MGM INSTITUTE OF HEALTH SCIENCES

(Deemed to be University u/s 3 of UGC Act, 1956)
Grade 'A' Accredited by NAAC
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CHOICE BASED CREDIT SYSTEM

(CBCS)

(with effect from 2018-19 Batches)

Curriculum for

M.Sc. Biostatistics

Amended upto AC-49/2024, Dated 25/04/2024

Amended History

1. Approved in BOM-53/2018 [Resolution No. 4.5.2] Dated 19/05/2018.
2. As Amended in BOM-55/2018 [Resolution No.4.19(i)], [Resolution No.4.4.1.3], [Resolution No.4.13], Dated 27/11/2018.
3. As Amended in BOM-57/2019, [Resolution No.3.1.4.2], [Resolution No.3.2.1.6.a], [Resolution No.3.2.1.6.d]; Dated 26/04/2019.
4. As Amended in BOM-63/2021[Resolution No.4.3.1.2], [Resolution No.4.3.1.3.], Dated 17/02/2021.
5. As Amended in AC-41/2021 [Resolution No. 3.5]; Dated 27/08/2021
6. As Amended in AC-42/2022 [Resolution No. 10.4.i], Dated 26/04/2022.
7. As Amended in AC-49/2024 [Resolution No. 3.10 ii], Dated 25/04/2024.

DIRECTOR'S MESSAGE

Dear Students,

Greetings!!!!!

I take this opportunity to welcome you on behalf of MGM family to the Masters Degree at MGM School of Biomedical Sciences (MGM SBS).

MGM School of Biomedical Sciences (MGM SBS) established in the year 2007, the MGM School of Biomedical Sciences envisaged building a progressive learning community and is committed to pursuit of excellence in higher education, total development of personality and shaping the students into sensitive, self-reliant citizens of the country imbued with the ideals of secularism and a scientific aptitude. We set global standards to make our students scientifically as well as ethically stronger. The college adopts the national qualification frame work for the post-graduate programs which has adopted Credit Base Choice System (CBCS) so that, we construct a value based system of education that encourages critical thinking and creativity, a research platform as opposed to rote learning.

The P.G (M.Sc.) courses offered are; Medical Anatomy, Medical Physiology, Medical Biochemistry, Medical Microbiology, Medical Pharmacology, Biotechnology, Genetics, Molecular Biology, Masters in Hospital administration and Biostatistics, M.Sc. Cardiac Care Technology, M.Sc. Medical Radiology and Imaging Technology, M. Optometry. Over time, the program has evolved, to meet the challenges of the ever changing field of biomedical education system.

With Best Wishes,

Director
MGM School of Biomedical Sciences

ABOUT MGM SCHOOL OF BIOMEDICAL SCIENCES

Mission

To improve the quality of life, both at individual and community levels by imparting quality medical education to tomorrow's doctors and medical scientists and by advancing knowledge in all fields of health sciences though meaningful and ethical research.

Vision

By the year 2020, MGM Institute of Health Sciences aims to be top-ranking Centre of Excellence in Medical Education and Research. Students graduating from the Institute will have the required skills to deliver quality health care to all sections of the society with compassion and benevolence, without prejudice or discrimination, at an affordable cost. As a research Centre, it shall focus on finding better, safer and affordable ways of diagnosing, treating and preventing diseases. In doing so, it will maintain the highest ethical standards.

About – School of Biomedical Sciences

MGM School of Biomedical Sciences is formed under the aegis of MGM IHS with the vision of offering basic Allied Science and Medical courses for students who aspire to pursue their career in the Allied Health Sciences, teaching as well as research.

School of Biomedical Sciences is dedicated to the providing the highest quality education in basic medical sciences by offering a dynamic study environment with well equipped labs. The school encompasses 21 courses each with its own distinct, specialized body of knowledge and skill. This includes 7 UG courses and 14 PG courses. The college at its growing years started with mere 100 students has recorded exponential growth and is now a full-fledged educational and research institution with the student strength reaching approximately 581 at present.

Our consistent theme throughout is to encourage students to become engaged, be active learners and to promote medical research so that ultimately they acquire knowledge, skills, and understanding so as to provide well qualified and trained professionals in Allied Health Sciences to improve the quality of life.

As there is increased need to deliver high quality, timely and easily accessible patient care system the collaborative efforts among physicians, nurses and allied health providers become ever more essential for an effective patient care. Thus the role of allied health professionals in ever-evolving medical system is very important in providing high-quality patient care.
Last but by no means least, School of Biomedical Sciences envisions to continuously grow and reform. Reformations are essential to any growing institution as it fulfills our bold aspirations of providing the best for the students, for us to serve long into the future and to get ourselves updated to changing and evolving trends in the health care systemsLast but by no means least, School of Biomedical Sciences envisions to continuously grow and reform. Reformations are essential to any growing institution as it fulfills our bold aspirations of providing the best for the students, for us to serve long into the future and to get ourselves updated to changing and evolving trends in the health care systems.

Programme Outcome:

The Master of Science in Biostatistics and will provide students knowledge and understanding of modern statistical biomedical methods. The students will learn about their application in all areas of public health, health, demography, and social sciences aimed at understanding and improving human wellbeing. The course offers a thorough grounding in modern biomedical research and the application of statistical methods to biomedical investigation and practice. Students will be given the opportunity to apply research techniques to a variety of challenging epidemiological and biomedical problems. The course also aim at providing students scope for professional development in understanding and use of statistical software packages including SPSS, In the second year of the course students shall write a dissertation on the basis of contemporary applications of boimedical and statistical methods and statistical software in public health, and demography. Opportunities are given to develop presentation and consultancy skills which are much valued by employers.

Programme Specific Outcome:

- M.Sc. in Bio-statistics programme will enable the students to learn through real examples by applying the statistical research techniques to variety of health data generated from our own hospital;
- Students will enable to understand and interpret the data generated in biology public health and other health sciences using modern Statistical Methods;
- Students will develop a thorough grasp of statistical methodology, before going on to apply statistical skills to solve real-life problems in various field;
- Student will be equipped with the skills needed to begin a career as a professional Biostatistician.

NAME OF THE DEGREE

Master of Science in Biostatistics: M.Sc. (Biostatistics)

AIMS OF THE PROGRAM

In India, there is acute shortage of biostatisticians, therefore MGM Institute of Health Sciences, Navi Mumbai has taken a step to start research oriented unique course M Sc –Biostatistics. "This is a data-rich world and people who can gather the evidence and evaluate it are incredibly valuable in every domain – research, medical, pharmaceutical, business or health care systems." This course will bridge the gap between statistical theory and its application in Medical, Pharmaceutical and Health care fields which will boost the quality of research.

The Master in Biostatistics will enable the students to understand and interpret the data generated in biology public health and other health sciences using modern Statistical Methods. The students will be able to learn through real examples by applying the statistical research techniques to variety of health data and biomedical research problems. Biostatistician can get the placement in research laboratories run by the government and the corporate sector. Private sector placements are in both technical and managerial positions. The biostatistician are in high demand, with a number of research institutes/organizations pharmaceutical and Health care related companies.

In academics, one can go for higher qualifications like Ph.D. in various field of biostatistics. There is a great demand of this course in our country and abroad as most of the foreign countries are looking for expert in this field.

DURATION OF STUDY: The duration of the study for M.Sc. Biostatistics will be of four semesters spread over two years.

Program pattern

- First Semester: July
- Second Semester: January
- Third Semester: July
- Fourth Semester: January

ADMISSION REQUIREMENTS: Candidates with 50% marks in Bachelor's degree from recognized universities in Mathematics or Statistics or BE/Btech.BCA B.Sc. Computer science subjects or with at least two full papers of Mathematics or Statistics.

CURRICULUM FOR M. Sc. IN BIOSTATISTICS

1ST YEAR

Semester I							
	Syllabus Ref. No.	**Subject**	**Credits**	**Teaching hours**	**Marks**		
	Theory				**Internal Assessment**	**Semester Exam**	**Total**
	MBS 101 T	Basic Mathematics and Introduction to Statistical Methods	4	4	20	80	100
	MBS 102 T	Epidemiology	4	4	20	80	100
	MBS 103 T	Health Economics	4	4	20	80	100
	MBS 104 T	Demography	4	4	20	80	100
	MBS 105 T	Health Care System and Policies & Health Surveys	4	4	20	80	100
	Practical						
	MBS 101 P	Basic Mathematics and Introduction to Statistical Methods	2	4	10	40	50
	MBS 102 P	Epidemiology	2	4	10	40	50
	MBS 103 P	Health Economics	2	4	10	40	50
	MBS 104 P	Demography	2	4	10	40	50
		Total	28	36	140	560	700

Semester II							
	Syllabus Ref. No.	**Subject**	**Credits**	**Teaching hours**	**Marks**		
	Theory				**Internal Assessment**	**Semester Exam**	**Total**
	MBS 106 T	Research Methodology-I	4	4	20	80	100
	MBS 107 T	Sampling Techniques in Health	4	4	20	80	100
	MBS 108 T	Estimation and Testing of Hypothesis	4	4	20	80	100
	MBS 109 T	Applied Multivariate Analysis	4	4	20	80	100
	Practical						
	MBS 106 P	Research Methodology-I	2	4	10	40	50
	MBS 107 P	Sampling Techniques in Health	2	4	10	40	50
	MBS 108 P	Estimation and Testing of Hypothesis	2	4	10	40	50
	MBS 109 P	Applied Multivariate Analysis	2	4	10	40	50
	MBS 110	Seminar	1	2	50	0	50
		Total	25	34	170	480	650

2ND YEAR

Semester III							
	Syllabus Ref. No.	**Subject**	**Credits**	**Teaching hours**	**Marks**		
	Theory				**Internal Assessment**	**Semester Exam**	**Total**
	MBS 111 T	Biostatistics and Research Methodology-II	4	4	20	80	100
	MBS 112 T	Survival Analysis	4	4	20	80	100
	MBS 113 T	Design of Experiment and Clinical Trial	4	4	20	80	100
		Core Elective course**	4	4	20	80	100
	MBS 114 T	Non parametric Test					
	MBS 115 T	Advance Statistical Computing					
	MBS 116 T	Time Series Analysis					
	MBS 117 T	Operations Research					
	MBS 118	Dissertation/Project*	6	12	50	-	50
	Practical						
	MBS 111 P	Biostatistics and Research Methodology-II	2	4	10	40	50
	MBS 112 P	Survival Analysis	2	4	10	40	50
	MBS 113 P	Design of Experiment and Clinical Trial	2	4	10	40	50
		***Core Electives**	2	4	10	40	50
	MBS 114 P	Non parametric Test					
	MBS 115 P	Advance Statistical Computing					
	MBS 116 P	Time Series Analysis					
	MBS 117 P	Operations Research					
	MBS 119	Seminar	1	2	50	0	50
		Total	31	46	220	480	700

Semester IV							
	Syllabus Ref. No.	**Subject**	**Credits**	**Teaching hours**	**Marks**		
	Theory				**Internal Assessment**	**Semester Exam**	**Total**
		General elective **	4	4	100	-	100
	GE 001 T	Pursuit of Inner Self Excellence (POISE)					
	GE 002 T	Bioethics, Biosafety, IPR & Technology Transfer					
	GE 003 T	Disaster management and mitigation resources					
	GE 004 T	Human rights					
	MBS118	Dissertation / Project*	18	36	-	200	200
	Practical						
	MBS120 P	Educational Tour / Field Work/Industrial Visit/Hospital Visit*	2	0	50	-	50
		Total	24	40	150	200	350

Syllabus of First Semester M. Sc. in Biostatistics

*** Core Electives: Any one subject is to be chosen from the subjects mentioned above (**Subjects offered may change from time to time depending on the need)

****General Elective: Any one subject is to be chosen from the subjects mentioned above** (Subjects offered may change from time to time depending on the availability of expertise):

Elective courses may or may not have practical and/or field work. ▲ Multidisciplinary / interdisciplinary

*****Educational Tours / Field Works*** Course may be carried out in any Semester or all Semesters

Industrial visit has its own importance in building a career of a student which is pursuing a professional degree. Objectives of industrial visit are to provide students an insight regarding internal working of reputed hospitals and labs. Industrial visits provides students an opportunity to learn practically thoughts interactions, working methods and employment practices as theoretical knowledge is not enough for making a competent and skilful professionals.

