

Scheme of Studies

**Associate Degree in Science
Combination-II
(Double Math & Statistics)**

Semester-I

Sr. No	Course Code	Course Title	Crd. Hrs		
			Theory	Lab.	Total
1	ENG-1107	Functional English (C1)	3	0	3
2	ISL-1112/ ETH-1112	Islamic Studies/Ethics (C2)	2	0	2
3	MAT-1115	Calculus-I (Ma1, F1)	3	0	3
4	STA-1101	Statistics-I (S1, M1)	3	1	4
5	ARA-1101	Arabic (C3)	3	0	3
Total			14	1	15

ENG-1107

ENGLISH-I (Functional English)

Credit Hrs: 03

Basics of Grammar, Parts of speech and use of articles, Sentence structure, active and passive voice, Practice in unified sentence, Analysis of phrase, clause and sentence structure, Transitive and intransitive verbs, Punctuation and spelling, Comprehension: Answers to questions on a given text, Discussion: General topics and every-day conversation (topics for discussion to be at the discretion of the teacher keeping in view the level of students), Listening: To be improved by showing documentaries/films carefully selected by subject teachers, Translation skills: Urdu to English, Paragraph writing: Topics to be chosen at the discretion of the teacher, Presentation skills: Introduction. **Note:** Extensive reading is required for vocabulary building

RECOMMENDED BOOKS

1. Practical English Grammar by A.J. Thomson and A.V. Martinet. Exercises 1. Third edition. Oxford University Press. 1997. ISBN 0194313492
2. Practical English Grammar by A.J. Thomson and A.V. Martinet. Exercises 2. Third edition. Oxford University Press. 1997. ISBN 0194313506
3. Writing. Intermediate by Marie-Christine Boutin, Suzanne Brinand and Francoise Grellet. Oxford Supplementary Skills. Fourth Impression 1993. ISBN 0 19 435405 7 Pages 20-27 and 35-4
4. Reading. Upper Intermediate. Brain Tomlinson and Rod Ellis. Oxford Supplementary Skills. Third Impression 1992. ISBN 0 19 453402 2.

ISL-1112

ISLAMIC STUDIES

Credit Hrs: 03

Fundamental of Islam, Tauheed: Arguments for oneness of God, impact of Tauheed on human life, place of man in the universe, purpose of creation, textual study of Surah al- Rehman and Surah al- Furqan, Prophethood, need for prophet, characteristics of a prophet, finality of prophethood, seerat; life of prophet as embodiment of Islamic ideology, faith in hereafter aakhirat, effects of belief on worldly life. Ibadah: Concepts of Ibadah, Salat, Saom, Zakat, Hajj and jihad. The Holy Quran: Its revelation and compilation, The authenticity of the text, Hadith: Its need, authenticity and importance. Consensus (Ijma), analogy (Qiyas). Sources of Knowledge: Islamic approach to institution, Reason and experience. Revelation Wahi as a source knowledge. Moral and social Philosophy of Islam: The concept of good and evil, Akhlaq -e- Hasna with special reference to surah Al- Hujrat, Professional Ethics Kasb-e- Halal. Islamic Political Principles: Salient feature of the Islamic state, Madina character, Responsibilities of the Head of the state, Rights and Duties of Citizens. Economics Oder of Islam: Right to property, System of Taxation, Distribution of Wealth Zakat and Ushar, Interest Free Economy Shirakat and Muzarabat. Islam as Living Force: Application of Islam Teaching to Socio- Economic Development in the 20th Century.

RECOMMENDED BOOKS

1. Muhammad, H. "Emergence of Islam", IRI, Islamabad.
2. Muhammad, H. "Muslim Conduct of State"
3. Muhammad, H. "Introduction to Islam"
5. Hussain, H. H. "An Introduction to the Study of Islamic Law" leaf Publication Islamabad, Pakistan.

6. Hasan, A. "Principles of Islamic Jurisprudence" Islamic Research Institute, International Islamic University, Islamabad (1993)

7. Mir, W. 1982. "Muslim Jurisprudence and the Quranic Law of Crimes"

Islamic Book Service.

