fair (60 – 74 %) Poor (< 60 %)

APMA 3080 (Section _) – Linear Algebra William's Linear Algebra w. Appl.s 6th Ed

Section	Topic	Problem On Final Exam	Wgt %	Average %	Proficiency Rating	Objectives/ Outcomes Evaluated
1	**Linear Equations and Vectors**					
1.1	Matrices and Systems of Linear Equations					
1.2, 1.3	Gauss-Jordan Elimination, The Vector Space $\mathbf{R}^n$					
1.4	Basis and Dimension					
1.5	Dot Product, Norm, Angle and Distance					
1.6	Curve Fittings, Electrical Networks, …					
2	**Matrices and Linear Transformations**					
2.1	Addition, Scalar Multiplication, and Multiplication of Matrices					
2.2	Properties of Matrix Operations					
2.3, 2.4	Symmetric Matrices, The Inverse of a Matrix, …					
2.5	Matrix Transformations, Rotations, …					
2.6	Linear Transformations, Graphics					
2.8	Markov Chains, Population Movements, …					
3	**Determinants and Eigenvectors**					
3.1, 3.2	Introduction to & Properties of Determinants					
3.3	Determinants, Matrix Inverses, and Systems of Linear Equations					
3.4	Eigenvalues and Eigenvectors					
3.5	Google, Demography, Weather Prediction					
4	**General Vector Spaces**					
4.1	General Vector Spaces and Subspaces					
4.2	Linear Combinations					
4.3	Linear Dependence and Independence					
4.4, 4.5	Properties of Bases, Rank					
4.6	Orthonormal Vectors and Projections					
4.7	Kernel, Range, Rank/Nullity Theorem					
4.8	One-to-One Transformations and Inverses					
4.9	Transformations & Systems of Linear Eqn.s					
5	**Coordinate Representations**					
5.1	Coordinate Vectors					
5.2	Matrix Representations of Linear Transf.s					
5.3	Diagonalization of Matrices					
5.4	Quadratic Forms, Difference Equations, Normal Modes					
6	**Inner Product Spaces**					
6.1	Inner Product Spaces					
6.3	Approximation of Functions, Coding Theory					
6.4	Least Squares Curves					
7	**Numerical Methods**					
7.1, 7.2	Gaussian Elimination, LU Decomposition					
7.3	Practical Difficulties in Solving Systems					
7.4	Iterative Methods for Solving Systems of Linear Equations					
	Final Exam Average					
	Number of Students Who Passed Final Exam/Course	/				
	Number of Students Who Failed Final Exam/Course	/				

Excellent (≥ 90 %) Good (75 – 89 %) Fair (60 – 74 %) Poor (< 60 %)

APMA 3100 (Section _) – Probability Yates-Goodman's Prob. & Stochastic Processes 2nd Ed

Section	Topic	Problem On Final Exam	Wgt %	Average %	Proficiency Rating	Objectives/ Outcomes Evaluated
1	**Experiments, Models, and Probabilities**					
1.1, 1.2, 1.3, 1.4	Set Theory, Probability Axioms					
1.5, 1.6	Conditional Probability, Independence					
1.7, 1.8	Sequential Experiments, Tree Diagrams, Counting Methods					
1.9, 1.10	Independent Trials, Reliability Problems					
2	**Discrete Random Variables**					
2.1, 2.2	Definitions, Probability Mass Function (PMF)					
2.3	Families of Discrete Random Variables (RVs)					
2.4, 2.5	Cumulative Distribution Function (CDF), Averages					
2.6	Functions of a RV					
2.7	Expected Value of a Derived RV					
2.8	Variance and Standard Deviation					
2.9	Conditional Probability Mass Function					
3	**Continuous Random Variables**					
3.1, 3.2	CDF, Probability Density Function (PDF)					
3.3	Expected Values					
3.4	Families of Continuous RVs					
3.5	Gaussian RVs					
3.7	Probability Models of Derived RVs					
3.8	Conditioning a Continuous RV					
4	**Pairs of Random Variables**					
4.1, 4.2, 4.3	Joint CDF, Joint PMF, Marginal PMF					
4.4, 4.5	Joint PDF, Marginal PDF					
4.6, 4.7	Functions of Two RV's, Expected Values					
4.8, 4.9	Conditioning by an Event, Conditioning by a Random Variable					
4.10	Independent RVs					
5	**Random Vectors**					
5.1, 5.2	Prob. Models of N Random Variables, Vector Notation					
5.3, 5.4	Marginal Probability Functions, Independence					
6	**Sums of Random Variables**					
6.1, 6.2	Expected Values of Sums, PDF of the Sum of Two RVs					
6.6, 6.7	Central Limit Theorem (CLT), Applications of CLT					
7	**Parameter Estimation Using the Sample Mean**					
7.1	Sample Mean: Expected Value and Variance					
7.2	Deviation of a Random Variable from the Expected Value					
7.3, 7.4	Point Estimates of Model Parameters, Confidence Intervals					
8	**Hypothesis Testing**					
8.1, 8.2	Significance Testing, Binary Hypothesis Testing					
8.3	Multiple Hypothesis Test					
9	**Estimation of a Random Variable**					
9.1	Optimum Estimation Given Another Random Variable					
9.2	Linear Estimation of X given Y					
9.3	MAP and ML Estimation					
10	**Stochastic Processes**					
10.5	The Poisson Process					
10.6	Properties of the Poisson Process					
	Final Exam Average					
	Number of Students Who Passed Final Exam/ Course	/				
	Number of Students Who Failed Final Exam/Course	/				