SEMESTER – I

PAPER I (Theory-60 hrs & Practical- 60 hrs)

MBS 101T& P- BASIC MATHEMATICS AND INTRODUCTION TO STATISTICS

Objectives:

To provide necessary foundations on Mathematics and Statistics which enables the students to calculate and interpret Statistical measures.

Outcome:

Students are expected to understand correlation matrix and other Statistical equations, formulas to calculate and interpret Statistical measures.

Unit I (10 hours) Matrix Operations; Linear Systems; Elementary Row operations; Row Reduced Echelon Form. Rank of Matrix; Finding (i) Solution to Linear System (ii) Inverse of a Nonsingular Matrix by Row reduction method. Generalized inverse of matrices

Unit **II (10 hours)** Vector space; Basis; Dimension; Sub- spaces Linear Transformation Inner Product Orthogonality Orthonormal Basis and Gram-SchmidtsOrthogonalization Process.

Unit III (10 hours) Determinants; Eigen value and Eigenvectors; Caley-Hamilton Theorem. Diagonalization; LU Decomposition; Cholesky Decomposition; Spectral Decomposition; Singular Value Decomposition. Positive Definite Matrices.

Unit IV (15 hours) a) Set operations: Basic of set theory Events: exhaustive mutually exclusive events Concept of probability A-priory and mathematical definition of probability; Laws of probability additive and multiplicative laws of probability.
b) Interpolation and extrapolation

Unit V (15 hours) Data representation and interpretation for nominal Ordinal and Interval scale variables frequency Distribution histogram frequency polygon pie diagram bar and multiple bar charts stack and bar diagram stem-leaf curve

Text Books:

1. R.B. Bapat Linear Algebra & Linear Models (3rd Edition) Hindustan Book Agency

2. A R Rao and P. Bhimashankaram; Linear Algebra Tata McGraw Hill

3. Carl D Meyer. Matrix Analysis and applied linear algebra; SIAM

4. David A Harville. Matrix Algebra from a Statistician's Perspective; Springer

5. Chakravorti S.R. and Giri N.(1997): *Basis Statistics* South Asian Publishers New Delhi

6. Clarke G.M. and Cooke D.(1994): A Basic Course in Statistics Arnold London.

7. **Goon A.M. Gupta M.K. and Dasgupta B.** (1985): *Fundamental of Statistics* Vol. I The World Press Private Ltd. Calcutta.

Reference Books:

1. Graybill FA (1983). Matrices with applications in statistics. John Wiley & Sons

2. Hadley G (1987). Linear Algebra; Narosa Publishing House.

3. Leon SJ (1980). Linear Algebra with applications; Macmillan

4. Goon A.M. Gupta M.K. and Dasgupta B. (1985): Fundamental of Statistics Vol. I The World Press Private Ltd. Calcutta.

5. Gupta S.C. and Kapoor V.K. (1986): Fundamental of Mathematical Statistics Sultan Chand and Sons Publishers

PAPER II(Theory-60 hrs & Practical- 60 hrs)

MBS 102T& P :EPIDEMIOLOGY

Objectives:

To get acquainted the students with structure and function of human body make students familiar with various observational study designs and distinguish between confounding and interaction

Outcome:

It is expected that students will get familiar with various observational study designs and distinguish between confounding and interaction, Introduction to Epidemiology and function of human body

Unit I. Introduction to human Biology (12 hours) Human life cycle. Definition & structure of cell Tissue structure & Type Anatomy and physiology of human organ and organ related diseases Digestive system 2. Respiratory system 3. Cardiovascular System 4. Lymphoid &haemopoiteic system (circulatory) 5. Nervous & the special senses 6. Muscular and Skeletal system 7. Excretory System 8. Urinary system 9. Reproductive System (Female and Male)

Unit II Introduction to Epidemiology (10 hours)

Definition Historical developments: John snows study and Doll and Hill study epidemiological triad Role of epidemiology in health services.

Exposures and outcomes: Types of exposure and outcomes sources of exposures includes questionnaires (self administered& interviewer administered) records biological and environmental measurements

Measures of occurrence of disease and other health related events

Measures of morbidity – point & period prevalence incidence rate person years age specific incidence rates case fatality rate Odds of a disease & exposure.
Standardization of rates- Concept Direct & indirect methods and introduction to confounding

Unit III: Observational Study Designs (17 hours)
Descriptive Epidemiological Studies: Case report Case series Correlation studies Cross sectional studies- Design analysis merits and demerits of all these studies
Analytical Epidemiological studies – Case control & Cohort
Case Control :Definition & selection of cases and controls measuring exposure Analysis - Odds Ratio (OR) Confidence interval for OR Interpretation of results Advantages & disadvantages of case control studies advantages & disadvantages of population based case control studies over hospital based.
Matched case control studies- selection of controls analysis advantages and disadvantages of matching
Cohort Studies: Choice of study population definition of cohort choice of comparison group measurement of exposure outcomes Analysis -Relative risk (RR) Rate difference confidence interval for RR interpretation of RR.
Methodology analysis merits & demerits of Nested case control studies Case cohort studies and historical cohort studies.
Advantages & disadvantages of prospective historical nested case control studies
Different types of biases in epidemiological studies Association and causality: Hill's criteria - Temporal relationship biological plausibility consistency strength exposure-response relationship specificity reversibility coherence

Unit IV: Dealing with confounding variables and measures of exposure effect (6 hours)
Dealing with confounding variables – Various methods of dealing with confounding matching (advantages and disadvantages) propensity score matching restricted sampling Introduction to stratification Mantel Hansel summary measures - MH Odds ratio & MH risk ratio MH Confidence interval for OR & RR
Interaction- additive and multiplicative
Measures of exposure effect – Relative and absolute measures of exposure effect
Relative measures - Risk ratio rate ratio and odds ratio
Absolute measures – Attributable risk Attributable risk percentage population excess risk

Unit V: Surveillance & Screening (5 hours)
Basic concepts of surveillance and levels of prevention – Primary Secondary & tertiary Screening – Definition and requirements evaluation of screening programs biases Validity Sensitivity specificity positive predictive negative predictive test results likelihood ratio positive & negative ROC analysis.

Text books:
1. Guyton Arthur C. 1991 Textbook of Medical Physiology A Prism Book Pvt. Ltd. Bangalore
2. Horton Casey 1994 Atlas of Anatomy Marshall Cavendish Books London

3. W.Gordon Sears Robert S. Winwood and J.L. Smith 1985 Anatomy and Physiology for Nurses and Students of Human Biology Education Academic and Medicinal Publishing Division of Hodder and Stoughton London.
4. Keele Neil et.al 1991 Samson Wright's Applied Physiology Oxford University Press Delhi.
5. Gordis Leon (1996). Epidemiology Elsevier Philadelphia.
6. Greenland & Rothman Kenneth (2008). Modern epidemiology Wolters Kluwer Health (India) Pvt Ltd New Delhi.

7. Detels Roger & Others (2006). Oxford Text Book of Public Health Oxford University Press Oxford.

Reference Books

1. Last John N & Others (2001). Dictionary of Epidemiology Oxford University Press

2. Dos Santos Silva (1999). Cancer Epidemiology: Principles and Methods IARC WHO.

3. Beaglehole R & Others (2002). Basic Epidemiology WHO Geneva.

4. Knapp Rebecca G & Miller Clinton M (1992). National Medical Series for Independent Study: Clinical Epidemiology and Biostatistics; William &Wilkinsbaltimore.

5. Joseph L Fleiss (1981).Statistical methods for rates and proportions John Wiley & Sons New York.

6. Park K (2009). Park's Text Book of Preventive and Social Medicine BanarsidasBhanotJabalpur .

7. Hennekens C H &Buring JE (1987). Epidemiology in Medicine Little Brown & Co Boston

8. Breslow & Day (1980). Statistical Methods in Cancer Research Vol. 1 : The Analysis of Case-Control Studies WHO.

9. SchlesselmanJJ . Case-Control studies: Design conduct and analysis.

10. Altman Douglas G (2000). Practical Statistics for Medical Research Chapman & Hall London.
11. WassertheilSmollerSylvi (2004). Biostatistics and Epidemiology: A Primer for Health and Biomedical Professionals Springer Verlag New York .

PAPER III(Theory-60 hrs & Practical- 60 hrs)

MBS 103T& P :HEALTH ECONOMICS

Objectives:

a. To acquaint the students with basic concepts theories and models in health economics and how to apply the economic tools in analyzing the structure and performance of health care sector.
b. To provide an understanding on the functioning of health care markets and health care industry.

c. To orient and encourage the students to understand main economics of health and micro financing of health care.

(Teaching Methods: Class room lectures group exercises seminars and case studies)

Outcome:

It is expected that students will be familiar with basic concepts theories and models in health economics , its application and tool in analyzing performance of health care sector. like health care markets and health care industry. Student will know economics of health and micro financing of health care.

Unit I. Basic concepts in health economics-relationship between economics economic development and economic aspects of health care- demand and supply in health care health care market failure and public goods

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Unit II Production function laws of production in health care externalities in health care markets resource allocation in health care- both in private and public sector.

Unit III Supply and demand for health care personnel hospitals technology. The trade-offs between quality and quantity- demand for health care services.

Unit IV Health output and input indicators- and their correlation with the level of economic development and with public expenditure on health.

Unit V. Application of cost-benefit analysis and cost-effectiveness - the role of health in economic development- value of output lost due to number of sick days- a review of per capita private and public expenditure on health. Cost concept- short term and long -term costs economies of scale various types of economic evaluation used in health care consumer impact assessment.

Unit VI Measuring health outcomes-human life and quality adjusted years of life cost-utility analysis Quality adjusted life years(QALYs) and Health year equivalents (HYEs).Economics of prevention and public health understand the principles of economic evaluation as applied to health care quality of life and statistics in health economic evaluation(including QALY and DALY).

Unit VII Efficiency and equity in health: health care and welfare state private versus public health care public-private partnerships in health care equity in healthcare delivery efficiency and effectiveness in health care case studies.

Unit VIII Health care financing- national health accounting sources and use of funds health budgeting interrelationship between epidemiological transition and health expenditure sources of health care spending.

Unit IX Health insurance- private health insurance regulation of health insurance government as health insurer in India recent developments in developed and developing countries Case studies - RSBY Aarogyasree etc.

Unit X Health sector reforms- International and Indian experiences regulation of health sector including pharmaceutical industry access to health care with quality health care utilization.

Text Books:

1. Banerjee D. (1982) Poverty class and Health Culture in India Vol. 1 ParchiPrakashan New Delhi.
2. Indian Council of Social Science Research and Indian Council of Medical Research (1981) Health for All by 2000 A. D. ICSSR Delhi.
3. Madan T.N. (1969)" Who Chooses Modern Medicine and Why" Economic and Political Weekly pp. 1475-84.
4. Feldstein M.S. (1977) Economic analysis of Health Service Efficiency North-Holland Amsterdam.
5. Cutler and Zeckhauser (1999) The Anatomy of Health Insurance NBER Working Paper # 7176.
6. Levy and Deleire (2002) What do People Buy When They Don't Buy Health Insurance? Working Paper Harris School University of Chicago.
7. Schoen and DesRoches (2000) "Uninsured and Unstably Insured: The Importance of Continuous Insurance Coverage" Heath Service Research 35 (1 Part II): 187-206.
8. Manning *et al*. (1987) "Health Insurance and the Demand for Medical Care: Evidence from a Randomized Experiment" American Economic Review 77(3): 251-277.
9. Grossman (1972) "On the Concept of Health Capital and the Demand for Health" Journal of Political Economy 80(2): 223-255.
10. Philipson (1999) " Economic Epidemiology and Infectious Diseases" NBER Working Paper # 7037.
11. Cuyler Anthony J. and Joseph P. Newhouse (2000) Handbook of Health Economics Volumes 1A and 1B North- Holland Elsevier Science.
12. Folland Sherman Allen C. Goodman and MironSanto(2004) The Economics of Health and Health Care Prentice Hall.
13. Wagstaff Adam (1986). "The Demand for Health: Theory and Applications" Journal of Epidemiology and Community Health 40(1) 1-11.
14. Deaton Angus. (2003)."Heath Inequality and Economic Development" Journal of Economic Literature 41(1) 113-158.
15. Bloom David David Canning and JaypeeSevilla. (2001). The Effect of Health on Economic Growth: Theory and Evidence NBER Working paper 8587.
16. Phelps Charles E.(1997) Health Economics Addison- Wesley Educational Publishers Inc. Reading Mass.
17. Govt. of India (2005) Report of the National Commission on Macroeconomics and Health Ministry of Health and Family Welfare New Delhi.
18. Rexford E. Sntrre and Stephen P. Neun (2007) Health Economics: Theories Insights and Industry Studies Thompson South – Western 3rd Edition (614 San/Hea 073226).
19. Zweifel and Breyer(1997) Health Economics Oxford University Press.
20. Drummond MF Sculpher MJ Torrence GW O'Brien B Stoddart GL eds.(2005) Methods for economic Evaluation of Health Care Programme Oxford University Press.