8. Bhatia, H.S. 1989. "Studies in Islamic Law, Religion and Society" Deep & Deep Publications New Delhi.

9. Muhammad, Zia-ul-Haq. 2001. "Introduction to Al Sharia Al Islamia" Allama Iqbal Open University, Islamabad.

MAT-1115

CALCULUS-I

Credit Hrs: 03

Introduction, real numbers, intervals, absolute values and its properties, coordinates planes and graphs, lines, functions, operation on functions, graph of functions, shifting of graph limits, continuity, graphical and analytical approach. The derivatives, geometrical meanings of derivatives, tangent lines and rate of changes. Derivatives of Trigonometric functions, inverse trigonometric functions, the chain rules, implicit differentiation, differential derivative of hyperbolic, inverse hyperbolic, logarithmic, exponent function, first order differential equation and application, increase and decrease, concavity relative extrema, first and second derivatives test, Maximum and minimum of a function, applied maximum and minimum problem, L' hospital rules integration, basic rules of integration, formula of integration, integration by parts, by substitutions, partial fraction definite integrals, Riemann sur theorems of definite integral, first and second fundamental theorems of calculus definite integral with property areas between curves, Disk and washer, volumes by cylindrical shell and slicim length of plane curves, Area of surface of revolution, First order differential equation and applications, Roll's theorem, mean values theorem and its application, improper integral, convergent and divergence of integrals, straight line in R3, Planes, Cylindrical and Spherical coordinate surfaces, cylinders and cones, sphere, spherical trigonometry.

RECOMMENDED BOOKS

1. Calculus and analytical Geometry, by Thomas & Finny. 10th Edition.
2. Calculus & Analytical Geometry, by Howard anton, 7th Edition
3. Calculus & Analytical Geometry, by S.M. Yosuf.
4. Calculus & Analytical Geometry, by SkowSky. 6th Edition.

STA- 1101: INTRODUCTORY STATISTICS

Learning Objectives:

1. To have introduction of statistics as a field of knowledge and its scope and relevance to other disciplines of natural and social sciences.
2. To equipped and prepare students for advance courses in the field of statistics.
3. To achieve the capability of critical thinking about data and its sources; have idea about variables and their types and scale measures.
4. Be able to calculate and interpret descriptive statistics (able to classify, tabulate, describe and display data using software).

Learning Outcomes:

1. Acquire the basic knowledge of the discipline of Statistics.
2. Understand and differentiate between the types of data and variables.
3. Evaluate and Interpret basic descriptive statistics. Display and Interpret data graphs.

Course Contents:

The nature and scope of the Statistics, Variables and their types, Data and its sources, Scales of measurements, Tabulation and classification of data, Graphs and Charts: Stem-and leaf diagram, Box and Whisker plots and their interpretation. Measures of Central Tendency, Quantiles, Measures of Dispersion: Their properties, usage, limitations and comparison. Moments, Measures of Skewness and Kurtosis and Distribution shapes. Rates and ratios, Standardized scores.

Index numbers: construction and uses of index numbers, un-weighted index numbers (simple aggregative index, average of relative price index numbers), weighted index numbers (Laspayer's, Paasche's and Fisher's ideal index numbers), Consumer price index (CPI) and Sensitive Price Indicators

Recommended Books:

1. Clark, G.M. and Cooke, D. (2011). "A Basic Course in Statistics", 5th edition, Arnold, London.
2. Ross, S. M. (2010). "Introductory Statistics", 3rd edition, Academic Press USA.
3. Mann, P. S. (2010) Introductory Statistics. Wiley.
4. Spiegel, M.R., Schiller, J.L. and Sirinivasan, R.L. (2012). "Probability and Statistics", 4th edition, Schaums Outlines Series. McGraw Hill. NY.
5. Walpole, P.E. Myers, R.H., Myers S.L. (2012). "Probability and Statistics for Engineers and Scientists", 9th edition, Prentice Hall.
6. Zaman, A. (2016), "Introduction to Statistics" Online access for book and related data sets.

a. <https://sites.google.com/site/introstats4muslims/textbook>
<https://sites.google.com/site/introstats4muslims/excel>.

ARA-1101

ARABIC

Credit Hrs: 03

الاول الدرس

تعريف فاعل، كى حرف، فعل اسم، مثال بين اسد تعامل، ك ان اشارات اسماء معانى ال فاعل، عربى *
مثال بين

امثلة واسد تعامل ك ا ب ل، ن عم، اسد تفهيم، ك ل مات *

الثانى الدرس

مشق اسد تعامل، م بين جملا عربى متصله ضمائر اق سام كى ضمائر معانى، ال فاعل *

ال ثلاث ال درس

ام ثلہ ت عریف۔ ، اضافی مرکب ام ثلہ و ت عریف فات کی نہ فی حروف ل یست، لال یس، معانی ال فاض، *
مشق ت رجمہ، جملے، عربی

ال سادس ال درس

مشق م ثال یں، راو مکسر جمع قواعد م ثال یں اور اق سام کی جمع جمع واحد، *

ال سابع ال درس

مشق ام ثلہ، ماضی، و ف عمل قواعد م ثال یں کی ماضی ف عمل ک لمات ت عریف ماضی، ف عمل *