Excellent (≥ 90 %) Good (75 – 89 %) Fair (60 – 74 %) Poor (< 60 %)

APMA 3110 (Section _) – Appl. Stat.s & Prob. Navidi's Stat.s for Engr.s & Scientists 2nd Ed

Section	Topic	Problem On Final Exam	Wgt %	Average %	Proficiency Rating	Objectives/ Outcomes Evaluated
	Sampling and Descriptive Statistics					
1.1, 1.2	Sampling, Summary Statistics					
1.3	Graphical Summaries					
	Probability					
2.1	Basic Ideas					
2.2	Counting Methods					
2.3	Conditional Probability and Independence					
2.4	Random Variables					
2.5	Linear Functions of Random Variables					
	Propagation of Errors					
3.1	Measurement Error					
3.2	Linear Combinations of Measurements					
3.3	Uncertainties for Functions of One Measurement					
	Commonly Used Distributions					
4.1	Bernoulli					
4.2	Binomial					
4.3	Poisson					
4.5	Normal					
4.7	Exponential					
4.9	Some Principles of Point Estimation					
4.11	Central Limit Theorem					
4.12	Simulation					
	Confidence Intervals					
5.1	Large Sample – Mean					
5.2	Proportions					
5.3	Small Sample – Mean					
5.4	Difference Between Two Means					
5.5	Difference Between Two Proportions					
5.6	Small Samples – Difference Between Two Means					
5.7	Paired Data					
	Hypothesis Testing					
6.1	Large Sample – Mean					
6.2	Drawing Conclusions from Results					
6.3	Proportion					
6.4	Small Sample – Mean					
6.5	Large Sample – Difference Between Two Means					
6.6	Difference Between Two Proportions					
6.10	Chi-Square Test					
6.11	F test for Equality of Variance					
6.12, 6.13	Fixed Level Testing, Power					
	Correlation and Simple Linear Regression					
7.1	Correlation					
7.2	Least-Squares Line					
7.3	Uncertainties in Least Squares Coefficient					
	Factorial Experiments					
9.1	One-Factor Experiments					
9.4	Randomized Complete Block Design					
	Statistical Quality Control					
10.1	Basic Ideas					
10.2	Control Charts for Variables					
	Final Exam Average					
	Number of Students Who Passed Final Exam/Course	/				
	Number of Students Who Failed Final Exam/Course	/				

Excellent (≥ 90 %) Good (75 – 89 %) Fair (60 – 74 %) Poor (< 60 %)

APMA 3120 (Section _) – Statistics Devore's Prob. & Statistics for Engr & Sci 7th Ed

Section	Topic	Problem On Final Exam	Wgt %	Average %	Proficiency Rating	Objectives/ Outcomes Evaluated
CH 6	**Point Estimation**					
6.1	Some general concepts of Point Estimation					
6.2	Methods of Point Estimation					
CH 7	**Statistical Intervals Based on a Single Sample**					
7.1	Basic Properties of Confidence Intervals					
7.2	Large-Sample Confidence Intervals					
7.3	Confidence Intervals on a Normal Population					
7.4	Confidence Intervals for Variances and Stds					
CH 8	**Tests of Hypotheses Based on a Single Sample**					
8.1	Hypotheses and Test Procedures					
8.2	Tests about Population Mean					
8.3	Tests about Population Proportion					
8.4	P-Values					
8.5	Some Comments on Selecting a Test					
Ch 9	**Inferences Based on Two Samples**					
9.1	Two sample z-Tests and Confidence Intervals					
9.2	Two sample t-Test and Confidence Intervals					
9.3	Analysis of Paired Data					
9.4	Inferences concerning a Difference between Population Proportions					
9.5	Inferences concerning two Population Variances					
CH 10	**Analysis of Variance**					
10.1	Single-Factor ANOVA					
10.2	Multiple Comparisons in ANOVA					
10.3	More on Single-Factor ANOVA					
CH 12	**Simple Linear Regression and Correlation**					
12.1	Simple Linear Regression Model					
12.2	Estimating Model Parameters					
12.3	Inferences about the Slope Parameters					
12.4	Inferences about the Prediction of Future Y Values					
12.5	Correlation					
CH 15	**Distribution-Free Procedures**					
15.1	Wilcoxon Signed-Rank Test					
15.2	Wilcoxon Rank-Sum Test					
15.3	Distribution-Free Confidence Intervals					
15.4	Distribution-Free ANOVA					
	Final Exam Average					
	Number of Students who Passed Final Exam/Course	/				
	Number of Students who Failed Final Exam/Course	/				

Excellent (≥ 90 %) Good (75 – 89 %) Fair (60 – 74 %) Poor (< 60 %)