21. Reddy K.S. et.al (2011)" Towards achievement of universal health care in India by 2020 : A Call of Action" www.thelancet.com.
22. Peters et.al (2002) Better Health System for India's poor: Findings Analysis and Options: The World Bank New Delhi.
23. Jack William (1999). Principles of Health Economics for Developing CountriesThe World Bank Washington DC.

PAPER IV(Theory-60 hrs & Practical- 60 hrs)

MBS 104T& P : DEMOGRAPHY

Objectives:

To introduce students the basic concepts of demography. To impart skills in the basic measures of population growth fertility mortality migration and urbanization. To understand socio-economic factors influencing fertility mortality and migration.

Outcome:

It is expected that students will be able to understand the basic concepts of demography. Get skilled in the basic measures of population growth fertility mortality migration and urbanization, understand socio-economic factors influencing fertility mortality and migration

1. **Sources of Demographic/PopulationData**
   1.1 Population census; Vital registration National Sample Survey (NSS) Sample Registration System (SRS) and Demographic Health Surveys (DHS) and National Fertility and Health Survey (NFHS) (4-rounds).

2. **Basic Concepts and Measures**
   2.1 Demography Population Studies and their Linkages with Health Science
   2.2 Basic Measures of Population Change (Rates Ratios & Proportions)
   2.3 The Balancing Equation of Population Change
   2.4 The Lexis Diagrams and Understanding of Period and Cohorts Rates
   2.5 The Concept of Cohort and Person-years
   2.6 Probabilities of Occurrence of Events

3. **Age-specific Rates and Probabilities**
   3.1 Period Age-specific Rates
   3.2 Standardization of Rates (Direct Standardization and Indirect Standardization)
   3.3 Decomposition of Difference between Rates or Proportions
   3.4 Age-specific Probabilities
   3.5 Probabilities of Death Based on Mortality Experience of a Single Calendar Year

4. **The Life Table and Single Decrement Process**

   4.1 Cohort and Period Life
   4.2 Steps of Construction of Cohort and Period Life Table
   4.3 Interpretation of Life Table Functions
   4.4 Applications of Life Tables
   4.5 Model Life Tables

5. **Measures of Fertility Reproduction and Nuptiality**

   5.1 Measures of Period Fertility Rates
   5.2 Measures of Cohort Fertility Rates
   5.3 Gross Reproduction Rate (GRR)
   5.4 Net Reproduction Rate (NRR)
   5.5 Measures of Nuptiality [Mean Age (from direct data on age at marriage) &Singulate Mean Age at Marriage (Estimated using indirect method from Census data on marital status by age)
   5.6 Concept of Marriage Squeeze and Double Marriage Squeeze

6. **Measures of Mortality**

   6.1 Crude Death Rate (CDR) Age-specific death Rate (ASDR)
   6.2 Infant and Child Mortality Rate (IMR U5MR)
   6.3 Neonatal Pre and post Natal Rates
   6.4 Measures of Pregnancy Wastage

7. **Dynamics of Age-sex and Ageing**

   7.1 Demographic Transition and its Effects on Age-sex Structure
   7.2 Factors Affecting Sex Ratio of a Population
   7.3 Measures of Ageing (Index of Ageing; Young Dependency Ratio; Old Age Dependency Ratio; Total Dependency Ratio)

8. **Population Estimates and Projection**

   8.1 Intercensal Estimates Post-censal Estimates Projections and Forecasts
   8.2 Mathematical Methods of Population Projection
   8.3 The Cohort Component Method
   8.4 The Projection Matrix and its Analysis
   8.5 Accuracy of Projections

9. **The Stable and Stationary Population Models**

   9.1 Stable Stationary and Non-Stable Populations
   9.2 Lotka's Stable Population Model
   9.3 The Relationship between Intrinsic Growth Rate and the Net Reproduction Rate (NRR)
   9.4 The Effects of Change in Fertility and Mortality on Age Structure Growth Rates Birth Rates and Death Rates

Text Books

1. Samuel H. Preston Patrick Henveline and Michel Guillot (2001) ***Demography: Measuring and Modeling*** Blackwell Publisher.

2. Nathan Keyfitz (1968) ***Introduction to the Mathematics of Population Addison – Wesley Publishing Company*** Reading Massachusettes

3. Jacob S. Siegel and David a. Swanson (2004): ***The Methods and Materials of Demography*** Second Edition Chapters 1 2 3 7 910 Elsevier Science USA.

4. Asha A. Bhende and Tara Kanitkar(2003) ***Principles of Population Studies Sixteenth*** Revised Edition Himalaya Publishing House Mumbai.

5. John R. Weeks (2005) ***Population: An Introduction to Concepts and Issues***Nineth Edition Wadsworth Publishing Company Belmont California

6. Pathak K.B.andF.Ram(1998): *Techniques of Demographic Analysis2nd Ed* Himalaya Publishing house Bombay(Chapters 2 & 3).

7. United Nations (1974): *Methods of Measuring Internal Migration* Manual VI UN New York.

8. United Nations (2004): *World Urbanization Prospects The 2003 Revision* New York.

PAPER V(Theory-60 hrs)

MBS 105T:HEALTH CARE SYSTEM AND POLICIES /HEALTH SURVEYS

Objectives:

To equip students with various components of the health care systems in Indiaand abroad. To impart the interrelationships among the system's components /structure/ functions. Acquire the ability to apply this knowledge and understanding to important health issues and problems. To introduce students to a variety of perspectives substantive areas and methodological approaches to health services and policy research. To familiarize the students with national and international health policies and programmes.

Objectives:

The students will understand the interrelationships among the system's components /structure/ functions.Students will get familiar with national and international health policies and programs. Students are expected acquire the knowledge for a variety of perspectives substantive areas and methodological approaches to health services and policy research.

(Theory lectures seminar group exercise visit to health care facilities evaluation of a health project/ programme each).

Unit I: Identify the structure components and characteristics of global health care system. Understanding the needs and goals for various policies related to public health policy environment frameworks for policy analysis. Basic models and functions of health services health care systems international experience.

Unit II: Health infrastructure and health delivery system in India- public private NGOs Indigenous health systems. Public health system- A re-appraisal and SWOT analysis a critique on the health delivery system- problems related to structural functional and management of public health care services. National health programmes- Public health preparedness.

Unit III: Health care system- stakeholders in health care system human capital and health role of government in providing health care improving access to health care with quality.

Health care legislations in India: Legal aspect of health care MTP Act biomedical waste Rules COPRA Act PNDT Act Transplantation of human organs Actetc.

Principles of planning and management of health programmes- monitoring and evaluation- quality assurance- health impact assessment- five year plans.

Unit IV: Heath services- Community needs assessment Decentralization of health facilities. Sustainability of public health intervention- Concept and mechanism of sustainability models and examples of sustainability community ownership Public-private mix.

Unit XII: Introduction to health services and research policies - Perspectives- methodological approach. Major public health problems – A critical review and analysis identification of major areas of public health requiring interventions ongoing public health interventions in India. Health system reforms and their impact

Text Books

1. Lassey M Lassey W and Jinks M. (1997). Health Care Systems around the World: Characteristics Issues and Reforms. Prentice-Hall Inc.
2. GraigLaurene A. (1999) Health of Nations: An International Perspective on US Healthcare Reform. 3rd Edition Congressional Quarterly Inc.
3. Bodenheimer Thomas S. Kevin Grumbach. *Understanding Health Policy*
4. Fort Meredith Mary Anne Mercer and Oscar Gish (Editors). *Sickness and Wealth: The Corporate Assault on Global Health*
5. Govt. of India (2002)-National Health Policy-2002 Ministry of Health and Family Welfare New Delhi.
6. Govt. of India (2005) Report of the National Commission on Macroeconomics and Health Ministry of Health and Family Welfare New Delhi.
7. Peters et.al (2002) Better Health System for India's poor: Findings Analysis and Options: The World bank New Delhi
8. Reddy K.S. et.al (2011)" Towards achievement of universal health care in India by 2020 : A Call of Action" www.thelancet.com
9. Banerjee D. (1982) Poverty class and Health Culture in India Vol. 1 ParchiPrakashan New Delhi.

10. Indian Council of Social Science Research and Indian Council of Medical Research (1981) Health for All by 2000 A. D. ICSSR Delhi.
11. Madan T.N. (1969) "Who Chooses Modern Medicine and Why" Economic and Political Weekly pp. 1475-84.

SEMESTER – II

PAPER VI(Theory-60 hrs & Practical- 60 hrs)

MBS-106 T & P :RESEARCH METHODOLOGY- I

Objectives: Thiscourse is to impart student's knowledge and skills on the principals and methods of social research to be used in epidemiological analysis of various disease, health and injuries.

Outcome: The purpose is to equip students with the skill to prepare a scientific research proposal with application of various bio statistical techniques and skills learnt during the course and also to conduct social science research with the help of hospital data.

1. Scientific Methods of Research Definition of Research, Assumptions, Operations and Aims of Scientific Research. The Research Process: conceptual, Empirical and Analytical Phases of Research Essentials Criterions of Scientific methods.
2. Research Designs Observational Studies: Descriptive, explanatory, and exploratory, Experimental Studies: Pre-test design, post-test design, Follow-up or longitudinal design, threats to internal validity Cohort Studies Case Control Studies Cross sectional studies Monitoring and evaluative studies Action research/Intervention studies, Panel Studies.

3. Measurement Reliability and validity of measurement Face, construct, concurrent, and predictive validity Inter-coder reliability and stability, Non random and random errors, Reliability and validity of screening and diagnostic tests, Concept of Golden Test, Specificity and Sensitivity Predictive power of positive and negative test ROC Curve and its interpretation Scaling and composite indices, Attitude Scales: Point scales, ranking scales, rating scales, limitations of attitude scales, Types of Scales: Bogardus, Guttman, Likert, Semantic, Thurstone scale. Use of standards in measurements Gold standards for measuring biomarkers field settings

4. Writing research proposal and report Purpose of a proposal/report Content of proposal/report Critical review of research report and journal article Introductory section, methodology adopted, Development of research tools Protocol preparation Analysis and inferences, Summary, conclusions and recommendations. References/Bibliography, Appendices, Footnotes. 5. Research Ethics, History of ethical guidelines and general principles Informed consent and human subject protection ICMR ethical guidelines for biomedical research on human participants.

Text Books: 1. Bernard, H. Russell, (1995): Research Methods in Anthropology: Qualitative and Quantitative Approaches, Altamira Press, Walnut Creek. 2. Goode W J and Hatt P K. 1952. Methods in Social Research. McGraw Hills, New York.3. Mukherji, P.N., (1999): Methodologies in Social Science, Sage Publications, New Delhi. 4. Royce A. Singleton and Bruce C. Straits, (1999): Approaches to Social

Research, Oxford, Oxford University Press. 5. Young P V. 1994. Scientific Social Surveys and Research. Prentice-Hall, New York (4th Edition).

PAPER VII (Theory-60 hrs & Practical- 60 hrs)

MBS 107T& P:SAMPLING TECHNIQUES IN HEALTH

Objectives: To teach the student basics of sampling types of sampling sample size estimation and to provide concepts of design weight sampling and non-sampling errors.