ال ثامن ال درس

مشق مکالمہ۔ مضارع، ف عمل قواعد ام ثلہ و مضارع، ف عمل ک لمات مضارع، ف عمل *

ال تاسع ال درس

مشق م ثال یں۔ و مصدنف ف عمل قواعد ام ثلہ و مصدنف ف عمل ک لمات و مصدنف ف عمل *

ال عاشر ال درس

مشق قواعد، م ثال یں۔ مع تل، ف عمل صدیح، ف عمل ک لمات مع تل، ف عمل صدیح، ف عمل *

عشر ال حادی ال درس

مشق الخمس تہ، اسماء م ثال یں۔ مونث، مذکر ک لمات مونث، مذکر *

عشر ال ثانی ال درس

ام ثلہ و عقود اعداد و قواعد ام ثلہ و اعداد اعداد *

عشر ال ثلاث ال درس

ام ثلہ ای ک م اسد تعمال ک ان اور ک م ای *

عشر ال رابع ال درس

جملے م ثال یں، ک لمات فاعل، اسم *

عشر ال خامس ال درس

م ثال یں جملے، اجسم اعضاء *

عشر ال سادس ال درس

ام ثلہ و ک لمات *

عشر ال سابع ال درس

فعلیہ جملہ و اسمیہ جملہ *

عشر ال ثامن ال درس

ال حروف مخارج قمریہ، شمسیہ، حروف حلقی، حروف مدہ حروف ال ہجاء، حروف *

عشر ال تاسع ال درس

ضد تہ الامر ال ضیاء، اجمل ما، دُعا الامذ تارہ ناشد ید الا *

پاکستان آباد اسلام یونورسٹی اوپن ایف بال علامہ ال عربی۔ ال لسان بک ٹریکسٹ

Semester-II

Sr. No	Course Code	Course Title	Crd. Hrs		
			Theory	Lab.	Total
1	STA-1202	Statistics-II (S2, M2)	3	1	4
2	COM-1205	Introduction to Computer (C4)	2	1	3
3	MAT-1215	Calculus-II (Ma2, F2)	3	0	3
4	STA-1203	Statistics-III (S3, M3)	3	1	4
5	ENG-1207	Composition & Comprehension (C5)	3	0	3
Total			14	3	17

STA- 1202: Introduction to Probability Theory

Learning Objectives:

1. Understand basic concepts of probability, conditional probability, independence etc.
2. Be familiar with some of the more commonly encountered random variables, particularly the Binomial and Normal random variable.
3. Be able to calculate first two moments of common random variables i.e. means and variances.
4. Be able to apply the concepts of random variables to scientific applications. Computation of uncertainty using probability techniques.

Learning Outcomes:

1. Acquire the basic knowledge of probability and probability distribution.
2. Understand the concepts of basic techniques of measuring the uncertainty problem.
3. Analyze the problem of genetics finance and telecommunications by using probability techniques.

Course Contents:

Set theory and its operations, Probability Concepts, Addition and Multiplication Rules, Bivariate Frequency Tables, Joint and Marginal Probabilities, Conditional Probability and Independence, Bayes' Rule. Random Variables, Discrete Probability Distribution, Mean and Variance of a Discrete Random Variable, Bernoulli Trials, Properties, Applications and Fitting of Binomial, Poisson, Hypergeometric, Negative Binomial and Geometric Distributions. Continuous Random Variable, Probability Density Function and its Properties, Normal Distribution and its Properties, Standard Normal Curve.

Recommended Books:

1. Cacoullos, T. (2012). *Exercises in probability*. Springer Science & Business Media.
2. Mclave, J.T., Benson, P.G. and Snitch, T. (2005) "*Statistics for Business & Economics*" 9th Edition. Prentice Hall, New Jersey.
3. Santos, David (David A.) (2011). *Probability: an introduction*. Jones and Bartlett Publishers, Sudbury, Mass 20.
4. Walpole, P.E. Myers, R.H., Myers S.L. (2012). "Probability and Statistics for Engineers and Scientists", 9th edition, Prentice Hall.

COM-1205

INTRODUCTION TO COMPUTING

Credit Hrs: 03

Brief history of computers and their applications, Major, components of a computer (CPU and Memory, Data storage devices, Input/Output devices), Software (Standards, Application software, System software, Standard options, Windows, Linux and Macintosh) Computers Networks, Telecommunication basics, The Internet and the World Wide Web, Web Pages, Intro to Information Systems in Business, Office automation tools, Word processing, Graphic packages, Databases and Spreadsheets, Current trends in research and future prospects, Legal and moral aspects of Computer Science, Presentation Software etc.

RECOMMENDED BOOKS

1. Meta, Toledo, Roman, Schaum's Outline of Introduction to Computer Science, McGraw Hill, Book Company, 2000
2. Kelly, Julia, Nelson, Stephan L., Office XP The Complete Reference, McGraw Hill Book Company, 2001.
3. Joseph, Rubin, Excel 2007, CPA Company, 2007
4. Michael, Halvorson, Microsoft XP 2000, Microsoft Press Washington, 2007.