APMA 3140 (Sec 1) - Partial Diff. Eqn.s Haberman's Appl. PDEs .. 4th Ed

Section	Topic	Problem On Final Exam	Wgt %	Average %	Proficiency Rating	Objectives/ Outcomes Evaluated
1	**Heat Equation**					
1.1, 1.2	Derivation of the Conduction of Heat in a 1D Rod					
1.3	Boundary Conditions					
1.4	Equilibrium Temperature Distribution					
1.5	Derivation of the Heat Equation in 2D and 3D					
2	**Method of Separation of Variables**					
2.1, 2.2	Linearity					
2.3	Heat Equation with Zero Temperatures at Finite Ends					
2.4	Heat Equation: Other Boundary Value Problems					
2.5	Laplace's Equation: Solutions and Properties					
3	**Fourier Series**					
3.1, 3.2	Statement of Convergence Theorem					
3.3	Fourier Cosine and Sine Series					
3.4	Term-by-Term Differentiation of Fourier Series					
3.5	Term-by-Term Integration of Fourier Series					
4	**Wave Equation: Vibrating Strings and Membranes**					
4.1, 4.2	Derivation of a Vertically Vibrating String					
4.3	Boundary Conditions					
4.4	Vibrating String with Fixed Ends					
4.5	Vibrating Membrane					
5	**Sturm-Liouville (SL) Eigenvalue Problems**					
5.1, 5.2, 5.3	Examples, SL Eigenvalue Problems					
5.4	Heat Flow in A Nonuniform Rod without Sources					
5.5	Self-Adjoint Operators, SL Eigenvalue Problems					
5.6	Rayleigh Quotient					
5.7	Vibrations of a Nonuniform String					
5.8	Boundary Conditions of the Third Kind					
5.9	Large Eigenvalues (Asymptotic Behavior)					
5.10	Approximation Properties					
6	**Finite Difference Numerical Methods of Partial Differential Equations**					
6.1, 6.2	Finite Differences and Truncated Taylor Series					
6.3	Heat Equation					
7	**Higher Dimensional Partial Differential Equations**					
7.1, 7.2	Separation of the Time Variable					
7.3	Vibrating Rectangular Membrane					
7.4	Statements and Illustrations of Theorems					
7.5	Green's Formula, Self-Adjoint Operators, Multidimensional Eigenvalue Problems					
7.6	Rayleigh Quotient and Laplace's Equation					
7.7, 7.8	Vibrating Circular Membrane, Bessel Functions					
7.9	Laplace's Equation in a Circular Cylinder					
7.10	Spherical Problems and Legendre Polynomials					
8	**Nonhomogeneous Problems**					
8.1, 8.2	Heat Flow with Sources and Nonhomogeneous Boundary Conditions (BCs)					
8.3	Method of Eigenfunction Expansion - Homogeneous BCs (Differentiating Series of Eigenfunctions)					
	Final Exam Average					
	Number of Students Who Passed Final Exam/Course	/				
	Number of Students Who Failed Final Exam/Course	/				

Excellent (≥ 90 %) Good (75 – 89 %) Fair (60 – 74 %) Poor (< 60 %)

APMA 3340 – Complex Variables Saff & Snider's …Complex Analysis 3rd Ed

Section	Topic	Problem On Final Exam	Wgt %	Average %	Proficiency Rating	Objectives/ Outcomes Evaluated
1	**Complex Numbers**					
1.1	The Algebra of Complex Numbers					
1.2	Point Representation of Complex Numbers					
1.3	Vectors and Polar Forms					
1.4, 1.5	The Complex Exponential, Powers and Roots					
1.6, 1.7	Planar Sets, The Riemann Sphere					
2	**Analytic Functions**					
2.1	Functions of a Complex Variable					
2.2, 2.3	Limits and Continuity, Analyticity					
2.4, 2.5	The Cauchy-Riemann Equations, Harmonic Fct.s					
2.6	Steady-State Temperature as a Harmonic Function					
3	**Elementary Functions**					
3.1	Polynomials and Rational Functions					
3.2	The Exponential, Trigonometric, & Hyperbolic Fct.s					
3.3	The Logarithmic Function					
3.4	Washers, Wedges, and Walls					
3.5	Complex Powers and Inverse Trigonometric Fct.s					
4	**Complex Integration**					
4.1, 4.2	Contours, Contour Integrals					
4.3, 4.4	Independence of Path, Cauchy's Integral Theorem					
4.5	Cauchy's Integral Formula and Its Consequences					
4.6	Bounds for Analytic Functions					
5	**Series Representations for Analytic Functions**					
5.1	Sequences and Series					
5.2, 5.3	Taylor Series, Power Series					
5.4, 5.5	Convergence, Laurent Series					
5.6, 5.7	Zeros and Singularities, The Point at Infinity					
6	**Residue Theory**					
6.1	The Residue Theorem					
6.2	Trigonometric Integrals					
6.3,6.4,6.5	Improper Integrals, Indented Contours					
6.6	Integrals Involving Multiple-Valued Functions					
6.7	The Argument Principle and Rouche's Theorem					
7	**Conformal Mapping**					
7.1	Invariance of Laplace's Equation					
7.2,7.3,7.4	Geometric Considerations, Mobius Transformations					
7.5	The Schwarz-Christoffel Transformation					
7.6	Applications: Electrostatics, Heat Flow, Fluid Mech.s					
7.7	Further Physical Applications of Conformal Mapping					
8	**The Transforms of Applied Mathematics**					
8.1	Fourier Series (The Finite Fourier Transform)					
8.2, 8.3	The Fourier Transform, The Laplace Transform					
8.4	The z-Transform					
8.5	Cauchy Integrals and the Hilbert Transform					
	Final Exam Average					
	Number of Students Who Passed Final Exam/Course	/				
	Number of Students Who Failed Final Exam/Course	/				

