University of Mumbai

No. UG/ 121 of 2019-20

CIRCULAR:-

Attention of the Principals of the Affiliated Colleges, the Head of the University Departments and Directors of the recognized Institutions in Science & Technology Faculty is invited to this office Circular No. UG/109 of 2013-14 dated 26th March, 2014 relating to the revised syllabus for the Post-Graduate Diploma in Applied Statistics with Software (PGDASS).

They are hereby informed that the recommendations made by the Board of Studies in Statistics at its meeting held on 19th June, 2019 have been accepted by the Academic Council at its meeting held on 26th July, 2019 **vide** item No.4.7 and that in accordance therewith, the revised syllabus of Post-Graduate Diploma in Applied Statistics with Software (PGDASS) (Sem. - I & II) has been brought into force with effect from the academic year 2019-20, accordingly. (The same is available on the University's website www.mu.ac.in).

(Dr. Vinod P. Patil)
I/c REGISTRAR

MUMBAI – 400 032
18th September, 2019

To

The Principals of the affiliated Colleges, the Head of the University Departments and Directors of the recognized Institutions in Science & Technology Faculty. (Circular No. UG/334 of 2017-18 dated 9th January, 2018.)

A.C/4.7/26/07/2019

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No. UG/ 121 -A of 2019-20 MUMBAI-400 032 18th September, 2019

Copy forwarded with Compliments for information to:-

1) The I/c Dean, Faculty of Science & Technology,
2) The Chairman, Board of Studies in Statistics,
3) The Director, Board of Examinations and Evaluation,
4) The Professor-cum-Director, Institute of Distance and Open Learning (IDOL),
5) The Director, Board of Students Development,
6) The Co-ordinator, University Computerization Centre,

(Dr. Vinod P. Patil)
I/c REGISTRAR

Cover Page

AC 26/7/19
Item No. 4.7

UNIVERSITY OF MUMBAI

Syllabus for Approval

Sr. No.	Heading	Particulars
1	Title of the Course	Post Graduate Diploma in Applied Statistics with Software (PGDASS)
2	Eligibility for Admission	Any graduate and Entrance test of Dept
3	Passing Marks	40% in internal and 40% in external
4	Ordinances / Regulations (if any)	N. A.
5	No. of Years / Semesters	two semesters
6	Level	P.G. / ~~U.G.~~ / Diploma / ~~Certificate~~ (Strike out which is not applicable)
7	Pattern	~~Yearly~~ / Semester (Strike out which is not applicable)
8	Status	~~New~~ / Revised (Strike out which is not applicable)
9	To be implemented from Academic Year	From Academic Year 2019-20

Date: 9-7-2019 Signature: VUDixit

Name of BOS Chairperson / ~~Dean~~: Dr (Mrs.) V. U. Dixit

UNIVERSITY OF MUMBAI

Syllabus for the Semester I and Semester II
Program: Post Graduate Diploma in Applied Statistics with Software.
Course : STATISTICS

(With effect from the academic year 2019–2020)

Post Graduate Diploma in Applied Statistics with Software

(Semester I and Semester II) Syllabus

To be implemented from the Academic year 2019-2020

Structure of the syllabus:

The program will have two semesters, semester I and semester II. In each of the semesters, there are four papers.

Following is the table showing the proposed courses to be covered in semester I and semester II.

Course	Title of the course
Semester I	
I	Basic Statistics
II	Statistics in market research
III	Applied regression analysis and analysis of variance
IV	Applied multivariate techniques
Semester II	
I	Six-Sigma and total quality management
II	Statistics in healthcare and clinical research
III	Business analytics
IV	Communication skills, soft skills and Statistical project

DETAILED SYLLABUS:

SEMESTER I

BASIC STATISTICS:

- Introduction to Statistics, need of Statistics, types of scale, variable and constant, notion of univariate, bivariate, multivariate data.
- Univariate Data presentation: simple and multiple bar diagrams, pie diagram, histogram, frequency curve, stem-leaf display.
- Summary statistics: mean, median, mode, harmonic mean, geometric mean, variance, coefficient of variation, mean deviation about median, mean deviation about mean, absolute mean, range, Box plot.
- Raw and central Moments upto fourth order, symmetric frequency curves, asymetric frequency curves, skewness, measures of skewness, kurtosis, measures of kurtosis
- Random experiment, sample space, concept of probability, examples, conditional probability, Bayes' theorem, random variable, probability function, distribution function, independence, expectations, examples on expectations, standard discrete

and continuous distributions: Bernoulli, binomial, Poisson, negative binomial, exponential, normal, chi-square, students t, F, applications of central limit theorem.