MAT-1215

CALCULUS-II

Credit Hrs: 03

Sequences, Monotone sequences, convergence of sequence, infinite series, partial sum, convergence test Alternating sequence, conditional convergence, Power series Taylor's and Maclaurin's series, differential and integration of series. Arc length in polar, Cartesian, parametric curves, surface area, area in polar and Cartesian form of curves. Area of revolution in polar and Cartesian forms. Conversion of systems, Unit tangent and normal Vectors, Curvature and radius of Curvature, Motion along a curve. Function of several variables, homogeneous function Euler theorem, Partial derivatives, Laplace equation. Differentiability and chain rules, Tangent planes, total differential, Directional Derivatives Gradient of two functions Function of n- Variables maxima and minima of two functions Lagrange Multipliers Double integral, triple integrals Centroid, center of Gravity, Total mass. Triple integrals, Jacobians, triple integrals in cylindrical and Spherical coordinates. Introduction to conic section, rotation of axes, Parabola, Ellipse, Hyperbola, Sketching of conics Volumes of Surfaces, complex numbers: DeMoivre's theorem and its applications, Complex functions, analytical functions, harmonic and conjugate, harmonic functions, Cauchy- Rehmunn equations (in Cartesian and polar coordinates). Line integrals, Green's theorem, Cauchy' theorem, Chauchy's integral formula, singularities, poles, residues and contour integration and applications.

RECOMENDED BOOKS

1. Calculus & Analytical Geometry, by Thomas & Finny, 10th Edition
2. Calculus & Analytical Geometry, by Howard Anton, 7th Ed
3. Calculus & Analytical Geometry, by S.M. Yousaf
4. Calculus & Analytical Geometry, by Skowsky, 6th Edition.

STA- 1203: Basic Statistical Inference

Learning Objectives:

1. To understanding of basic techniques of sampling and estimation, their properties and application
2. To select a sample from a given population and use it to make inferences about the population and its parameter
3. To test, deduce and infer the validity of different types of hypotheses and models built on the basis of the raw data collected in diverse problem-situations.

Learning Outcomes:

1. Acquire the knowledge of the sampling distributions and their properties.

2. Derive the appropriate estimators for parameters using best estimation procedure.
3. Use appropriate sampling distributions for interval estimation and hypotheses testing.
4. Apply appropriate inferential procedures to handle the practical situations.

Course Contents:

Sampling and sampling distribution of sample mean, proportion, difference between means and difference between proportions; Point and interval estimate properties of good point estimator; Testing of hypothesis for population mean, difference between population means and population proportion and difference between two population proportions, difference between means for paired data; Single population variance, ratio of two variances; Non-parametric methods: The sign test, Wilcoxon's signed rank test, Mann-Whitney U test, Median test, Run test, Kolmogorov-Smirnov test, Kruskal-Wallis test, Median test for k-samples, Friedman test.

Recommended Books:

1. Ross, S. (2019). *A first course in Probability*. 10th edition. Pearson Education Limited.
2. DeGroot, M. Schervish, M. (2017). *Probability and Statistics*. 4th edition. Pearson Education Limited.
3. Srivastava, M.K., Khan, A.H. and Srivastava, N. (2014). *Statistical Inference: Theory of Estimation*. Prentice-Hall of India Pvt. Ltd
4. Clark, G.M. and Cooke, D. (2011). "A Basic Course in Statistics", 5th edition, Arnold, London.
5. Mclave, J.T., Benson P.G. and Sincich, T. (2014). "Statistics for Business and Economics". 12th edition, Pearson Education Ltd, U.K.
6. Spiegel, M.R., Schiller, J.L. and Sirinivasan, R.L. (2015). "Probability and Statistics". 3rd edition, Schaums Outlines Series. McGraw-Hill. NY.

Semester-III

Sr.No	Course Code	Course Title	Crd. Hrs		
			Theory	Lab.	Total
1	PS-2317	Pakistan Studies (C6)	2	0	2
2	MAT-2301	Mechanics-I (Ma3, M4)	3	0	3
3	STA-2304	Statistics-IV (S3, M5)	3	1	4
4	MAT-2315	Linear Algebra (Ma4, M6)	3	0	3
5	ENG-2307	Communication Skills (C7)	3	0	3
6	MAT-2305/ SAT-2305	Math/ Statistics (E1)	3	0	3
Total			17	1	18