Excellent (≥ 90 %) Good (75 – 89 %) Fair (60 – 74 %) Poor (< 60 %)

APMA 5070 – Numerical Methods Cheney & Kincaid's Num. Math & Comp. 6th Ed

Section	Topic	Problem On Final Exam	Wgt %	Average %	Proficiency Rating	Objectives/ Outcomes Evaluated
1	**Introduction**					
1.1, 1.2	Preliminary Remarks, Review of Taylor Series					
2	**Floating-Point Representation and Errors**					
2.1	Floating-Point Representation					
2.2	Loss of Significance					
3	**Locating Roots of Equations**					
3.1,3.2, 3.3	Bisection, Newton's, and Secant Methods					
4	**Interpolation and Numerical Differentiation**					
4.1	Polynomial Interpolation					
4.2	Errors in Polynomial Interpolation					
4.3	Estimating Derivatives and Richardson Extrapolation					
5	**Numerical Integration**					
5.1	Lower and Upper Sums					
5.2, 5.3	Trapezoid Rule, Romberg Algorithm					
6	**Additional Topics on Numerical Integration**					
6.1	Simpson's Rule and Adaptive Simpson's Rule					
6.2	Gaussian Quadrature Formulas					
7	**Systems of Linear Equations**					
7.1	Naive Gaussian Elimination					
7.2	Gaussian Elimination with Scaled Partial Pivoting					
7.3	Tridiagonal and Banded Systems					
10	**Ordinary Differential Equations**					
10.1,	Taylor-Series Methods					
10.2	Runge-Kutta Methods					
10.3	Stability and Adaptive Runge-Kutta and Multistep Methods					
11	**Systems of Ordinary Differential Equations**					
11.1	Methods for First-Order Systems					
11.2	Higher-Order Equations and Systems					
11.3	Adams-Bashforth-Moulton Methods					
13	**Monte Carlo Methods and Simulation**					
13.1	Random Numbers					
13.2	Estimation of Areas and Volumes by Monte Carlo Techniques					
13.3	Simulation					
14	**Boundary-Value Problems for Ordinary Differential Equations**					
14.1, 14.2	Shooting Method, A Discretization Method					
15	**Partial Differential Equations**					
15.1	Parabolic Problems					
15.2	Hyperbolic Problems					
15.3	Elliptic Problems					
	Final Exam Average					
	Number of Students Who Passed Final Exam/Course	/				
	Number of Students Who Failed Final Exam/Course	/				

Excellent (≥ 90 %) Good (75 – 89 %) Fair (60 – 74 %) Poor (< 60 %)

APMA 6410-Review.Beginning.Engr.Math.I Greenberg's Adv.Engr.Math.

Section	Topic	Problem On Beginning Review Test	Average %	Proficiency Rating	Objectives/ Outcomes Evaluated
1	**Introduction to Differential Equations**				
1.1, 1.2, 1.3	Definitions, Introduction to Modeling				
2	**Equations Of First Order**				
2.1, 2.2, 2.3	The Linear Equation, Applications				
2.4	Separable Equations				
2.5	Exact Equations and Integrating Factors				
3	**Linear Differential Equations of Second Order and Higher**				
3.1, 3.2	Linear Dependence and Linear Independence				
3.3	Homogeneous Equation: General Solution				
3.4	Solution of Homogeneous Equation: Constant Coefficients				
3.5	Application to Harmonic Oscillator: Free Oscillation				
3.6	Solution of Homogeneous Equation: Nonconstant Coeff.s				
3.7	Solution of Nonhomogeneous Equation				
3.8	Application to Harmonic Oscillator: Forced Oscillation				
3.9	Systems of Linear Differential Equations				
4	**Power Series Solutions**				
4.1, 4.2	Power Series Solutions				
4.3	The Method of Frobenius				
4.4	Legendre Functions				
4.5	Singular Integrals; Gamma Function				
4.6	Bessel Functions				
5	**Laplace Transform**				
5.1, 5.2	Calculation of the Transform				
5.3	Properties of the Transform				
5.4	Application to the Solution of Differential Equations				
5.5	Discontinuous Forcing Functions; Heaviside Step Function				
5.6	Impulsive Forcing Functions; Dirac Impulse Function				
5.7	Additional Properties				
6	**Quantitative Methods: Numerical Solution of Differential Equations**				
6.1, 6.2	Euler's Method				
6.3	Improvements: Midpoint Rule and Runge-Kutta				
6.4	Application to Systems and Boundary Value Problems				
6.5	Stability and Difference Equations				
7	**Qualitative Methods: Phase Plane and Nonlinear Differential Equations**				
7.1, 7.2	The Phase Plane				
7.3, 7.4	Singular Points and Stability, Applications				
7.5	Limit Cycles, van der Pol equation, …				
7.6	The Duffing Equation: Jumps and Chaos				
8	**Systems of Linear Algebraic Equations: Gauss Elimination**				
8.1, 8.2	Preliminary Ideas and Geometrical Approach				
8.3	Solution by Gauss Elimination				
9	**Vector Space**				
9.1, 9.2	Vectors; Geometrical Representation				
9.3	Introduction of Angle and Dot Product				
9.4 ,9.5	*n*-Space , Dot Product, Norm, and Angle for *n*-Space				
9.6	Generalized Vector Space				
9.7	Span and Subspace				
9.8	Linear Dependence				
9.9	Bases, Expansions, Dimension				
9.10	Best Approximation				
					PAGE 1 of 2

APMA 6410-Review.Beginning.Engr.Math.I Greenberg's Adv.Engr.Math.