Outcome: Students will be able to utilize fundamentals and use of the sampling Techniques in biostatistics ; like student will be able to decide about research design, sampling methodology, calculation of sample size for health related studies

Unit I. (15 hours) Concept of population and sample need for sampling sample survey verses census elementary units sampling units assumptions of sampling from finite population sampling frame selection and inclusion probabilities probability and non-probability sampling concept of sampling mechanism and sampling design.

Unit II.(15 hours) Simple random sampling with and without replacement concept of unequal probability sampling with and without replacement. Stratified random sampling sample allocation methods gain due to stratification determination of strata boundaries number of strata allocations for multiple characteristics.

Unit III(15 hours) Concept of systematic sampling comparison with simple random sampling variance estimation comparison with stratified random sampling systematic sampling selection procedure for fractional interval circular systematic sampling. Use of auxiliary information ratio and regression methods of estimation under simple random sampling bias mean square error and ratio and regression estimators in stratified random sampling.

Unit IV(15hours) Simple random cluster sampling for equal size and unequal size clusters gain in efficiency of cluster sampling concept of multi stage sampling two stage equal probability sampling at both stages comparisons with unistage unit sampling and cluster samplings components of variance of two stage sampling and estimation cost function and sample size determination. Sampling weight concept and computation sampling and sampling errors.

Text Books

1. Cochran W.G. : Sampling Technique Third edition. Wiley Eastern.
2. Des Raj and Chandok: Sampling Design. Tata McGraw Hill.

3. Sukhatme et al. : Sampling Theory of Surveys with Applications. Indian Society of Agricultural Statistics New Delhi.
4. Murthy M.N.: Sampling Theory and Methods. Statistical Publishing Society Calcutta.

PAPER VIII(Theory-60 hrs & Practical- 60 hrs)

MBS 108T& P : ESTIMATION AND TESTING OF HYPOTHESIS

Objectives: To provide foundation of statistical estimation procedures and their properties and to introduce concept of testing of hypothesis.

Outcome: Students will be able to utilize fundamentals and use of theParametric statistical methods in biostatistics ; Analysis and Interpretation of results using various parametric methods; Strength of association using contingency tables.

Unit I (30 hours) Estimation:

1. Concept of population random sample parameter statistic estimator sampling distribution of random sample joint and marginal distribution of functions of random variables.
2. Methods for finding estimators-method of moments maximum likelihood method of minimum Chi-square properties of estimators: mean square error (MSE) minimum MSE unbiasedness and minimum variance unbiased estimator (MVUE) Cramer-Rao lower bound of variance relative efficiency of estimator.
4. Concept of confidence interval confidence interval for- mean difference in means variance methods of finding confidence interval- pivotal quantity and statistical methods.

Unit II (30 hours) Testing of Hypothesis

1. Statistical hypotheses- simple and composite statistical tests critical region Type I and Type II errors size and power of test.
2. Definition of most powerful (MP) and uniformly most powerful (UMP) tests power functions of tests with illustration Neyman- Pearson lemma and its application in hypotheses testing regarding binomial Poisson normal and exponential distributions.
3. One sample and two sample test for mean test for a binomial proportion; Score test versus Wald; Exact binomial test; Tests for differences in binomial proportions; Intervals for differences in binomial proportions.
4. Introduce Fisher's exact test; Chi-squared test for equivalence of two binomial proportions; Chi-squared tests for independence; Chi-squared tests for goodness of fit; Hypothesis tests of marginal homogeneity; Estimating marginal risk difference; Estimating marginal odds ratios; Distinction between conditional and marginal odds ratios.

Text Books

1. Hogg R.V and Craig A.T.: Introduction to Mathematical Statistics Fourth edition. Collier Macmillan Publisher.
2. Mood A.M. Graybill F.A. and Boes D.C. : Introduction to the Theory of Statistics Third edition. McGraw Hill.
3. Goon A.M. Gupta M.K. and Dasgupta B. : An Outline of Statistical Theory Vol 2. The World Press Publishers Pvt. Ltd.Calcutta.
4. Roa C.R.: Linear Statistical Inference and Applications Revised edition. Wiley Eastern.

PAPER VIII(Theory-60 hrs & Practical- 60 hrs)

MBS 109 T& P: APPLIED MULTIVARIATE ANALYSIS

Objectives:

The course is intended to give an overview of statistical models commonly used in causal analyses ofnon-experimental data in the social and bio-medical sciences. The goal is to impart an intuitiveunderstanding and working knowledge of these models. The strategy would be to simplify the treatmentof statistical inference and to focus primarily on how to specify and interpret models in the context oftesting causal relationships. All the problems/exercises will be based on real data in the social/biosciences and will be solved through the widely used statistical computing package, namely, SPSS, SAS Emphasis will be given on interpreting and understanding of the results obtained from thesestatistical models/computer outputs. Students of statistics/mathematics wishing to upgrade theirmethodological skills will find this course very useful. To know the background theory of various commonly used multivariate techniques situations of applications of each methods as well as analysis interpretation & reporting of results.

Outcome: Student will be able to develop statistical models with the understating of background theory of various commonly used multivariate techniques situations of applications of each methods as well as analysis interpretation & reporting of results

Unit I: Bivariate Linear Regression: Terminology, fitting least square line, Least Square Line as Causal Model, The Bivariate Linear Regression, Statistical inference, Hypothesis testing, confidence interval, outliers, test of goodness of fit, SE of estimate, coefficient of determination, correlation coefficient

Unit II: Multiple Regression: The problem of bias in Bivariate Linear RegressionMultiple regression with two predictors, Multiple regression with three or more predictors, Dummy variable to represent categorical Variables, Multicollinearity, Interaction, Nonlinearities, Goodness of Fit, Statistical Inference.

Unit III : Multiple Classification Analysis (MCA): Basic MCA Table, adjusted and unadjusted values, The MCA Table in Deviation form, MCA with Interactions, MCA with additional Quantitative Control Values, Presenting the results graphically as well as in ordinary Multiple Regression in an MCA format

Unit IV Path Analysis: Path Diagrams and Path Coefficient, Path Models with one exogenous variable, Path Models with control Variables, Saturated and Unsaturated Path Models, Path Analysis with standardized variables, Path Models with Interactions and Nonlinearities

Unit V: The Logistic Regression Model, The Logistic Function, The multivariate Logistic Function, Odds Ratio, The Logit of P, Logit Regression Coefficient as measures of effect on Logit P, The Effect of the predictor variables on the Risk P itself, Interaction, Nonlinearities. Statistical Inference, Goodness of Fit, MCA Adapted Logit Regression Model, Fitting of Logit Regression Model and its Limitation

Unit V: The Multinomial Logistic Regression Model: From Logit to Multinomial Logit, Multinomial Logit Model with Interaction and nonlinearities, A more general formulation of Multinomial Logit Model, Reconceptualizing contraceptive Method Choice as a Two step process

Unit VI : Discriminant Analysis

The Discriminant Function for Two Groups Relationship between Two-Group Discriminant Analysis and Multiple Regression Discriminant Analysis for Several Groups Discriminant Functions Standardized Discriminant Functions Tests of Significance Tests for the Two-Group Case Tests for the Several-Group Case Interpretation of Discriminant functions Standardized Coefficients Partial *F*-Values Correlations between Variables and Discriminant Functions Stepwise Selection of Variables classification analysis, estimating misclassification rate improved estimates of error rates – partitioning the sample and Holdout method

Unit VII: Principal Component Analysis&Factor Analysis

Geometric and Algebraic Bases of Principal Components Principal Components and Perpendicular Regression Plotting of Principal Components Principal Components from the Correlation Matrix Deciding How Many Components to Retain Information in the Last Few Principal Components Interpretation of Principal Components

Orthogonal Factor Model Definition and Assumptions Non uniqueness of Factor Loadings Estimation of Loadings and Communalities Principal Component Method
Principal Factor Method & other methods (introduction) Choosing the Number of Factors *m* Rotation

Text book

1. Statistical Models for Causal Analysis, Robert D. Retherford, Minja Kim Choe, ISBN: 978-0-471-55802-6,, November 1993, Wiley - Interscience
2. Alvin C Rencher. Methods of multivariate analysis. 2nd ed. USA: Wiley interscience; 2002.
3. TenkoRaykov& George A Marcoulides. An introduction to applied multivariate analysis. Taylor & Francis Group USA
4. Anderson T W. An introduction to multivariate statistical analysis. 1st ed. India: Wiley Eastern Private Limited; 1974.
5. Johnson R A& Wichern D W Applied multivariate statistical analysis. Person education.

MBS 110 SEMINAR:

For seminar/presentation there will be a maximum of 50 marks. Seminar / presentations will be evaluated by the teachers of the dept. The marks obtained in the same will be kept confidentially with the Head of the Dept. and will be submitted along with the internal assessment marks.

SEMESTER –III

PAPER X (Theory-60 hrs & Practical- 60 hrs)

MBS 111 T& P :Biostatistics and Research Methodology II

Objectives: The main objective of this course is to prepare students to design, carry out, report, and present a research projects based on the fieldwork carried out by them. Students learn how to collect data using methods different methods in a real population. The course equips students with conceptual understandings of current academic debates regarding methods of data collection with practical skills to put those methods into practice. Students submit a written report and present their practical work for assessment.

Outcome: The course equips students with conceptual understandings of current academic debates regarding methods of data collection with practical skills to put those methods into Students submit a written report and present their practical work for assessment,practice.

1**. Methods of Data Collection** – Quantitative and qualitative

Quantitative Methods: Questionnaire (mail method, interviews through telephone, internet and computers), interview schedule (face-to-face interviews or personal interviews). Questionnaire/interview schedule design and construction: Principles of constructing a questionnaire/interview schedule, Types of questions, framing of questions, sequencing of sections and questions and Interview techniques

Qualitative Method: Walk through and observation (participatory and non-participatory),

Social mapping, key informant interview, In-depth interviews, Focus group discussion, content analysis, free listing, pile sorting, mechanical devices (camera, tape recorder)

2. Data Collection - Field work

3. Data processing and analysis, research report

4. Presentation of research report

Biostatistics

1 Measuring the occurrence of disease, Measures of morbidity - prevalence and incidence rate, association between prevalence and incidence, uses of prevalence and incidence, problems with incidence and prevalence measurements; Clinical agreement: kappa statistics, Mantel-Haenszel test; intra-class correlation; Surveillance

2 Assessing the validity and reliability of diagnostic and screening test: Validity of screening test – sensitivity, specificity, positive predictive value and negative predictive value; Reliability; Relationship between validity and reliability; ROC curve and its applications; Overall accuracy

3 Issues in epidemiology: Association; causation; causal inference; Errors and bias; Confounding; Controlling confounding; Measurement of interactions; Generalizability Estimating risk: Estimating association – absolute risk, relative risk, odds ratio;

4. Estimating potential for prevention – attributable risk; comparison of relative risk and attributable risk; Odds ratios for retrospective studies; Odds ratios approximating the prospective RR; Exact inference for odds ratio analysis of matched case-control data

Statistical process control: special and common causes of variation, Shewhart, CUSUM and EWMA charts

Text Books:Research Methodology

1. Bernard, H. Russell, (1995): Research Methods in Anthropology: Qualitative and Quantitative Approaches, Altamira Press, Walnut Creek.
2. Goode W J and Hatt P K. 1952. Methods in Social Research. McGraw Hills, New York.
3. Pullum W. 2006. An Assessment of Age and Data Reporting in the DHS Surveys, 1985-2003. DHS Methodological Report No. 5. Calverton, Maryland, Marco International Inc.
4. Royce A. Singleton and Bruce C. Straits, (1999): Approaches to Social Research, Oxford, Oxford University Press.
5. Young P V. 1994. Scientific Social Surveys and Research. Prentice-Hall, New York (4th Edition).
6. Altman D G: Practical Statistics for Medical Research, London: Chapman and Hall, 2006.
7. Rosner B: Fundamentals of Biostatistics, ed. 6, 2006.
8. Dunn G, Everitt B: Clinical Biostatistics: An Introduction to Evidence-based Medicine. Edward Arnold, 1995.