An overview of the British Rule in the sub-continent, two nation theory & role of Sir Sayyed for the revival of Muslims, major political organization (congress muslim league), Constitutional reforms, Constitutional & political struggle (separate electrolate, Lucknow Pact), Tehrik –e-Khilafat, Nehru Report, Jinnah’s 14 point, e-Allah Abad Address 1930, Round table conferences, Election of 1937 and Congress Minstries, Pakistan Moment (194047), Crips proposal 1942, Wavell plane and shimla conference 1945, Election of 1945-46, Cabinet mission plan 1946, 3rd June plane and Red cliff award, Pakistan's Immediate Problems: Administrative problems, problems of Refuges, Problems of Accession of states(Kashmir, Hyderabad, June Garh), Distribution of Assets, Canal Water dispute, political and constitutional Development, Hurdles of Constitution Making, 1956 constitution, Islamic clauses) 1962 constitution (Islamic clauses) and Ayub Era, Yahya Regime and first General election 1970, Bhutto in power 1973 constitution (Islamic clauses), Zia government steps for Islamization, Era of Democracy (1988-1999), Pakistan’s foreign policy: Relations with USA, Soviet union, Relations with neighboring countries (India, china, Iran, Afghanistan), Relations with Saudi Arabia and Turkey, Pakistan and International Organizations (UNO, OIC, ECO,SAARC), M.D. Zafar, Pakistan studies, Aziz Book Depot Urdu Bazaar Lahore.

RECOMMENDED BOOKS

1. Sheikh Muhammad Rafique, Pakistan studies, urdu Bazar Lahore
2. Sheikh Muhammad Rafique, History of Pakistan, urdu Bazar Lahore.

Course Code: MAT-2301

Title: Mechanics-I

Credit Hrs: 03

Course Outline:

Forces: Fundamental concepts and principles, Newtonian Mechanics, Inertial-non-inertial frames, Resultant of several concurrent forces, The parallelogram law of forces, Resolution of a forces, triangle of forces, Lamy’s theorem, polygon of forces, Conditions of equilibrium for a particle, External and internal forces, principle of transmissibility, Resultant of like and unlike parallel forces, Moment of forces about a point, Varignon’s theorem, Moment of a couple, equivalent couples, composition of couples, Reduction of coplanar forces to a force or a couple

Friction: Dry friction and fluid friction, Laws of dry friction, coefficients of friction, angle of friction, Equilibrium of a particle on a rough inclined plane, Particle on a rough inclined plane acted on by an external force, Conditions for sliding or titling

Virtual Work: Principle of virtual work, Problems involving tensions and thrust.

Text and Reference Books:

1. A. Bedford and W. Fowler, *Dynamics Engineering Mechanics*, Addison-Wesley, Reading, USA.
2. T. L. Chow, *Classical Mechanics*, John Wiley and Sons, New York, 1995.
3. H. Goldstein, *Classical Mechanics*, 2nd Edition, Addison Wesley, Reading, Ma, USA, 1980.
4. J. B. Marion, *Classical Dynamics of Particles and Fields*, 2nd Edition, Academic Press, New York, 1970.
5. J. R. Taylor, *Classical Mechanics*, University Science Books, 2005.

STA-2404: Introduction to Regression and Analysis of Variance

Learning Objectives:

1. To provide foundations of regression analysis.
2. To provide basic knowledge and art of statistical data analysis
3. To predict and draw inference about the parameters of the parameters of population.

Learning Outcomes:

1. Explore more adequately the connection between theories of regression.
2. Analysis of real world problems.
3. Prediction of dependent variable.

Course Contents:

Relationship between variables, Simple linear regression model, Estimation of parameters by method of least squares and corresponding variance estimates, Testing and confidence intervals for least squares estimators, mean prediction and individual prediction. Multiple linear regression with two regressors, coefficient of multiple determination, Partial and multiple correlation up to three variables. Inference of simple, partial and multiple correlation coefficients, Analysis of variance for one-way classification and two-way classification. Decomposition of total sum of squares, Multiple comparison tests; least significant difference and Duncan's multiple range test, Tukey test and Least significant difference test.

Recommended Books:

1. Montgomery, D. C., Peck, E. A., and Vining, G. G. (2012). Introduction to linear regression analysis (Vol. 821). John Wiley and Sons.
2. Dielman, T. E. (2001). Applied regression analysis for business and economics. Pacific Grove, CA: Duxbury/Thomson Learning.
3. Rawlings, J. O., Pantula, S. G., and Dickey, D. A. (2001). Applied regression analysis: a research tool. Springer Science and Business Media.

MAT-2315

LINEAR ALGEBRA

Credit Hrs: 03

System of Linear Equations: Basic concepts. Standard matrix form, Inverse of matrix, Matrix operations, Elementary row and column operation Echelon & Reduce Echelon form System of homogeneous & non- homogeneous linear equations (Gauss Elimination and Gauss- Jordan). Application of linear equations, Linear Dependence & Independence sets of vectors, Linear Transformations. Vector spaces: Definitions, Properties of vector spaces, vector spaces and subspaces, Basic, Dimensions of vector space, Eigen vector & Eigen value, Characteristic Equations, Eigen vectors and Linear Transformations, Inner Product, Length and Orthogonality sets, Gram Schmidt process, Inner Product Spaces.

RECOMMENDED BOOKS

1. Linear algebra and its application (3rd edition) by David C. Lay.
2. Advance Engineering Mathematics by Ervin KAREYZIG, 9th Edition.
3. Elementary Linear Algebra (8th edition) by ANTON.