Section	Topic	Problem On Beginning Review Test	Average %	Proficiency Rating	Objectives/ Outcomes Evaluated
10	**Matrices and Linear Equations**				
10.1, 10.2	Matrices and Matrix Algebra				
10.3, 10.4	The Transpose Matrix, Determinants				
10.5	Rank; Application to Linear Dependence, to Existence and Uniqueness for **Ax = c**				
10.6	Inverse Matrix, Cramer's Rule, Factorization				
10.7, 10.8	Change of Basis, Vector Transformation				
11	**The Eigenvalue Problem**				
11.1, 11.2	Solution Procedure and Applications				
11.3, 11.4	Symmetric Matrices, Diagonalization				
11.5	Application to First Order Systems with Constant Coefficients				
11.6	Quadratic Forms				
12	**Extension to Complex Case**				
12.1, 12.2	Complex *n*-Space				
12.3	Complex Matrices				
13	**Differential Calculus of Functions of Several Variables**				
13.1,13.2	Preliminaries				
13.3	Partial Derivatives				
13.4	Composite Functions and Chain Differentiation				
13.5	Taylor's Formula and Mean Value Theorem				
13.6	Implicit Functions and Jacobians				
13.7	Maxima and Minima				
13.8	Leibniz Rule				
14	**Vectors In 3-Space**				
14.1, 14.2	Dot and Cross Product				
14.3	Cartesian Coordinates				
14.4	Multiple Products				
14.5	Differentiation of a Vector Function of a Single Variable				
14.6	Non-Cartesian Coordinates				
15	**Curves, Surfaces, and Volumes**				
15.1, 15.2	Curves and Line Integrals				
15.3	Double and Triple Integrals				
15.4	Surfaces				
15.5	Surface Integrals				
15.6	Volumes and Volume Integrals				
16	**Scalar and Vector Field Theory**				
16.1, 16.2, 16.3	Preliminaries; Divergence				
16.4, 16.5	Gradient; Curl				
16.6	Combinations; Laplacian				
16.7	Non-Cartesian Systems; Div, Grad, and Laplacian				
16.8	Divergence Theorem				
16.9	Stokes's Theorem				
16.10	Irrotational Fields				
					PAGE 2 of 2

APMA 6410 – Engineering Math. I Haberman's Appl.PDEs…4th Ed

Section	Topic	Problem On Final Exam	Wgt %	Average %	Proficiency Rating	Objectives/ Outcomes Evaluated
1	**Heat Equation**					
1.1, 1.2	Derivation of the Conduction of Heat in a 1D Rod					
1.3	Boundary Conditions					
1.4	Equilibrium Temperature Distribution					
1.5	Derivation of the Heat Equation in 2D and 3D					
2	**Method of Separation of Variables**					
2.1, 2.2	Linearity					
2.3	Heat Equation with Zero Temperatures at Finite Ends					
2.4	Heat Equation: Other Boundary Value Problems					
2.5	Laplace's Equation: Solutions and Properties					
3	**Fourier Series**					
3.1, 3.2	Statement of Convergence Theorem					
3.3	Fourier Cosine and Sine Series					
3.4	Term-by-Term Differentiation of Fourier Series					
3.5	Term-by-Term Integration of Fourier Series					
4	**Wave Equation: Vibrating Strings and Membranes**					
4.1, 4.2	Derivation of a Vertically Vibrating String					
4.3	Boundary Conditions					
4.4	Vibrating String with Fixed Ends					
4.5	Vibrating Membrane					
5	**Sturm-Liouville (SL) Eigenvalue Problems**					
5.1, 5.2, 5.3	Examples, SL Eigenvalue Problems					
5.4	Heat Flow in A Nonuniform Rod without Sources					
5.5	Self-Adjoint Operators, SL Eigenvalue Problems					
5.6	Rayleigh Quotient					
5.7	Vibrations of a Nonuniform String					
5.8	Boundary Conditions of the Third Kind					
5.9	Large Eigenvalues (Asymptotic Behavior)					
5.10	Approximation Properties					
6	**Finite Difference Numerical Methods of Partial Differential Equations**					
6.1, 6.2	Finite Differences and Truncated Taylor Series					
6.3	Heat Equation					
7	**Higher Dimensional Partial Differential Equations**					
7.1, 7.2	Separation of the Time Variable					
7.3	Vibrating Rectangular Membrane					
7.4	Statements and Illustrations of Theorems					
7.5	Green's Formula, Self-Adjoint Operators, Multidimensional Eigenvalue Problems					
7.6	Rayleigh Quotient and Laplace's Equation					
7.7, 7.8	Vibrating Circular Membrane, Bessel Functions					
7.9	Laplace's Equation in a Circular Cylinder					
7.10	Spherical Problems and Legendre Polynomials					
8	**Nonhomogeneous Problems**					
8.1, 8.2	Heat Flow with Sources and Nonhomogeneous Boundary Conditions (BCs)					
8.3	Method of Eigenfunction Expansion - Homogeneous BCs (Differentiating Series of Eigenfunctions)					
	Final Exam Average					
	Number of Students Who Passed Final Exam/Course	/				
	Number of Students Who Failed Final Exam/Course	/				