- Estimation and testing of hypothesis: need of estimation, notion of statistic, random sample, likelihood function, introduction to methods of estimation: maximum likelihood estimation, method of moments, properties of estimators.
- Confidence interval for mean, variance.

REFERENCE BOOKS:

1. Anderson, D. R., Sweeny, D. J. and Williams-Rochester, T. A. (2002): Statistics for business and economics. Thomson Press.
2. Hanagal, D. D. (2017): Introduction to Applied Statistics: Non-Calculus Based Approach. Narosa Publishing House.
3. Hogg, R., Craig, A. T. and McKean, J. W. (1995): Introduction to Mathematical Statistics. Pearson. 6th Edition.
4. Levin, R. I. and Rubin, D. S. (1998): Statistics for management. Pearson. 6th Edition.
5. Mood, A. M., Graybill, F. A. and Boes, D. C. (1973): Introduction to the theory of Statistics. McGraw –Hill. 3rd Edition.
6. Wackerly, D., Mendenhall, W. and Scheaffer, R. L. (2008): Mathematical Statistics with applications. Thomson. 7th Edition.

STATISTICS IN MARKET RESEARCH:

1.	Definition of marketing research and market research, need for marketing research, requirement of good marketing research, manager researcher relationship, competitive and complex nature of Indian markets, role of research in new product development, packaging, branding, positioning, distribution and pricing, ethics in Business Research.
2.	Planning the research Process - Steps in marketing Research.
3	Techniques for identifying management problem and research problem.
4.	Meaning & types of research designs-exploratory, descriptive and casual.
5.	Exploratory research designs, Sampling & data collection methods
6.	Causal research designs: Data collection methods
7.	Descriptive research design: Sampling methods, Types of scales, questionnaire design
8.	Preparations research proposal
13.	Applications of Marketing Research - Introduction, Consumer Market Research, Business-to-Business Market Research, Product Research, Pricing Research,

	Motivational Research, Distribution Research, Advertising Research, Media research, Sales Analysis and Forecasting, Data Mining
14.	Recent Trends in Marketing research - Introduction, Marketing Information System and Research, Online Marketing Research, Research in Lifestyle Retail, Marketing Research and Social Marketing, Rural Marketing Research, Trends in Services Marketing Research, Brand Equity Research, International Marketing and Branding Research
15.	Consumer segmentation techniques: Chi-square test of independence, Cluster analysis
16.	Customer discriminating technique: Discriminant analysis
17.	Product positioning techniques: Snake chart, Benefit structure analysis, Multi-dimensional scaling technique, Factor analysis
18.	**CH**i-squared **A**utomatic **I**nteraction **D**etector (CHAID)
19.	New product development technique: Conjoint analysis
20.	Report writing

REFERENCE BOOKS:

- Aaker, D. A., Kumar, V., Leone, R. and Day, G. S. (2012) Marketing Research. John Wiley. 11th Edition.
- Burns, A. C. and Bush, R. F. (2005): Marketing Research with SPSS 13.0. Prentice. 5th Edition.
- Gibbons, J. D. and Chakraborti, S. (2010): Nonparametric Statistical Inference. CRC Press. 5th Edition.
- Hogg, R., Craig, A. T. and McKean, J. W. (1995): Introduction to Mathematical Statistics. Pearson. 6th Edition.
- Hanagal, D. D. (2017): Introduction to Applied Statistics: Non-Calculus Based Approach. Narosa Publishing House.
- Harper, W. B., Westfall, R. and Stasch, S. F. (1989): Marketing Research: Text and Cases. Richard d. Irwin. 7th Edition.
- Kinnear, T. C. and Taylor, J. R. (1995): Marketing Research: An applied Approach. McGraw Hill.
- Kulkarni, M. B., Ghatpande, S. B. and Gore, S. D.(1999): Common Statistical Tests. Satyajeet Prakashan.
- Malhotra, N. K. and Das, S. (2019): Marketing Research: An applied orientation revised Edition. Pearson. 7th Edition.
- Mood, A. M., Graybill, F. A. and Boes, D. C. (1973): Introduction to the theory of Statistics. McGraw –Hill. 3rd Edition.