PAPER XI(Theory-60 hrs & Practical- 60 hrs)

MBS 112 T& P: SURVIVAL ANALYSIS

Objectives: The main objective of this course is to equip students with the basic concepts and methods employed in survival analysis. At the same time, the course aims to equip the student with recent advances in the field of Survival Analysis. The idea is to emphasize concepts over details, with recent applications in public health. After going through this course, the student should be capable enough to take up responsibility and actively participate in academics, government organizations, pharmaceutical companies, health organizations, etc.

Outcome: After going through this course, the student should be capable enough to take up responsibility and actively participate in academics, government organizations, pharmaceutical companies, health organizations, etc.

Unit I : Introduction to survival analysis; motivating the need; concepts and definitions; concept of censoring and type of censoring.

Unit II. Survival function, probability density function, hazard function; relationship between the three types of function; survival curve; estimating medium survival time;estimation of these function in the absence and presence of censoring; application ofthese functions in survival analysis.

Unit III. Survival distributions- Weibull distribution; exponential distribution; lognormal distribution; gamma distribution.

Unit IV. Survival Model: Introduction, Acturial Life Table, Product Limit Life Table, Life Table in Continuous form, Nonparametric methods of estimating survival function-introduction; Kaplan-Meierestimates; life table estimates; clinical life tables; life table vs. Kaplan-Meier estimates; The Mantel-Haenszel test.

Unit V Estimating survival rates using large scale data like DHS, NFHS, DLHS, etc. Comparing survival curves- Generalized Wilconxon (Breslow, Gehan); logrank test

Unit VI. Regression methods for survival analysis- Proportional Hazard Models, Calculation of Life Tables from the Proportional Hazard Models, Statistical Inference and Goodness of Fit, MCA adapted to Proportional Hazard Model, in Epidemiology and Public Health.

Unit VII. Hazard Model with Time dependent, Time Dependent Predictor variables and Time Dependent Coefficient.

Text Books

1. Altman D G: Practical Statistics for Medical Research, London: Chapman and Hall,2006
2. Lee E T: Statistical Methods for survival Data Analysis, ed. 2. New York, John Wiley & Sons.
3. Armitage P, Berry G: Statistical Methods in Medical Research, ed.4, Wiley Blackwell, 2001.
4. Choe MK, Retherford RD: Statistical Models for Causal Analysis, Wiley- Interscience, 1993.

PAPER XII(Theory-60 hrs & Practical- 60 hrs)

MBS 113 T& P: DESIGN OF EXPERIMENTS AND CLINICAL TRIAL

Objectives: To train the students in design and conduct of clinical trials so that students are capable to identify the experimental design which is to be used;
Understand the essential design issues of randomized clinical trials and apply statistical principles concepts and methods for analysis of data in a clinical trial

Outcome: Student is expected to understand the essential design issues of randomized clinical trials and apply statistical principles concepts and methods for analysis of data in a clinical trial.

Unit I (20 hours) Design of experiments

General introduction of the design of experiments. Completely Randomised designs Randomised complete block designs Factorial designs Latin square designs and Repeated measures design

Unit II (40 hours) Clinical Trials

Introduction to clinical trials Historical development. Why clinical trials needed? Problems in the timing of a clinical trials. Phases of a clinical trial –Phase 1 2 3 and 4.

Planning and designing clinical trial :

Selection of questions- Primary question secondary questions adverse effects ancillary questions sub studies. Intervention. Study population-Definition Baseline assessment and Recruitment. Ethics in clinical trials.

Study protocol and Statistical Analysis Plan (SAP)

Basic trial designs:

Parallel designs- Randomised control studies Nonrandomised concurrent controlled studies Historical controls designs. Cross over designs including n – of -1 designs. Group allocation designs. Two stage designs.

Allocation to treatment group and outcome of clinical trial:

Fixed allocation randomisation- simple block stratified.

Adaptive randomization- Baseline adaptive and response adaptive randomizations.

Blinding: Unblinded trials single blind trials double blind trials triple blind trials;

Assessment of blinding

Surrogate response variables and their desirable properties and usefulness in clinical trials.

Sample size data collection and analysis

Sample size determination for a clinical trial (for qualitative and quantitative outcomes), Data collection and quality control Assessing and reporting adverse events Issues in data analysis: Which participants should be analysed?- Ineligibility. Non adherence poor quality or missing data competing events.

Covariate adjustments- Surrogate as covariates baseline characteristics as covariates Multiple test and Subgroup analysis including adjustments of significance level and p values. Intention to treat analysis & per protocol analysis Comparison of multiple variables.

Closeout procedure for clinical trial
Termination procedures Early stopping due to intervention activity/toxicity post study follow-up data cleanup and verification storage of study material

Other variants of Clinical Trials
Multi centre and multi site trials and cluster randomized trials**.** BA & pharmacokinetic studies. Bioequivalence trials- Introduction to superiority non-inferiority equivalence trials.

Text books:

1. Cochrane WG Cox GM. Experimental designs. 2nd edition. John Wiley & Sons. 1992.

2. Friedman IM Furberg CD Demets DL. Fundamentals of clinical trials. 4th edition. Springer. 2010.

References:

1. Meinert CL. Clinical trials: Design conduct and analysis. 2nd edition. New York: Oxford University Press. 2012.

2. Pocock S. Clinical trials – A practical approach. John Wiley & Sons. 2010.

3. Cochrane WG Cox GM. Experimental designs. 2nd edition. John Wiley & Sons. 1992.

4. Daniel WW. Biostatistics: A foundation for analysis in the health sciences. 10th edition. John Wiley & Sons. 2013.

5. Campbell DT Shadish WR Cook TD. Experimental and quasi experimental designs for generalized causal inference. New York: Houghton Mifflin. 2002

CORE ELECTIVE COURSES:**(Theory-60 hrs & Practical- 60 hrs)**

MBS 114 T& P: NON - PARAMETRIC TESTS

Objectives: To provide the students Fundamentals and use of the Non parametric statistical methods in biostatistics Analysis and Interpretation of results using various Non Parametric methods and strength of association using contingency tables

Outcome: Expected from student the concept, fundamentals and use of the Non parametric statistical methods in biostatistics Analysis and Interpretation of results using various software packages

Unit I: Introduction & Analysis of contingency tables **(20 hours)**
Definition of Non parametric statistics-data & variable type for non parametric analysis. Robustness and distribution free advantages and disadvantages of non parametric methods. Introduction to boots trapping bootstrap standard error and confidence interval Jackknife

method. Analysis of 2x2 tables-assumptions and limitations chi-square test and fisher exact test extension to r x c tables.

Unit II: One sample methods & Test of goodness of fit **(20 hours)**
A non parametric test for hypothesis and confidence interval for median – binomial test. Inferences for percentiles Tolerance limits sign test. Chi-square test for goodness of fit Kolmogorov smirnov one sample statistic test for lilleifors test for normality visual analysis of goodness of fit Sample size for chi-square test

Unit III: Two independent sample comparison & its extension **(20 hours)**
Two sample permutation test sign test Willcoxon rank sum test Mann Whitney U test Equivalence of Mann Whitney U test and Willcoxon rank sum test selection among Willcoxon rank sum and T test relative efficiency. Test for equality of scale parameters – Siegel Tukey and Ansari-Bradley test. Kruskal Wallis one way ANOVA and multiple comparison The Jonckheere test for ordered alternatives. Levene's test for equality of variance.

Text Books:

1. Gibbons JK Practical Non Parametric Statistics Third edition Wiley publications
2. James J. Higgins Introduction to Non parametric statistics Duxbury advanced series.
3. Sidney Siegel & Castellan Jhon. Non parametric statistics for behavioural sciences second edition McGraw-Hill international editions.

Reference Books:
1. Gibbons &Chakraborthy Non parametric statistical inference CRC press

2. P. Sprent Applied non parametric methods Chapman & Hall

MBS 115T& P :ADVANCED STATISTICAL COMPUTING

Objectives: To provide the students Fundamentals and use of the Advance statistical computing techniques in biostatistics Analysis and Interpretation of results using various statistical methods

Outcome: Expected that basic concepts and use of the advance statistical computing techniques in biostatistics Analysis (say R programming)and Interpretation of results using various statistical methods

Unit I: R Software: Introduction, Types of functions: Data functions, Summary functions, Elementary functions and graphical functions. Commands/Statements in R for descriptive Statistics, representation of Multivariate data.

Unit II Using R Software's: Correlation & Regression analysis: simple and multiple. Tests of significance, Test of significance of large samples, Test of single proportion, Test of significance of difference of proportions.

UnitIIIUsing R Software's: Difference of mean & proportion, Chi-Square test for independence of attributes and Contingency table, t-test, Paired t-test, Test for correlation in sampling from normal population, F-test, testing of two variance of two univariate normal population.
Unit IV Using R Software's: Simulation Studies, random number generation of various probability distributions. Codes for different programmes in R-Software. Estimation of parameters of different probability functions by using R.

Unit V Large scale data management. Data processing architectures, Parallel processing, Distributed processing, Online analytical processing , Multi-query processing

Unit VI 5 Data Sharing and Re-Use Policies. Why data-sharing policies matter? Overview of Scientific Data Sharing, Legal and ethical matter consideration of Research data, Plan for Archiving and Preservation of Data

Text Books

1. S.C. Gupta & V.K. Kapoor (2012), Fundamentals of Mathematical Statistics, Sultan Chand & Sons.
2. Dudewicz, E.J. and Mishra, S.N. (1988): Modern Mathematical Statistics, Willy, Int'l Students edition.
3. R Development Core Team (2011), "R: A language and environment for statistical computing," R Foundation for Statistical Computing, Vienna, Austria
4. The R Development Core Team (2011), "R: A language and environment for statistical computing, Reference Index." Version 2.13.0 (2011-04-13)
5. Fred R McFadden, Jeffery A Hoffer, Mary B. Prescott, (2000): Modern Database Management, Addison Wesley, 5 th edition
6. T. White, Hadoop (2012): The Definitive Guide, O'Reilly, 3rd edition.
7. J. Lin, C. Dyer (2010): Data-Intensive Text Processing with MapReduce, Morgan and Claypool, 1 st edition.
8. E. Redmond, J. R. Wilson (2012): Seven Databases in Seven Weeks: A Guide to Modern Databases and the NoSQL Movement, Pragmatic Bookshelf, 1st edition.

MBS 116 T& P : TIME SERIES ANALYSIS

Objectives: This course is to impart student's knowledge and skills on the Time series Analysis to be used in epidemiological analysis of various disease, health and injuries.

Outcome Student is expected to analyze and interpret Time series data used in epidemiological analysis of various disease, health and injuries.

Unit I Time-Series as discrete parameter stochastic process. Auto covariance functions and their properties.

Unit II Exploratory Time Series Analysis, Tests for trend and seasonality. Exponential and Moving Average Smoothing. Forecasting based on smoothing, adaptive smoothing.

Unit III Detailed study of the stationary processes: (1) moving average (MA) (2) Auto regressive (AR) (3) ARMA and ($) AR integrated MAS (ARIMA) models. Box-Jenkins models. Discussion (without proof) of estimation of mean, auto covariance and autocorrelation functions under large sample theory. Choice of AR and MA periods. Estimation of ARIMA model parameters. Forecasting. Residual analysis and diagnostic checking.

Unit IV Spectral Analysis of weakly stationary processes Periodogram and correlogram analysis. Computations based on Fourier transform. Spectral decomposition of weakly AR process and representation as a one-aided MA process-necessary and sufficient conditions. Implication in prediction problem.(60h)

Text Books

1. Box G.P. and Jenkins G.H. (1976): Time Series Analysis-Forecastingand control. Holden-day, San Fransisco.

2. Anderson T.W(1971): The Statistical Analysis of Time Series. Wiley, N.Y.

3. Kendall M.G. and Stuart A (1966): Advanced Theory of Statistics Vol. 3. Charies Griffin, London.

4. Montgemory, D.d. & Johnson, L.A. (1977): Forecasting and Time Series Analysis. Mc Graw Hill.

5. Kendall, Sir Maurice and Ord, J.K. (1990): Time Series (Third Edition), Edward Arnold. - 30

6. Brockwell, P.J. and Davis, R.A. Time Series: Theory and Methods (second Edition). Springer-Verlag.

MBS 117 T& P: OPERATIONS RESEARCH

Objectives: To teach the student important applications of operations research and to provide concepts,identification of Problem and Solution related to healthcare data .