Excellent (≥ 90 %) Good (75 – 89 %) Fair (60 – 74 %) Poor (< 60 %)

APMA 6410 – Engineering Math. I Greenberg's Adv.Engr.Math…2nd Ed

Section	Topic	Problem On Final Exam	Wgt %	Average %	Proficiency Rating	Objectives/ Outcomes Evaluated
17	**Fourier Series, Fourier Integral, Fourier Transform**					
17.1	Introduction					
17.2	Even, Odd, and Periodic Functions					
17.3	Fourier Series of a Periodic Function					
17.3.1	Fourier series					
17.3.2	Euler's formulas					
17.3.3	Applications					
17.3.4	Complex exponential form for Fourier series					
17.4	Half- and Quarter- Range Expansions					
17.7	The Sturm-Liouville Theory					
17.7.1	Sturm-Liouville problem					
17.7.2	Lagrange identity and proofs					
17.8	Periodic and Singular Sturm-Liouville Problems					
18	**Diffusion Equation**					
18.1	Introduction					
18.2	Preliminary Concepts					
18.2.1	Definitions					
18.2.2	Second-order linear equations and their classification					
18.2.3	Diffusion equation and modeling					
18.3	Separation of Variables					
18.3.1	The method of separation of variables					
18.3.2	Verification of solution					
18.3.3	Use of Sturm-Liouville theory					
19	**Wave Equation**					
19.1	Introduction					
19.2	Separation of Variables; Vibrating String					
19.2.1	Solution by separation of variables					
19.2.2	Traveling wave interpretation					
19.2.3	Using Sturm-Liouville theory					
19.3	Separation of Variables; Vibrating Membrane					
19.4	Vibrating String; d'Alembert's Solution					
19.4.1	d'Alembert's solution					
20	**Laplace Equation**					
20.1	Introduction					
20.2	Separation of Variables; Cartesian Coordinates					
20.3	Separation of Variables; Non-Cartesian Coordinates					
20.3.1	Plane polar coordinates					
20.3.2	Cylindrical coordinates					
20.3.3	Spherical coordinates					

Excellent (≥ 90 %) Good (75 – 89 %) Fair (60 – 74 %) Poor (< 60 %)

APMA 6420 – Engineering Mathematics II Haberman's Applied PDEs … 4th Ed

Section	Topic	Problem On Final Exam	Wgt %	Average %	Proficiency Rating	Objectives/ Outcomes Evaluated
6	**Finite Difference Numerical Methods for Partial Differential Equations**					
6.1, 6.2	Finite Differences and Truncated Taylor Series					
6.3	Heat Equation					
8	**Nonhomogeneous Problems**					
8.1, 8.2	Heat Flow with Sources and Nonhomogeneous Boundary Conditions (BCs)					
8.3	Method of Eigenfunction Expansion - Homogeneous BCs (Differentiating Series of Eigenfunctions)					
8.4	Method of Eigenfunction Expansion Using Green's Formula (With or Without Homogeneous BCs)					
8.5	Forced Vibrating Membranes and Resonance					
8.6	Poisson's Equation					
9	**Green's Functions for Time-Independent Problems**					
9.1, 9.2	One-dimensional Heat Equation					
9.3	Green's Functions for Boundary Value Problems for Ordinary Differential Equations					
9.4	Fredholm Alternative and Generalized Green's Functions					
9.5	Green's Functions for Poisson's Equation					
10	**Infinite Domain Problems: Fourier Transform Solutions of Partial Differential Equations**					
10.1, 10.2	Heat Equation on an Infinite Domain					
10.3	Fourier Transform Pair					
10.4	Fourier Transform and the Heat Equation					
10.5	Fourier Sine and Cosine Transforms					
10.6	Worked Examples Using Transforms					
11	**Green's Functions for Wave and Heat Equations**					
11.1, 11.2	Green's Functions for the Wave Equations					
11.3	Green's Functions for the Heat Equation					
13	**Laplace Transform Solution of Partial Differential Equations**					
13.1, 13.2	Properties of the Laplace Transform					
13.3	Green's Functions for Initial Value Problems for Ordinary Differential Equations					
13.4	A Signal Problem for the Wave Equation					
13.5	A Signal Problem for a Vibrating String of Finite Length					
13.6	The Wave Equation and its Green's Function					
13.7	Inversion of Laplace Transforms Using Contour Integrals in the Complex Plane					
13.8	Solving the Wave Equation Using Laplace Transforms (with Complex Variables)					
	Final Exam Average					
	Number of Students Who Passed Final Exam/Course	/				
	Number of Students Who Failed Final Exam/Course	/				

Excellent (≥ 90 %) Good (75 – 89 %) Fair (60 – 74 %) Poor (< 60 %)