- Nargundkar, R. (2003), Marketing Research Text & Cases. Tata McGraw Hills.
- Paul, E., Tull, D. S. and Albaum, G. G. (2009): Research for Marketing Decision. PHI. 5th Edition.

APPLIED REGRESSION ANALYSIS AND ANALYSIS OF VARIANCE

- Simple linear regression, interpretation of regression coefficients, estimation of regression coefficients, test of significance of regression coefficients.
- Multiple linear regression, transformation of variables, qualitative variables as predictors, Estimation, testing of significance, Regression diagnostics, selection of variables. Analysis of collinear data.
- Logistic regression, Poisson regression
- One-way analysis of variance, two-way analysis of variance with and without interaction, multi-way analysis of variance, nested models, analysis of covariance, random effect models.

REFERENCE BOOKS:

- Chatterjee, S. and Hadi, A. S. (2012): Regression Analysis by Example. John Wiley. 5th Edition.
- Chatterjee, S., Handcock, M. S. and Simonoff, J. F. (1995) A Casebook for a first course in Statistics and data Analysis. John Wiley.
- Dielman, T. E. (2004): Applied Regression analysis: A second course on Business and Economics Statistics. Brooks/Cole. 4th Edition.
- Draper, N. R. and Smith, H. (1998): Applied Regression Analysis. John Wiley. 3rd Edition.
- Montgomery, D. C., Peck, E. A. and Vinning, G. G. (2012): Introduction to linear regression analysis. John Wiley. 5th Edition. Onyiah, L. C. (2008): Design and analysis of experiments: Classical and regression approach with SAS. CRC Press.
- Seber, George A. F. (2003) Linear Regression Analysis. John Wiley. 2nd Edition.

APPLIED MULTIVARIATE TECHNIQUES

- The organization of data, data display and pictorial representation, detecting outliers and data cleaning.
- Assessing the assumption of multivariate normality, transformations to near multivariate normality.
- Hotelling's T^2 statistic and its applications to testing of hypotheses.
- One-way, two-way multivariate analysis of variance.
- Confidence Regions and simultaneous Comparisons of Component Means.
- Large Sample Inferences about a Population Mean Vector
- Multivariate Regression Model.

- Principal Component analysis
- Factor Analysis
- Cluster Analysis
- Discrimination and Classification
- Multi Dimensional Scaling

REFERENCE BOOKS:

- Bishop, Y. M., Fienbeng, S. E. and Holland, P. W. (2007): Discrete Multivariate Analysis: Theory and Practice. Springer.
- Bryan, F. J. M. and Jorge A. (2017): Multivariate Statistical Methods: A primer. CRC Press. 4th Edition.
- Johnson, R. A. and Wichern, D. W. (2015): Applied Multivariate Statistical Analysis. 6th Edition. PHI Learning Private Limited.
- Husson, F., Sebastien L. and Pages, J. (2017): Exploratory Multivariate analysis by examples using R. CRC Press.
- Srivastava, M. S. (2002): Methods of Multivariate Statistics. John Wiley.
- Wolfgang, K. Hardle and Leopold Simar (2015): Applied Multivariate Statistical analysis. Springer. 4th Edition.

SEMESTER II

SIX-SIGMA AND TOTAL QUALITY MANAGEMENT

- Introduction to Lean and six – sigma : Definition of Lean , 5 S in Lean , 7 wastes in lean
- 5 principles of lean. Definition of six – sigma and definition of Lean six – sigma
- DMAIC over view ,Define phase : VOC,VOB,VOP,CTQ,COPQ ,Project charter ,DPU , DPMO ,Yield , Brain Storming , SIPOC , Cause and Effect diagram
- Measure phase : Process definition , Process Mapping , Value Stream Mapping ,MSA,
- Process Capability Analysis , statistical techniques : Averages ,Dispersion
- Analyse Phase: Correlation and Regression , Probability distributions , Determination of

sample size ,Testing of Hypothesis

- Improve Phase : Multi voting , Delphi Technique , Nominal group technique , Kaizen
- Control Phase :Control plans, Poka Yoke , SPC :Control plans ,IMR chart , X – bar , R – charts, P – chart , C and U charts
- Taguchi Techniques
- ISO 9000