ENG-2307

ENGLISH-III (Communication Skills)

Credit Hrs: 03

Paragraph writing, Practice in writing a good, unified and coherent paragraph, Essay writing, Introduction, CV and job application, Translation skills, Urdu to English, Study skills, Skimming and scanning, intensive and extensive, and speed reading, summary, and précis writing and comprehension, Academic skills, Letter/memo writing, minutes of meetings, use of library and internet, Presentation skills, Personality development (emphasis on content, style and pronunciation)

Note: documentaries to be shown for discussion and review.

RECOMMENDED BOOKS

1. Practical English Grammar by A.J. Thomson and A.V. Martinet. Exercises 2. Third edition. Oxford University Press 1986. ISBN 0 19 431350 6.
2. Writing. Intermediate by Marie-Christine Boutin, Suzanne Brinand and Françoise Grellet. Oxford Supplementary Skills. Fourth Impression 1993. ISBN 019 435405 7 Pages 45-53 (note taking).
3. Writing. Upper-Intermediate by Rob Nolasco. Oxford Supplementary Skills. Fourth Impression 1992. ISBN 0 19 435406 5 (particularly good for writing memos, introduction to presentations, descriptive and argumentative writing).
4. Reading. Advanced. Brian Tomlinson and Rod Ellis. Oxford Supplementary Skills. Third Impression 1991. ISBN 0 19 453403 0.
5. Reading and Study Skills by John Langan
6. Study Skills by Richard Yorky.

STA-2320 Exploratory Data Analysis and Visualization

Learning Objectives:

1. To provide solid understanding of the process of Exploratory Data Analysis
2. To educate students in data exploration, analysis, and visualization
3. To train students in industry standard tools for data analysis and visualization

Learning outcomes:

1. describe exploratory data analysis and visualization concepts
2. describe data analysis and visualization models and algorithms
3. describe applicability of different data analysis and visualization models techniques to solve real-world problems
4. acquire and pre-process data
5. apply exploratory data analysis to some real data sets and provide interpretations via relevant visualization

Course Contents:

Exploratory Data Analysis: Explore, Visualize and Analyze, Repeat. Selective data collective and data exploration. Data visualization and Data analysis (using Excel/Tableau/R/STATA/SPSS etc).

Recommended Books:

1. Pearson, R. K. (2018). "Exploratory Data Analysis using R". 1st edition, Chapman and Hall/CRC, Taylor and Francis Group UK.
2. Datar, R., Garg, R. (2019). "Hands-On Exploratory Data Analysis with R: Become an expert in exploratory data analysis using R packages". 1st Edition, Kindle Edition.
3. Tukey, J. (1977). "Exploratory Data Analysis". Addison Wesley.
4. Chang, W. (2013). R Graphics Cookbook. O'Reilly. <http://www.cookbook-r.com/>.
5. Wickham, H. (2016). ggplot2: Elegant Graphics for Data Analysis. Springer. <http://ggplot2.org/book/>; <http://hadley.nz/>.

Semester-IV

Sr.No	Course Code	Course Title	Crd. Hrs		
			Theory	Lab.	Total
1	MAT-2402	Mechanics-II (Ma5, M7)	3	0	3
2	MAT-2403	Ordinary Differential Equations (Ma6, M8)	3	0	3
3	STA-2420	Statistics-V (E2)	3	1	4
4	MAT-2404	Matric Space and Number Theory ((Ma7, M9))	2+2	0	4
5	*SUB-2499	Project Or	4 or	4	4
	MAS-2415	Mathematics Statistics Or	3	1	
	COM-2405	Programming Fundamental	3	1	
Total			17	1	18

*SUB (MAT or PHY or STA)

Course Code: MAT-2402

Title: Mechanics-II

Credit Hrs: 03

Course Outline:

Kinematics: Rectilinear motion of particles. Uniform rectilinear motion, uniformly accelerated rectilinear motion. Curvilinear motion of particle, rectangular components of velocity and acceleration. Tangential and normal components. Radial and transverse components. Projectile motion. **Kinetics:** Work, power, kinetic energy, Conservation Laws (conservative force fields. Conservation of energy Conservation of linear and angular momentum), impulse, torque. Non-conservative forces. **Simple Harmonic Motion:** The simple harmonic oscillator, period, frequency. Resonance and energy. The damped harmonic oscillator, over damped, critically damped and under damped. Motion, forces and vibrations. **Central Forces and Planetary Motion:** Central force fields, Properties of Central Force Field, Equations of motion, potential energy, orbits. Kepler's law of planetary motion. Apsides and apsidal angles for nearly circular orbits. Motion in an inverse square field.