APMA 6420 – Engineering Math. II Greenberg's Adv.Engr.Math..2nd Ed

Section	Topic	Problem On Final Exam	Wgt %	Average %	Proficiency Rating	Objectives/ Outcomes Evaluated
21	**Functions of a Complex Variable**					
21.1	Introduction					
21.2	Complex Numbers and the Complex Plane					
21.3	Elementary Functions					
21.3.1	Preliminary ideas					
21.3.2	Exponential function					
21.3.3	Trigonometric and hyperbolic functions					
21.3.4	Application of complex numbers to integration and the solution of differential equations					
21.4	Polar Form, Additional Elementary Functions, and Multi-valuedness					
21.4.1	Polar form					
21.4.2	Integral powers of z and de Moivre's formula					
21.4.3	Fractional powers					
21.4.4	The logarithm of z					
21.4.5	General powers of z					
21.4.6	Obtaining single-valued functions by branch cuts					
21.4.7	More about branch cuts					
21.5	The Differential Calculus and Analyticity					
23	**The Complex Integral Calculus**					
23.1	Introduction					
23.2	Complex Integration					
23.2.1	Definition and properties					
23.2.2	Bounds					
23.3	Cauchy's Theorem					
23.4	Fundamental Theorem of the Complex Integral Calculus					
23.5	Cauchy's Integral Formula					
24	**Taylor's Series, Laurent Series, and the Residue Theorem**					
24.1	Introduction					
24.2	Complex Series and Taylor Series					
24.2.1	Complex Series					
24.2.2	Taylor Series					
24.3	Laurent Series					
24.4	Classification of Singularities					
24.5	Residue Theorem					
24.5.1	Residue theorem					
24.5.2	Calculating residues					
24.5.3	Applications of the residue theorem					

Excellent (≥ 90 %) Good (75 – 89 %) Fair (60 – 74 %) Poor (< 60 %)

APMA 6430 – Statistics for Engr.s & Sci. Milton & Arnold's Intr. Prob. & Stat.s

Section	Topic	Problem On Final Exam	Wgt %	Average %	Proficiency Rating	Objectives/ Outcomes Evaluated
1	**Introduction to Probability and Counting**					
1.1, 1.2, 1.3	Sample Spaces, Events, Permutations, Combinations					
2	**Some Probability Laws**					
2.1, 2.2	Axioms, Conditional Probability					
2.3, 2.4	Independence, Bayes' Theorem					
3	**Discrete Distributions**					
3.1, 3.2	Random Variables, Discrete Probability Densities					
3.3, 3.4	Expectation, Geometric Distr., Moment Generating Fct.					
3.5 - 3.9	Binomial, Neg. Binom., Hypergeom., Poisson Distr.s, ...					
4	**Continuous Distributions**					
4.1, 4.2	Densities, Expectation, Distribution Parameters					
4.3, 4.4	Gamma, Exponential, Chi-Squared, Normal Distr.s					
4.5, 4.6, 4.7	Chebyshev's Inequality, Weibull Distr. and Reliability					
4.8, 4.9	Transform. of Variables, Simulating a Continuous Distr.					
5	**Joint Distributions**					
5.1, 5.2	Joint Densities, Independence, Expectation, Covariance					
5.3, 5.4, 5.5	Correlation, Conditional Densities, Regression, …					
7	**Estimation**					
7.1, 7.2	Point Estimation, Method of Moments, Max. Likelihood					
7.3, 7.4	Functions of Random Var.s, Interval Estimation, CLT					
8	**Inferences on the Mean & Variance of a Distribution**					
8.1	Interval Estimation of Variability					
8.2	Estimating the Mean, the Student-*t* Distribution					
8.3 - 8.6, 8.7	Hypothesis Testing, Significance Testing, …					
9	**Inferences on Proportions**					
9.1, 9.2	Estimating & Testing Hypotheses on a Proportion					
9.3, 9.4	Comparing Proportions: Estimation, Hypothesis Testing					
10	**Comparing Two Means and Two Variances**					
10.1	Point Estimation: Independent Samples					
10.2	Comparing Variances: The *F* Distribution					
10.3, 10.4	Comparing Means: Variances Equal and Unequal					
10.5	Comparing Means: Paired Data					
10.6	Alternative Nonparametric Methods					
11	**Simple Linear Regression and Correlation**					
11.1, 11.2	Model - Parameter Estimation, Least-Squares Estimators					
11.3	Confidence Interval Estimation and Hypothesis Testing					
11.4 - 11.6	Rep. Meas.s, Lack of Fit, Residual Analysis, Correlation					
13	**Analysis of Variance**					
13.1	One-Way Classification Fixed-Effects Model					
13.2 - 13.4	Comparing Variances, Pairwise Comp.s, Test Contrasts					
13.5 - 13.9	Randomized Block Design, Random-Effects Models, …					
16	**Statistical Quality Control**					
16.1 - 16.3	Control Charts					
16.4 - 16.7	Tolerance Limits, Acceptance Sampling, …					
	Final Exam Average					
	Number of Students Who Passed Final Exam/Course	/				
	Number of Students Who Failed Final Exam/Course	/				

Excellent (≥ 90 %) Good (75 – 89 %) Fair (60 – 74 %) Poor (< 60 %)