REFERENCE BOOKS:

- Harry, M. and Schroeder, R. (2006): Six Sigma: The Breakthrough Management strategy revolutionizing the world's top corporations. Crown Business.
- Ishikawa, K. (1991): Guide To Quality Control. Asian Productivity Organization.
- Montgomery, D. C. (2012): Introduction to statistical quality control. John Wiley. 7th Edition.
- Pande, P. S., Neuman, R. P. and Cavanagh, R. R. (2002): The Six Sigma Way Team Fieldbook: An Implementation Guide for Process Improvement teams. McGraw Hill.
- Phadke, M. S. (1989): Quality Engineering Using Robust Design. Prentice Hall.
- Taguchi, G. (1986): Introduction to Quality Engineering: Designing Quality into Products and Processes. Quality Resources.

STATISTICS IN HEALTH CARE AND CLINICAL RESEARCH:

- Introduction to biostatistics.
- Clinical trial study designs: parallel and crossover designs. Drug development: phases of clinical trials. Randomization and blinding.
- Statistics in epidemiology.
- Sampling in research: probability and non-probability sampling, Simple random Sampling, convenience sampling, systematic sampling, stratified random sampling, cluster sampling, bootstrap sampling, sample size calculation.
- Statistical analysis plan (SAP) in clinical trials
- Analysis of datasets: intent-to-treat, per-protocol
- Data analysis in bioavailability (BA) and bioequivalence (BE) studies-PK/PD studies: data transformation, AUC, Cmax, Tmax, softwares (SAS, Stata, Win-Nonlin)
- Early stopping of clinical trials, placebo, causality assessment
- Multiplicity and interim analysis
- Survival analysis.
- Correlation and regression.
- Non-parametric tests for hypothesis testing: Fisher's exact test, Wilcoxon signed rank test, Wilcoxon rank sum test, Mann-Whitney 'U' test, Kruskal-Wallis test, Friedman test.
- Parametric tests for hypothesis testing: Analysis of variance (ANOVA), t-test, repeat measures ANOVA
- Binary response data, odds ratio, relative risk, categorical data analysis

- Meta-Analysis (Systematic review)
- Method comparison and evaluation, diagnostic tools: ROC curve analysis, Bland-Altman plot, sensitivity, specificity, negative predictive value, positive predictive value
- Agreement: intraclass correlation coefficient, Kappa's inter-rater agreement, Cronbach's alpha.

REFERENCE BOOKS:

- Bernard, R. (2016): Fundamentals of Biostatistics. Cengage Learning. 8th Edition.
- Chap, T. L. (2003): Introductory Biostatistics. John Wiley.
- Chernick, M. R. and Friis, R. H. (2003): Introductory Biostatistics for the Health Sciences: Modern Applications Including Bootstrap. John Wiley.
- Davis, C. S. (2002): Statistical Methods for the Analysis of Repeated Measurements.
- Fleiss, J. L., Bruce, L. and Paik. M. C. (2003): Statistical Methods for Rates and Proportions.
- Petrie, A. (2005): Medical Statistics at a Glance. Blackwell Publishing. 2nd Edition.
- Shoukri, M. M. and Pause, C. A. (1999): Statistical Methods for Health Sciences. Second Edition.
- Tal, J. (2011): Strategy and Statistics in Clinical Trials (A Non-Statistician's Guide to Thinking, Designing, and Executing). Elsevier

BUSINESS ANALYTICS:

- Introduction to Business Analytics, basic concepts of forecasting and decision making and data analytics
- Quantitative techniques of decision making: decision tree, break-even analysis, investment appraisal, critical path analysis.
- Qualitative techniques of decision making: SWOT analysis, PESTEL analysis, Six thinking hats technique, human mindset affecting implementation of decision.
- Statistical rules of decision making: maximin criterion, maximax criterion, minimax regret criterion, Laplace criterion.
- Bayesian approach to decision making: prior analysis, pre-posterior analysis, posterior analysis, sequential analysis.
- Quantitative time series techniques of forecasting: trend projection models, smoothing techniques, classical decomposition model, Box-Genkins model
- Selection of right forecasting method.