Planer Motion of Rigid Bodies: Introduction to rigid and elastic bodies, degree of freedom, translations, rotations, instantaneous axis and center of rotation, Rotation of a rigid body about a fixed axis, moments and products of inertia. Parallel and perpendicular axis theorem.

Text and Reference Books

1. A. Bedford and W. Fowler, *Dynamics Engineering Mechanics*, Addison-Wesley, Reading, USA.
2. T. L. Chow, *Classical Mechanics*, John Wiley and Sons, New York, 1995.
3. H. Goldstein, *Classical Mechanics*, 2nd Edition, Addison Wesley, Reading, Ma, USA, 1980.
4. J. B. Marion, *Classical Dynamics of Particles and Fields*, 2nd Edition, Academic Press, New York, 1970.
5. J. R. Taylor, *Classical Mechanics*, Null Edition, University Science Books, 2005.

MAT-2403

DIFFERENTIAL EQUATIONS

Credit Hrs: 03

Introduction to ODEs (physical motivation), First order ODEs (separate variables, homogeneous equations, exact equations, linear equations, Bernoulli equation and other examples), applications of first order ODEs linear and non-linear, linear differential equations of higher order (initial value and boundary value problems, linear dependence and independence, solutions of linear equations, constructing a second solution from a known solution, homogeneous linear equations with constant coefficients, undetermined coefficients, variation of parameters), applications of second order ODEs (simple harmonic equation, damped and forced oscillators, electrical circuits and springs), differential equations with variable coefficients (Cauchy-Euler equation, power series solution of differential equation- solutions about ordinary and singular points-Legendre's and Bessel's equations as examples), Laplace transform (Laplace transform and its inverse properties, use in solving differential equations, Dirac function).

RECOMENDED BOOKS

1. D. G. Zill and M. R. Cullen, *Differential equations with boundary value problems*, 3rd Ed., National Book Foundation.
2. E. Kreyszig, *Advanced engineering mathematics*, Jhon Wiley, 8th

3. K. F. Riley, M. P. Hobson and S. J. Bence, *Mathematical Methods for Physicists*, Cambridge University Press 2006.

STA-2420

Applied Statistics

Learning Objectives:

1. Demonstrate the knowledge and need of sampling.
2. Understanding the sampling methodology used in surveys.
3. Develop the deep understanding of the concept of Time series.
4. Briefly explain the concept and explanation of vital statistics.

Learning Outcomes:

1. The ability to analyze the sample data.
2. Skill of high order to develop questionnaire.
3. Analyze the demographic characteristics of a given population.
4. Identify and interpret demographic data.

Course Contents:

Sampling: Need of sampling, Sample versus population, Random and non-random sampling, concepts of statistic and population parameter. Sampling techniques: Simple Random, Stratified and Systematic random sampling. Census and survey problem, framing of questionnaire. Sampling and Non-Sampling Errors.

Time Series Analysis: Components of time series and their isolation.

Vital Statistics: Meaning of vital statistics, registrations of Birth and death in Pakistan. Uses of vital statistics, shortcomings of vital statistics, rates and ratios (Sex ratio, child women ratio, birth and death ratio, population growth rate, classification of natal rates, death rates or mortality rates, crude death rate, specific death rate, infant mortality rate, case fatality rate, fertility rates, crude birth rate, specific birth rate, standardized death rate, reproduction rates, gross reproduction rate, net reproduction rate, morbidity or sickness rates, marriage rates, divorce rates etc. general; fertility rate, total fertility rate.)

Recommended Books:

1. Walpole, P.E. Myers, R.H., Myers S.L. (2012). "Probability and Statistics for Engineers and Scientists", 9th edition, Prentice Hall.
2. Clark, G.M. and Cooke, D. (2011). "A Basic Course in Statistics", 5th edition, Arnold, London.
3. Mclave, J.T. Benson, P.G. and Snitch, T. (2017). "Statistics for Business & Economics" 13th Edition, Prentice Hall New Jersey.
4. Cochran, W.G. (1977). "Sampling Techniques". 3rd edition, Wiley New York.
5. Yousuf, F., Martins, Jo. M., Swanson, D. A. (2014). "Method of Demographic Analysis", Springer Dordrecht Heidelberg New York.

Course Code: MAT-2404 Title: Metric Space and Number Theory Credit Hrs: 2+2

Course Outline Metric Space: Preliminary Concepts, Definition and Examples of Metric Spaces, Open and Closed Spheres and Sets, Convergent Sequences, Cauchy Sequences, Cantor's Intersection Theorem, Complete Metric Spaces, Dense and Nowhere Dense Subsets, Continuous and Uniform Continuous Functions and Their Properties,

Course Outline Number Theory: Divisibility, Euclidean Algorithm, GCD and LCM of two Integers, Properties of Prime Numbers, Fundamental Theorem of Arithmetic (UFT), Congruence Relation, Residue System, Euler's Phi-Function, Solution of System of Linear Congruence, Congruences of Higher Degree, Chinese Remainder Theorem, Fermat's Little Theorem, Wilson's Theorem and Applications, Primitive Roots and Indices, Integers Belonging to a Given Exponent (mod p), Primitive Roots of Prime and Composite Moduli, Indices