Outcome: Students will be able to utilize fundamentals and use of the applications of operations research and to provide concepts,identification of Problem student will be able to decide about application of operation researchand its role for health related studies

Unit I Definition and scope of Operational research, Necessity of Operations Research in Industry; phases in Operations Research. LP problems: Simplex method and Extreme point theorems; Revised Simplex Method, Transportation and Assignment Problems with their methods of solution.

Unit II Duality in LPP, Symmetric and asymmetric dual problems, duality theorems, Primal-Dual Relations, Complementary Slackness Theorem and Complementary Slackness conditions, Dual Simplex Method, Sensitivity Analysis.

Unit III Decision Making in the face of competition, two–person, Zero sum games, Games with mixed strategies, existence of solution and uniqueness of value in zero-sum games, finding solutions in 2x2, 2xm and mxn games, Equivalence between game theory and linear programming problem.

Unit IV Sequencing and scheduling problems: 2 machine n-job; 3 machine n-job problems with identical machine sequence for all jobs; 2-job n-machine problem with different routings. Project management; PERT and CPM; Probability of project completion.

Text Books:

1. Taha H.A. (1982) Operational Research: An introduction; Macmillan.
2. Philips D.T., Ravindran A. and Solberg J. Operation Research, Principles and Practice
3. KantiSwarup, P.K. and Singh,M.M.. (1985) Operation Research; Sultan Chand & Sons.

Reference Books

1. Hillier F.S. and Lieberman G.J. (1962) Introduction to Operation Research; HoldenDay.
2. Saaty T.L. (1961) Elements of Queuing Theory with Applications; McGraw Hill.
3. Churchman C.W, Ackoff R.L. and Arnoff E.L. (1957) Introduction to Operations Research
4. R. Panneerselvam(2002): Operations Research: Prentice Hall

MBS 118: DISSERTATION/PROJECT PROPOSAL

****The Dissertation work will begin from 3rd Semester, and will continue through the 4th Semester.**

MBS 119: SEMINAR

For seminar/presentation there will be a maximum of 50marks. Seminar / presentations will be evaluated by the teachers of the dept. The marks obtained in the same will be kept confidentially with the Head of the Dept. and will be submitted along with the internal assessment marks.

SEMESTER – IV

GENERAL ELECTIVE COURSE (60 Hrs.)

GE 001 T: Pursuit of Inner Self Excellence (POISE)THEORY

Objectives:

- To inculcate moral values in students – Self-Discipline , Time Management, Develop attitude of Service with humility, Empathy, Compassion, brotherhood, Respect for teachers, colleagues & society members.
- Develop Effective means of communication & presentation skills in students
- To develop wisdom in students for deciding their career based on their areas of interest and inner skills.
- Introduce techniques for Relaxation, Meditation & Connecting with innerself.
- Rejuvenation Techniques which can be used by students to distress themselves
- To improve performance of students during various assignments, projects, elocutions, events, quiz, interviews.

Outcome:

- Students will become self dependent, more decisive and develop intuitive ability for their study and career related matter.
- Students ability to present their ideas will be developed.
- Enhanced communication skills, public speaking & improved Presentation ability.
- Students will be able to explore their inner potential and inner ability to become a successful researcher or technician & hence become more focused.
- Students will observe significant reduction in stress level.
- With the development of personal attributes like Empathy, Compassion, Service, Love &brotherhood , students will serve the society and industry in better way with teamwork and thus grow professionally.

Unit I: Spiritual Values for human excellence : The value of human integration; Compassion, universal love and brotherhood (Universal Prayer) ; Heart based living ; Silence and its values, Peace and non-violence in thought, word and deed ; Ancient treasure of values - Shatsampatti , Patanjali'sAshtanga Yoga ,Vedic education - The role of the Acharya , values drawn from various cultures and religious practices - Ubuntu, Buddism, etc.; Why spirituality? Concept – significance ; Thought culture

Unit I Ways and Means : Correlation between the values and the subjects ;Different teaching techniques to impart value education; Introduction to Brighter Minds initiative; Principles of Communication; Inspiration from the lives of Masters for spiritual values - Role of the living

Unit III:Integrating spiritual values and life: Relevance of VBSE (Value Based Spiritual Education) in contemporary life ; Significant spiritual values ; Spiritual destiny ; Principles of Self-management; Designing destiny

Unit IV:Experiencing through the heart for self-transformation (Heartfulness Meditation): Who am I? ; Introduction to Relaxation; Why, what and how HFN Meditation?; Journal writing for Self-Observation ; Why, what and how HFN Rejuvenation (Cleaning)? ; Why, what and how HFN connect to Self (Prayer)?; Pursuit of inner self excellence ; Collective Consciousness-concept of egregore effect;

Reference Books:

1. www.pdfdrive.net
2. www.khanacademy.org
3. www.acadeicearths.org
4. www.edx.org
5. www.open2study.com
6. www.academicjournals.org

GE 002 T :BIOETHICS, BIOSAFETY, IPR & TECHNOLOGY TRANSFER

Objectives The students will gain structural knowledge on:

- To list the routes of exposure for a pathogen to a human being
- To demonstrate and assess the proper use of PPE, best practices,biological containment, and be prepared to safely conduct research;
- To identify the role of the Bio-safety Professional inBiomedical Research Laboratories;
- To appreciate the importance of assertion in interpersonal communication and beintroduced to some key assertion strategies;
- To understand the interpersonal nature of giving feedback, receiving criticism and resolving conflicts.
- To establish attentive listening as an assertion strategy

Outcome Students will learn to:

- Effectively manage the health and safety aspects of a biological laboratory.
- Give reliable, professional and informed advice and information to colleagues and managers.
- Help to ensure that their institution complies with relevant legislation, liaise effectively with enforcing authorities and be aware of the penalties for failing to comply
- Build a context of understanding through communication.
- Mediate between other conflicting parties.

- Exhibit de-escalatory behaviors in situations of conflict.
- Demonstrate acknowledgment and validation of the feelings, opinions, andcontributions of others.

Unit 1:Ethics:Benefits of ethics, ELSI of bioscience, recombinant therapeutic products for human health care, genetic modifications and food consumption, release of genetically engineered organisms, applications of human genetic rDNA research, human embryonic stem cell research.

Unit II: Patenting:Patent and Trademark, Biotechnology products and processes, Intellectual property rights, Plant breeders rights, trademarks, industrial designs, copyright bioscience in developing countries. Biosafety and its implementation, Quality control in bioscience.

Unit III: Introduction to quality assurance, accreditation*& SOP writing :*Concept of ISO standards and certification , National regulatory body for accreditation, Quality parameters, GMP & GLP, Standard operating procedures, Application of QA in field of genetics, Data management of clinical and testing laboratory

Unit IV: Funding of bioscience business(Financing alternatives, funding, funding for bioscience/medical health sector in India, Exit strategy, licensing strategies, valuation), support mechanisms for entrepreneurship (Bio-entrepreneurship efforts in India, difficulties in India experienced, organizations supporting bioscience growth, areas of scope, funding agencies in India, policy initiatives). Role of knowledge centers and R&D (knowledge centers like Universities and research institutions, role of technology and up gradation)

GE 003 T Disaster Management and Mitigation Resources (60 Hrs)

Objectives: The course will uplift about: Understand and appreciate the specific contributions of the Red Cross/Red Crescent movement to the practice and conceptual understanding of disaster management and humanitarian response and their significance in the current context; Recognize issues, debates and challenges arising from the nexus between paradigm of development and disasters; Critically evaluate disaster risk reduction and humanitarian response policy and practice from multiple perspectives; Respond to disaster risk reduction initiatives and disasters in an effective, humane and sustainable manner.

Outcome: At the successful completion of course the student will gain: knowledge and understanding of the disaster phenomenon, its different contextual aspects, impacts and public health consequences; Knowledge and understanding of the International Strategy for Disaster Reduction (UN-ISDR) and to increase skills and abilities for implementing the Disaster Risk Reduction (DRR) Strategy; Ensure skills and abilities to analyse potential effects of disasters and of the strategies and methods to deliver public health response to avert these effects.

Unit 1. (8 hours) Introduction: Definition of Disaster, hazard, global and Indian scenario, general perspective, importance of study in human life, Direct and indirect effects of disasters, long term effects of disasters. Introduction to global warming and climate change.

Unit 2. (15 hours) Natural Disaster and Manmade disasters: Natural Disaster: Meaning and nature of natural disaster, Flood, Flash flood, drought, cloud burst, Earthquake, Landslides, Avalanches, Volcanic eruptions, Mudflow, Cyclone, Storm, Storm Surge, climate change, global warming, sea level rise, ozone depletion Manmade Disasters: Chemical, Industrial, Nuclear and Fire Hazards. Role of growing population and subsequent industrialization, urbanization and changing lifestyle of human beings in frequent occurrences of manmade disasters.

Unit 3. (12 hours) Disaster Management, Policy and Administration: Disaster management: meaning, concept, importance, objective of disaster management policy, disaster risks in India, Paradigm shift in disaster management; Policy and administration: Importance and principles of disaster management policies, command and co-ordination of in disaster management, rescue operations-how to start with and how to proceed in due course of time, study of flowchart showing the entire process.

Unit 4. (13 hours) Financing Relief Measures: Ways to raise finance for relief expenditure, role of government agencies and NGO's in this process, Legal aspects related to finance raising as well as overall management of disasters. Various NGO's and the works they have carried out in the past on the occurrence of various disasters, Ways to approach these teams. International relief aid agencies and their role in extreme events.

Unit 5. (1 hours) Preventive and Mitigation Measures: Pre-disaster, during disaster and post-disaster measures in some events in general structural mapping: Risk mapping, assessment and analysis, sea walls and embankments, Bio shield, shelters, early warning and communication Non Structural Mitigation: Community based disaster preparedness, risk transfer and risk financing, capacity development and training, awareness and education, contingency plans. Do's and don'ts in case of disasters and effective implementation of relief aids.

Reference Books:

1. ShailendraK.Singh : Safety & Risk Management, Mittal Publishers
2. J.H.Diwan : Safety, Security & Risk Management,APH
3. Stephen Ayers &Garmvik: Text Book of Critical Care, Holbook and Shoemaker
4. www.pdfdrive.net
5. www.khanacademy.org
6. www.acadeicearths.org
7. www.edx.org
8. www.open2study.com
9. www.academicjournals.org

GE 004 T: HUMAN RIGHTS (60 HRS.)

Objectives:

Students will comprehend on: A branch of public international law, and relevant juridical mechanisms at global as well as regional levels; Human rights as an object of study in history, philosophy and the social sciences, as well as a practical reality in national and international politics. Different forms of promoting and implementing human rights,

domestically as well as on the international level; The role of human rights in contemporary issues relating to terrorism, religion, ethnicity, gender and development; Cholarly values such as transparency, impartiality, clarity, reliance and the importance of sound reasoning and empirical inference.

Outcome:
Student will be able to virtue:identify, contextualize and use information about the human rights situation in a given country; critically appraise source material, including cases from human rights committees and tribunals and reports and summary records from treaty bodies; analyse a country's situation or an international situation in terms of human rights and formulate human rights-based initiatives and policies; Promote human rights through legal as well as non-legal means; Participate in legal, political and other debates involving human rights in a knowledgeable and constructive way

Unit I: Background: Introduction, Meaning, Nature and Scope, Development of Human Rights, Theories of Rights, Types of Rights
Unit II: Human rights at various level Human Rights at Global Level UNO, Human Rights – UDHR 1948 – UN Conventions on Human Rights: International Covenant on civil and Political Rights 1966, International Convent on Economic, Social and Cultural Right, Racial Discrimination -1966 International, Instruments: U.N. Commission for Human Rights, European Convention on Human Rights.
Unit III: Human rights in India : Development of Human Rights in India, Human Rights and the Constitution of India, Protection of Human Rights Act 1993- National Human Rights Commission, State Human Rights Commission, Composition Powers and Functions, National Commission for Minorities, SC/ST and Woman
Unit IV: Human Rights Violations: Human Rights Violations against Women, Human Rights Violations against Children, 35 Human Rights Violations against Minorities SC/ST and Trans-genders, Preventive Measures.
Unit V:Political issues: Political Economic and Health Issues, Poverty, Unemployment, Corruption and Human Rights, Terrorism and Human Rights, Environment and Human Rights, Health and Human Rights

Books

1. JagannathMohanty Teaching of Human sRights New Trends and Innovations Deep & Deep Publications Pvt. Ltd. New Delhi2009
2. Ram Ahuja: Violence Against Women Rawat Publications Jewahar Nager Jaipur.1998.
3. SivagamiParmasivam Human Rights Salem 2008
4. Hingorani R.C.: Human Rights in India: Oxford and IBA New Delhi.