- Qualitative methods of forecasting: Delphi Method, subjective probabilities method, market research.
- Decision making under uncertainty, role of probability theory and statistical techniques, forecasting-based decision making.
- Characteristics of decision: unstructured or non-programmable decisions, structured or programmable decisions.
- Financial analytics, operational analytics, investment analytics
- Inventory management and introduction, inventory control, costs in inventory problems, techniques of inventory control with selective control (ABC analysis, usage rate and criticality)
- Techniques of inventory control with known demand and E.O.Q with uniform demand, production runs of unequal length, with finite rate of replenishment, problem of E.O.Q with shortage
- Techniques inventory control with uncertain demand and buffer stock computation, stochastic problems and uniform demand.
- Techniques in inventory control with price discounts
- break even analysis, marginal costing

REFERENCE BOOKS:

1. Mayes Timothy R. and Shack Todd. M (2006): Financial Analysis with Microsoft Excel.
2. Martin Mindy C., Hansen Steven M. and Klingher Beth, (1996): Mastering Excel 2000. Premium Edition.
3. Spyros G Makrindakis Steyan C. Wheelwright Rob J. Hyndman: Forecasting: Methods & Applications
4. Hanke, John E.,Reitsch Arthur G.,Wichern Dean W.: Business Forecasting 7th Edition

Communication Skills, Soft skills and Statistical Project

Module I: Communication Skills, Soft skills

Objectives of the Course:

i. to orient learners towards the functional aspect of language

ii. to train learners to be effective verbal and written communicators

iii. to enhance language proficiency and to encourage learners in spoken English

iv. to develop effective writing skills to enable learners to write in clear, concise and persuasive manner and to make them job-ready

Units:

A. Fundamentals of Grammar- Basic grammar and sentence construction, Concords, Articles, Confusing words, Spotting and avoiding grammatical and semantic errors.

B. Letter writing- Parts, Structure, Layouts of formal letters, familiarizing with different formats of formal letters, Principles of Effective Letter Writing, Writing an impressive covering letter

C. Curriculum Vitae- Understanding different formats of writing CV, Selecting the best-suited CV for the learner and creating it.

D. Group Discussion- Types of GD, Methods and means to handle a GD

E. Interviews- Grooming and preparation before an interview, Checklist and bio-data, how to be winsome and effective in an interview, Follow up

F. Presentations- Verbal and PowerPoint presentations, how to be an effective communicator, essentials of a good PowerPoint, Presentation Skills

Reference Books:

- Allen, J. G. (2004): The Complete Q & A Job Interview Book. John Wiley.
- Brown, R. (2004): Making Business Writing Happen: A Simple and Effective Guide to Writing: Well, Allen and Unwin.
- Krantman, S. (2001): The Resume Writer's Workbook. Delmar.
- Nierenberg, A. H. (2005): Winning the Interview Game. Amacom.
- Rich, J. (2000): Great Resume: Get Noticed, Get Hired. Learning Express.
- Sinha, N. C. (2016): Fundamentals of English Language. Prabhat.

Webliography:

- http://www.onestopenglish.com
- www.britishcouncil.org/learning-learn-english.htm
- http://www.teachingeng1ish.org.uk
- http://www.usingenglish.com?
- Technical writing PDF (David McMurrey)
- http://www.bbc.co.uk/
- http://www.pearsoned.co.uk/AboutUs/ELT/
- http://www.howisay.com/
- http://www.thefreedictionary.com/

Module II: Statistical PROJECT

Students should carry out the project on Statistical Application based on data

The entire course will be taught using Statistics Software such as **R/SAS/SPSS/MINITAB**.

Examination pattern and standard of passing:

In each semester and for each course (except paper VIII) there will be internal/midterm exam of 40 marks and external exam of 60 marks. Student has to secure minimum 40% marks to pass in that paper. Student has to pass separately in internal exam as well as external exam. Thus student has to secure minimum 16 marks out of 40 marks in internal examination and minimum 24 marks out of 60 marks in external paper. If student fails in securing minimum marks in any of the internal or external exam paper then he has to appear for that paper in the next exam whenever it is conducted.

Student will be declared as passed if the student passes in all papers including project.

A registration of the student will be valid only for three years for the course.