Text and Reference Books

1. C. W. Patty, *Foundation of Topology*, 2nd Edition, The Jones and Bartlett Publishers, 2009.
2. J. Dugundji, *Topology*, W.M. C. Brown Publisher, 1990.
3. E. Kreyszig, *Introductory Fundamental Analysis with Applications*, John Wiley and Sons, 1978.
4. M. O. Searcoid, *Metric Spaces*, 2007 Edition, Springer, 2006.
5. P. K. Jain, *Metric Spaces*, 2nd Edition, Alpha Science Intl Ltd, 2004.
6. G. A. Jones and J. M. Jones, *Elementary Number Theory*, Springer-Varlog, London Limited, 1998.
7. M. B. Nathanson, *Methods in Number Theory*, Springer-Verlag, New York, 2000.
8. A.N. Parshin and I.R. Shafarevich, *Number Theory-I, Fundamental Problems, Ideas and Theories*, Springer-Verlag, Berlin Heidelberg, 1995.
9. K. H. E. Rosen, *Elementary Number theory and its Applications*, 4th Edition, Addison Wesley, Reading, Ma, USA, 2000.
10. T. Andreesco and D. Andrica, *Number theory*, 2009 Edition, Birkhauser, 2009.

Course Code: MAS-2415

Title: Mathematical Statistics

Credit Hrs: 03

Course Outline: The postulates of probability, Some elementary theorems, Addition and multiplication rules, Baye's rule and future Baye's theorem, Random variables and probability functions, Uniform, Bernoulli and Binomial distribution, Hypergeometric and geometric distribution, Negative binomial and Poisson distribution, Uniform and exponential distribution, Gamma and beta distributions, Normal distribution, Moments and moment generating functions Moments of binomial, hypergeometric, Poisson, gamma, beta and normal distributions

Text and Reference Books

1. M. H. De-Groot and M. J. Schervish, *Probability and Statistics*, 3rd Edition, Addison Wesley, 2002.
2. A. Papoulis, *Probability, Random Variables, and Stochastic Processes*, 3rd Edition, Mc-Graw Hill, 1991.
3. T. Sincich, *Statistics by Examples*, Dellen Publishing Company, 1990.
4. A. S. Hirahi. *A Course in Mathematical Statistics*, 4th Edition, Ilmi Kitab Khana, Lahore, Pakistan, 2012.
5. S. M. Chaudhry and S. Kamal, *Introduction to Statistical Theory Part-II*, Ilmi Kitab Khana, Lahore, Pakistan, 2012.

COM-2405

PROGRAMMING FUNDAMENTALS

Credit Hrs: 03

Computer programming, principles of structured and modular programming, overview of structured programming languages, algorithms and problem solving, program development, analyzing problem, designing algorithm/solution, testing designed solution, translating algorithms into programs, fundamental programming constructs, data types, basics of input and output, selection and decision (If, If-else, Nested If-else, Switch statement, and Condition operator), repetition (While and For Loop, Do-while Loops), break statement, continue statement, control structures, functions, arrays, pointers, records, files, (Input/Output), testing and debugging.

RECOMMENDED BOOKS

1. C how to program, Paul Deitel and Harvey Deitel, Prentice Hall; 7th Ed. (2012)
2. Programming in C, Stephen G. Kochan, Addison-Welley Professional; 4th Ed. (2013)
3. Java how to program, Paul Deitel and Harvey Deitel, Prentice Hall; 9th Ed. (2011)
4. C++ how to program, Paul Deitel and Harvey Deitel, Prentice Hall; 9th Ed. (2013).

ENG-2301

ENGLISH-II

Credit Hrs. 03

Objectives: To enable the students to write a research paper / technical report in a succinct manner according to a specified format.

Presentation skills, Essay writing, Descriptive, narrative, discursive, argumentative, Academic writing
How to write a proposal for research paper/ term paper. How to write a research paper/term paper
(emphasis on style, content, language, form, clarity, consistency), Technical Report writing, Note:
Extensive reading is required for vocabulary building

Recommended Books:

1. R. White, Writing. Advanced, Oxford Supplementary Skills. Third Impression 1992. (Particularly suitable for discursive, descriptive, argumentative and report writing).
2. J. Langan. College Writing Skills, McGraw-Hill Higher Education. 2004.
3. L. G. Kirszner and S. R. Mandell. Patterns of College Writing, 4th edition St. Martin's Press.
4. The Mercury Reader. A Custom Publication. Compiled by northern Illinois University. General Editors: Janice Neulib; Kathleen Shine Cain; Stephen Ruskus and Maurice Scharon.