MBS118: DISSERTATION

1. Dissertation/Project work should be carried out as an individual Dissertation and actual bench work.

2. The students will carry independent project work under the supervision of the staff of Department on an advanced topic assigned to him/her. Inhouse projects are encouraged. Students may be allowed to carry out the

project work in other Departmental laboratories /Research institutes /Industries as per the availability of Infrastructure.

3. Co guides from the other institutions may be allowed.

4. The Dissertation/Project work will begin from 3rd Semester, and will continue through the 4th Semester.

5. The Dissertation/Project report (also work book shall be presented at the time of presentation and viva voce) will be submitted at the end of the 4th Semester and evaluated.

6. Five copies of the project report shall be submitted to the Director, SBS.

7. For the conduct of the End Semester Examination and evaluation of Dissertation/Project work the University will appoint External Examiners.

8. Since the dissertation is by research, Dissertation/Project work carries a total of 200 marks and evaluation will be carried out by both internal and external evaluators.

9. The student has to defend his/her Dissertation/Project Work in a seminar which will be evaluated by an internal and external experts appointed by the University.

10. The assignment of marks for Project/Dissertation is as follows:

    Part I-

    Topic Selection, Review of Literature, Novelty of works-50 marks

    Part-II-

    a. Continuous Internal Assessment, Novelty, Overall Lab Work Culture - 100 Marks

    b. Dissertation/Project work book: 50 Marks

    c. Viva-Voce: 50 Marks

d. However, a student in 4th semester will have to opt for general elective course from other related disciplines in addition to his Dissertation/Project work in the parent department.

The M.Sc. student is required to complete a satisfactory thesis in his/her area of interest. Each student will undertake an experimental project under supervision of one of the teachers during Semester 4 and submit 4 copies of the dissertation which will include: a) Review of the relevant literature, b) Objectives of the study, c) Materials and Methods, d) Results/Observations (supported by figures/tables etc as required), e) Discussion of the Results/Observations, f) Summary and g) References.

At the end of his/her study, the student must defend his/her thesis in an oral examination.

MBS 120 P: Educational Tour/Field Work/Industrial Visit/Hospital Visit*

MONITORING LEARNING PROGRESS

It is essential to monitor the learning progress of each candidate through continuous appraisal and regular assessment. It not only also helps teachers to evaluate students, but also students to evaluate themselves. The monitoring be done by the staff of the department based on participation of students in various teaching / learning activities. It may be structured and assessment be done using checklists that assess various aspects. Model Checklists are attached

The learning out comes to be assessed should include:

i) **Journal Review Meeting (Journal Club):** The ability to do literature search, in depth study, presentation skills, and use of audio- visual aids are to be assessed. The assessment is made by faculty members and peers attending the meeting using a checklist (see Model Checklist – I)

ii) **Seminars / Symposia**: The topics should be assigned to the student well in advance to facilitate in depth study. The ability to do literature search, in depth study, presentation skills and use of audio- visual aids are to be assessed using a checklist (see Model Checklist-II)

iii) **Teaching skills**: Candidates should be encouraged to teach undergraduate medical students and paramedical students, if any. This performance should be based on assessment by the faculty members of the department and from feedback from the undergraduate students (See Model checklist III,)

iv) **Work diary / Log Book**- Every candidate shall maintain a work diary and record his/her participation in the training programmes conducted by the department such as journal, reviews, seminars, etc. Special mention may be made of the presentations by the candidate as well as details of experiments or laboratory procedures, if any conducted by the candidate.

v) **Records**: Records, log books and marks obtained in tests will be maintained by the Head of the Department.

Checklist - I

Model Checklist for Evaluation of Journal Review Presentations

Name of the student:_____ Date:_____

Name of the Faculty/ Observer:_____

S No.	Items for observation during presentation		Below average	Average	Good	Very Good
		0	1	2	3	4
1	Article chosen was					
2	Extent of understanding of scope & objectives of the paper by the candidate					
3	Whether cross- references have been consulted					
4	Whether other relevant references have been Consulted					
5	Ability to respond to questions on the paper /subject					
6	Audio-visuals aids used					
7	Ability to defend the paper					
8	Clarity of presentation					
9	Any other observation					
	Total score					

Checklist - II

Model Checklist for Evaluation of the Seminar Presentations

Name of the student:_____ Date:_____

Name of the Faculty/ Observer:_____

S No.	Items for observation during presentation		Below average	Average	Good	Very Good
		0	1	2	3	4
1	Article chosen was					
2	Extent of understanding of scope & objectives of the paper by the candidate					
3	Whether cross- references have been consulted					
4	Whether other relevant references have been Consulted					
5	Ability to respond to questions on the paper /subject					
6	Audio-visuals aids used					
7	Ability to defend the paper					
8	Clarity of presentation					
9	Any other observation					
	Total score					

Checklist - III

Model Checklist for Evaluation of Teaching Skill

Name of the student: _____ Date: _____
Name of the Faculty/ Observer: _____

S. No.		Strong Point	Weak point
1	Communication of the purpose of the talk		
2	Evokes audience interest in the subject		
3	The introduction		
4	The sequence of ideas		
5	The use of practical examples and /or illustrations		
6	Speaking style (enjoyable, monotonous, etc., specify)		
7	Summary of the main points at the end		
8	Ask questions		
9	Answer questions asked by the audience		
10	Rapport of speaker with his audience		
11	Effectiveness of the talk		
12	Uses of AV aids appropriately		

Checklist - IV

Model Check list for Dissertation / Project Work Presentations

Name of the student:_____ Date:_____

Name of the faculty/ Observer:_____

S No.	Points to be covered		Below average	Average	Good	Very Good
		0	1	2	3	4
1	Interest shown in selecting topic					
2	Appropriate review					
3	Discussion with guide and other faculty					
4	Quality of protocol					
5	Preparation of proforma					
	Total score					

Checklist - V

Continuous Evaluation of dissertation / project work by Guide/ Co-Guide

Name of the student:_____ Date:_____

S No.	Points to be covered		Below average	Average	Good	Very Good
		0	1	2	3	4
1	Interest shown in selecting topic					
2	Appropriate review					
3	Discussion with guide and other faculty					
4	Quality of protocol					
5	Preparation of proforma					
	Total score					

Resolution No. 4.19(i) of BOM-55/2018: Resolved to include B.Sc. (Life Science) in the existing eligibility criteria of M.Sc. Biostatistics course.

Resolution No. 4.4.1.3 of BOM-55/2018: Resolved to approve the revised syllabus of 'Research Methodology and Biostatistics" subject for all the PG courses (including 3 years) and to shift it in 2nd semester with effective from the batch admitted in the Academic Year 2018-19 onwards under MGM School of Biomedical Sciences. **[Annexure-13]**

Gmail

Mansee Thakur <mansibiotech79@gmail.com>

Annexure-13

To compulsorily include in the BOS agenda

1 message

Registrar <registrar@mgmuhs.com> 6 September 2018 at 14:17
To: drravindrai@gmail.com, inamdar123456@gmail.com, ipseetamohanty@yahoo.co.in, jaishreeghanekar@gmail.com, drspravin22@gmail.com, dr_spravin@hotmail.com, sudhirkul1979@gmail.com, mansibiotech79@gmail.com, sbsnm@mgmuhs.com, rajani.kanade@gmail.com, mgmschoolofphysiotherapy@gmail.com, prabhadasila@gmail.com, mgmnewbombaycollegeofnursing@gmail.com, gashroff2006@gmail.com, rupalgshroff@yahoo.com, manjushreeb@yahoo.com, drshobhasalve@gmail.com, spdubhashi@gmail.com, jayantkarbhase@gmail.com, veenashatolkar@gmail.com, sharathcrisp@gmail.com, mgmlpth@themgmgroup.com, anuradhamhaske@hotmail.com, principalconabad@gmail.com
Cc: registrarmgmihs@gmail.com, mgmihsaurangabad@gmail.com, dr.rajeshkadam07@gmail.com, aradmin@mgmuhs.com

Dear Sir/Madam,

Please find attached herewith request from Dr. Rita Abbi, Professor, Biostatistics regarding Modification in the syllabus of 'Research Methodology and Biostatistics' subject and Proposal to make this subject compulsory in all the PG courses. You are requested go through this and include it in your agenda for forthcoming BOS in September, 2018.

Thanks and regards,

Dr. Rajesh B. Goel

Registrar

MGM Institute of Health Sciences, Navi Mumbai

(Deemed University u/s 3 of UGC act, 1956)

3rd Floor, MGM Educational Campus,

Plot No. 1 & 2, Sector -1, Kamothe,

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Tel.: 022 - 27432471 / 27432994

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Email: registrar@mgmuhs.com

Website: www.mgmuhs.com

Modification in the syllabus of Research Methodology and Biosta.pdf
2261K

MGM SCHOOL OF BIOMEDICAL SCIENCES, NAVI MUMBAI

(A constituent unit of MGM INSTITUTE OF HEALTH SCIENCES)
(Deemed University u/s 3 of UGC Act 1956)
Grade "A" Accredited by NAAC
Sector 1, Kamothe Navi Mumbai-410209, Tel.No.:022-27437631,27432890
Email. sbsnm@mgmuhs.com / Website : www.mgmsbsnm.edu.in

To,
The Director
MGM School of Biomedical Sciences
Kamothe,
Navi Mumbai – 410 209

7-6-2018

Subject: Modification in the syllabus of 'Research Methodology and Biostatistics' Subject and Proposal to make this subject compulsory in all the PG courses

Dear Madam,

Research Methodology and Biostatistics subject is a significant tool for academic research. It has been observed that majority of post graduate courses have this subject as a part of their course work. There is a need to modify the curriculum of 'Research Methodology and Biostatistics subject' due to the following reasons:

1. While going through the Research Methodology and Biostatistics syllabus it was found that in some courses more weightage was given to computer hardware e.g. History and development of computers(old pattern) which may not be needed now as we have witnessed the revolution in Information Technology. Students should be taught latest technology and software.
2. Secondly, in most of the syllabi 'Vital Statistic' is missing which is an important topic for healthcare field. Some of the essential topics like 'Normal distribution' etc are missing.
3. By streamlining the syllabus it will save teacher's teaching time, paper setting time. Moreover, Exam section need not call multiple examiners for the same subject, this will be economical for exam section.

This subject is well recognized as an essential tool in medical research, clinical decision making, and health management. It is recommended to streamline the syllabus and make **Research Methodology and Biostatistics' compulsory in all the post graduate courses of School Biomedical Sciences.** The modified syllabus is enclosed.
This is for your kind perusal and necessary action please.

With regards,

Dr. Rita Abbi
Professor, Biostatistics

Copy for information to
Registrar MGMIHS Navi Mumbai;
Hon'ble Vice Chancellor, MGMIHS Navi Mumbai
Hon'ble Medical Director, MGM Medical College

BOS → Faculty → Academic Council.