APMA-Math.Prep.for.Grad.Engr. Greenberg's Adv. Engr. Math. 2nd Ed

Section	Topic	Problem On Final Exam	Problem Average	Proficiency Rating	Goals Evaluated
1	**Introduction to Differential Equations**				
1.1, 1.2, 1.3	Definitions, Introduction to Modeling				
2	**Equations Of First Order**				
2.1, 2.2, 2.3	The Linear Equation, Applications				
2.4	Separable Equations				
2.5	Exact Equations and Integrating Factors				
3	**Linear Differential Equations of Second Order and Higher**				
3.1, 3.2	Linear Dependence and Linear Independence				
3.3	Homogeneous Equation: General Solution				
3.4	Solution of Homogeneous Equation: Constant Coefficients				
3.5	Application to Harmonic Oscillator: Free Oscillation				
3.6	Solution of Homogeneous Equation: Nonconstant Coeff.s				
3.7	Solution of Nonhomogeneous Equation				
3.8	Application to Harmonic Oscillator: Forced Oscillation				
3.9	Systems of Linear Differential Equations				
4	**Power Series Solutions**				
4.1, 4.2	Power Series Solutions				
4.3	The Method of Frobenius				
4.4	Legendre Functions				
4.5	Singular Integrals; Gamma Function				
4.6	Bessel Functions				
5	**Laplace Transform**				
5.1, 5.2	Calculation of the Transform				
5.3	Properties of the Transform				
5.4	Application to the Solution of Differential Equations				
5.5	Discontinuous Forcing Functions; Heaviside Step Function				
5.6	Impulsive Forcing Functions; Dirac Impulse Function				
5.7	Additional Properties				
6	**Quantitative Methods: Numerical Solution of Differential Equations**				
6.1, 6.2	Euler's Method				
6.3	Improvements: Midpoint Rule and Runge-Kutta				
6.4	Application to Systems and Boundary Value Problems				
6.5	Stability and Difference Equations				
7	**Qualitative Methods: Phase Plane and Nonlinear Differential Equations**				
7.1, 7.2	The Phase Plane				
7.3, 7.4	Singular Points and Stability, Applications				
7.5	Limit Cycles, van der Pol equation, …				
7.6	The Duffing Equation: Jumps and Chaos				
8	**Systems of Linear Algebraic Equations: Gauss Elimination**				
8.1, 8.2	Preliminary Ideas and Geometrical Approach				
8.3	Solution by Gauss Elimination				
9	**Vector Space**				
9.1, 9.2	Vectors; Geometrical Representation				
9.3	Introduction of Angle and Dot Product				
9.4 ,9.5	*n*-Space , Dot Product, Norm, and Angle for *n*-Space				
9.6	Generalized Vector Space				
9.7	Span and Subspace				
9.8	Linear Dependence				
9.9	Bases, Expansions, Dimension				
9.10	Best Approximation				
					PAGE 1 of 2

APMA-Math.Prep.for.Grad.Engr. Greenberg's Adv. Engr. Math. 2nd Ed

Section	Topic	Problem On Final Exam	Problem Average	Proficiency Rating	Goals Evaluated
10	**Matrices and Linear Equations**				
10.1, 10.2	Matrices and Matrix Algebra				
10.3, 10.4	The Transpose Matrix, Determinants				
10.5	Rank; Application to Linear Dependence, to Existence and Uniqueness for **Ax = c**				
10.6	Inverse Matrix, Cramer's Rule, Factorization				
10.7, 10.8	Change of Basis, Vector Transformation				
11	**The Eigenvalue Problem**				
11.1, 11.2	Solution Procedure and Applications				
11.3, 11.4	Symmetric Matrices, Diagonalization				
11.5	Application to First Order Systems with Constant Coefficients				
11.6	Quadratic Forms				
12	**Extension to Complex Case**				
12.1, 12.2	Complex *n*-Space				
12.3	Complex Matrices				
13	**Differential Calculus of Functions of Several Variables**				
13.1,13.2	Preliminaries				
13.3	Partial Derivatives				
13.4	Composite Functions and Chain Differentiation				
13.5	Taylor's Formula and Mean Value Theorem				
13.6	Implicit Functions and Jacobians				
13.7	Maxima and Minima				
13.8	Leibniz Rule				
14	**Vectors In 3-Space**				
14.1, 14.2	Dot and Cross Product				
14.3	Cartesian Coordinates				
14.4	Multiple Products				
14.5	Differentiation of a Vector Function of a Single Variable				
14.6	Non-Cartesian Coordinates				
15	**Curves, Surfaces, and Volumes**				
15.1, 15.2	Curves and Line Integrals				
15.3	Double and Triple Integrals				
15.4	Surfaces				
15.5	Surface Integrals				
15.6	Volumes and Volume Integrals				
16	**Scalar and Vector Field Theory**				
16.1, 16.2, 16.3	Preliminaries; Divergence				
16.4, 16.5	Gradient; Curl				
16.6	Combinations; Laplacian				
16.7	Non-Cartesian Systems; Div, Grad, and Laplacian				
16.8	Divergence Theorem				
16.9	Stokes's Theorem				
16.10	Irrotational Fields				
					PAGE 2 of 2
	Final Exam Average				
	Number of Students Who Passed Final Exam/Course	/			
	Number of Students Who Failed Final Exam/Course	/			