MGM Institute Of Health Sciences
INWARD NO. 5720
DATE: 25/6/18
REF:

MGM INSTITUTE OF HEALTH SCIENCES

M. Sc. Students

Syllabus for Research Methodology and Biostatistics

		No. of Hours	
	I. Research Methodology:	Theory	Practical
1	**Scientific Methods of Research :** Definition of Research, Assumptions, Operations and Aims of Scientific Research. Research Process, Significance and Criteria of Good Research , Research Methods versus Methodology, Different Steps in Writing Report, Technique of Interpretation, Precaution in interpretation, Significance of Report Writing, Layout of the Research Report	5	—
2	**Research Designs:** Observational Studies: Descriptive, explanatory, and exploratory, Experimental Studies: Pre-test design, post-test design, Follow-up or longitudinal design, Cohort Studies, Case Control Studies, Cross sectional studies, Intervention studies, Panel Studies.	5	—
3	Sampling Designs : Census and Sample Survey, Implications of a Sample Design, Steps in Sampling Design Criteria of Selecting a Sampling Procedure, Characteristics of a Good Sample Design, Different Types of Sample Designs (Probability sampling and non probability sampling), How to Select a Random Sample?, Systematic sampling, Stratified sampling, Cluster sampling, Area sampling, Multi-stage sampling, Sampling with probability proportional to size, Sequential sampling.	5	4
4	**Measurement in research:** Measurement Scales, Sources of Error in Measurement, Tests of Sound Measurement, Technique of Developing Measurement Tools, Scaling Meaning of Scaling, Scale Classification Bases, Important Scaling Techniques, Scale Construction Techniques, Possible sources of error in measurement, Tests of sound measurement	5	5
5	**Methods of Data Collection:** Types of data, Collection of Primary Data, Observation Method, Interview Method, Collection of Primary Data	5	3
6	**Sampling Fundamentals :** Need and importance for Sampling, Central Limit Theorem, Sampling Theory, Concept of Standard Error, Estimation, Estimating the Population Mean Estimating Population Proportion, Sample Size and its Determination, Determination of Sample Size through the Approach Based on Precision Rate and Confidence Level.	5	3
	II. Biostatistics		
1	**Data Presentation** : Types of numerical data: Nominal, Ordinal, Ranked, Discrete and continuous. Tables: Frequency distributions, Relative frequency, Graph: Bar charts, Histograms, Frequency polygons, one way scatter plots, Box plots, two way scatter plots, line graphs	3	4
2	**Measures of Central Tendency and Dispersion** : Mean, Median, Mode Range, Inter quartile range, variance and Standard Deviation, Coefficient of variation, grouped mean and grouped standard deviation (including merits and demerits).	3	4

3	**Testing of Hypotheses**: Definition, Basic Concepts, Procedure for Hypothesis Testing, Measuring the Power of a Hypothesis Test, Normal distribution, data transformationImportant Parametric Tests, Hypothesis Testing of Means, Hypothesis Testing for Differences between Means, Hypothesis Testing for Comparing Two Related Samples, Hypothesis Testing of Proportions, Hypothesis Testing for Difference between Proportions, Hypothesis Testing for Comparing a Variance to Some Hypothesized Population Variance, Testing the Equality of Variances of Two Normal Populations.	6	
4	**Chi-square Test:** Chi-square as a Non-parametric Test, Conditions for the Application Chi-square test, Steps Involved in Applying Chi-square Test, Alternative Formula, Yates' Correction, and Coefficient by Contingency.	2	2
5	**Measures of Relationship**: Need and meaning, Correlation and Simple Regression Analysis	2	3
6	**Analysis of Variance and Covariance**: Analysis of Variance (ANOVA):Concept and technique of ANOVA, One-way ANOVA, Two-way ANOVA, ANOVA in Latin-Square Design Analysis of Co-variance (ANOCOVA), ANOCOVA Technique.	4	4
7	**Nonparametric or Distribution-free Tests:** Important Nonparametric or Distribution-free Test Sign test, Wilcoxon signed-Rank Test, Wilcoxon Rank Sum Test: Mann-Whitney U test Kruskal Walli's test, Friedman's test, and Spearman Correlation test.	3	4
8	**Vital Health Statistics:** Measurement of Population: rate, crude rate, specific rate, *Measurement of fertility* : specific fertility rate, Total fertility rate, *Reproduction rate,* Gross Reproduction Rate, Net Reproduction Rate, Measures related to mortality: Crude Death Rate (CDR) , Age-specific death Rate, Infant and child mortality rate, Measures related to morbidity.	4	6
9	**Computer Application** Use of Computer in data analysis and research, Use of Software and Statistical package. Introduction to SPSS. Importing data from excel, access, tab and comma separated files. Entering data, labeling a variable, coding and recoding a categorical and continuous variable. Converting data from string to numeric variables, sorting & filtering, merging, appending data sets. Frequencies, descriptive statistics, cross tabulations. Diagrammatic presentation include histogram, bar chart, pie chart, scatter diagram, box plot, line chart. Parametric test of hypothesis-one sample, Independent and paired sample t test, one way ANOVA& post HOC test. Testing for normality,Chi-square test with measures of association. Pearson correlation. Non parametric test	3	6
	Total hours	60	60

Resolution No. 4.13 of BOM-55/2018: Resolved as follows:-

(i) Slow learners must be re-designated as potential learners.

(ii) Students scoring less than 35% marks in a particular subjects/course in the 1st formative exam are to be listed as potential learners. These learners must be constantly encouraged to perform better with the help of various remedial measures.

(iii) Students scoring more than 75% marks in a particular subjects/course in the 1st formative exam are to be listed as advanced learners. These learners must be constantly encouraged to participate in various scholarly activities.

Resolution No. 3.1.4.2 of BOM-57/2019:

i. Resolved to include "Gender Sensitization" into UG (from new batch 2019-2020) and PG (from existing batches) curricula. **[Annexure-21]**

ii. Resolved to align the module of "Gender Sensitization" with MCI CBME pattern for MBBS students.

iii. Resolved that Dr. Swati Shiradkar, Prof., Dept. of OBGY., MGM Medical College, Aurangabad will coordinate this activity at both campuses.

Annexure - 21

Gender sensitization for UG (2nd , 3rd , 8th semesters) and PG (3 hours)

INCLUSION OF " GENDER SENSATIZATION" IN CURRICULUM

Introduction :

The health care provider should have a healthy gender attitude, so that discrimination, stigmatization, bias while providing health care will be avoided. The health care provider should also be aware of certain medico legal issues related with sex & gender.

Society particularly youth & adolescents need medically accurate, culturally & agewise appropriate knowledge about sex, gender & sexuality. So we can train the trainers for the same. It is need of the hour to prevent sexual harassment & abuse .

To fulfill these objectives, some suggestions are there for approval of BOS.

Outline

1)For undergraduates :- Three sessions of two hours each, one in 2nd term, one in 3rd term & one in 8th term.

2)For Faculties and postgraduates :- One session of two hrs .

3)For those want to be trainers or interested for their ownself, value added course, which is optional about sex, gender, sexuality & related issues.

Responsibility

ICC of MGM, MCHA , with necessary support from IQAC & respective departments.

Details of undergraduate sessions

1)First session in 2nd term

Aim – To make Students aware about the concept of sexuality & gender**.**

To check accuracy of knowledge they have,

To make them comfortable with their own gender identify & related issues.

To make them aware about ICC & it is functioning.

Mode – Brain storming , Interactive power point presentation experience sharing.

Duration – Around two hours

Evaluation – Feedback from participants.

2)Second session in 3rd / 4th term

Aim – To ensure healthy gender attitude in these students as now they start interacting with patients.

To ensure that the maintain dignity privacy while interacting with patients and relatives, particularly gender related.

To make them aware about importance of confidentiality related with gender issues.

To encourage them to note gender related issues affecting health care & seek solutions.

Mode – focused group discussions on case studies, Role plays & discussion.

Duration – Around two hours.

Evaluation – Feedback from participants.

Third session in 8th term.

Aim – To understand effect of gender attitudes on health care in various subjects.

To develop healthy gender attitude while dealing with these issues.

Mode – Suggested PBL by departments individually. (In collaboration with ICC till faculty sensitization is complete)

Evaluation – Feedback

****

FOR POSTGRADUATES

Session of 2-3 hrs preferably in induction program.

Aim – To introduce medically accurate concept of gender, sex, gender role & sex role.

To ensure healthy gender attitude at workplace.

To understand gender associated concepts on health related issues & avoid such bias wile providing health care.

To make them aware about ICC & it's functioning.

Mode – Interactive PPT

Role plays & discussion

Duration – 2 to 3 hrs

Evaluation – Feedback.

FOR FACULTIES

Session of 2 hours may be during combined activities.

Aim – To ensure clarity of concept abut gender & sex.

To discuss effect of these concept on health related issues.

To identify such gender & sex related issues in indivual subject specialties.

To discuss methodology like PBL for under graduate students when whey are in 7^{th}-8^{th} semester.

Mode – Role play

Focused group discussion

Case studies

Evaluation – Feed back.

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Sdp-Pimple/joshi-obgy

Resolution No. 3.2.1.6.a of BOM-57/2019: Resolved to allot 50 marks for Internal Assessment in Industrial Visit for all the batches under CBCS pattern - M.Sc. (2 year) & MHA program.

Resolution No. 3.2.1.6.d of BOM-57/2019: Resolved that in "Rules & Regulation of Exam for PG Student (CBCS)" to keep "10 marks for Viva instead of 5 marks and no marks for journal" in the final university exam for PG students (M.Sc. 02 years CBCS pattern) admitted from Academic Year 2019-20 onwards.

Resolution No. 4.3.1.2 of BOM-63/2021: Resolved to include topics related to COVID 19 in UG {B.Sc. AT & OT (BOTAT 108L), B.Sc. MLT(BMLT 108 L), B.Sc. MRIT (BMRIT 108L), B.Sc. MDT-(BMDT 108L), B.Sc. CCT (BCCT 108L), B.Sc.PT (BPT 108L), B.Optometry (BOPTOM 108L) Programs for Batch AY 2020-21 (Semester II)} & B.Sc. Medical Laboratory Technology SEMESTER-VI in subject of Medical Microbiology-II (BMLT 125 L) & Medical Microbiology-II (BMLT 125 P) for Batch AY 2020-21. [Annexure-7]
Further Dr. N.N. Kadam, Hon'ble Pro Vice Chancellor suggested to add topics under "Newer Infectious Diseases" as the main topic.

Annexure-07 of BOM-63/2021 dt 17.02.2021

To include Covid-19 topics in health professional curriculum as per the BOM Resolution No. 3.7 of BOM-62/2020

a) M.Sc. (PG Program), (M.Sc. Medical Biotechnology, M.Sc. Medical Genetics, M.Sc. Biostatistics, M.Sc. Molecular Biology, M.Sc. MRIT, M.Sc. CCT, M.Sc. Clinical Nutrition, M.Sc. Clinical Embryology, Master in Hospital Administration, Master of Public Health, and M.Optometry)

Approved syllabus	**Name of the subject**	**Existing content**	**Proposed changes**
Common Syllabus for Semester IV – 2 year M.Sc. programs (M.Sc. Medical Biotechnology, M.Sc. Medical Genetics, M.Sc. Biostatistics, M.Sc. Molecular Biology, M.Sc. MRIT, M.Sc. CCT, M.Sc. Clinical Nutrition, M.Sc. Clinical Embryology, Master in Hospital Administration, Master of Public	**BIOETHICS, BIOSAFETY, IPR & TECHNOLOGY TRANSFER** **GE 002 L**	**Sr. no. 2** Introduction to quality assurance, accreditation & SOP writing :Concept of ISO standards and certification , National regulatory body for accreditation, Quality parameters, GMP & GLP, Standard operating procedures, Application of QA in field of genetics, Data	**Sr. no. 2** Introduction to quality assurance, accreditation & SOP writing :Concept of ISO standards and certification , National regulatory body for accreditation, Quality parameters, GMP & GLP, Standard operating procedures, Application of QA in field of genetics, Data management of clinical and testing laboratory, **WHO & CDC, ICMR guidelines for**

Health, and M.Optometry)		management of clinical and testing laboratory	**Biosafety and Vaccines with regards COVID 19**

Resolution No. 4.3.1.3 of BOM-63/2021: Accorded post facto approval for changes in the index of UG (B.Sc. AT & OT, B.Sc. MLT, B.Sc. MRIT, B.Sc. MDT, B.Sc. CCT, B.Sc.PT, B. Optometry) and PG 2 year (M.Sc. Medical Biotechnology, M.Sc. Medical Genetics, M.Sc. Biostatistics, M.Sc. Molecular Biology, M.Sc. MRIT, M.Sc. CCT, M.Sc. Clinical Nutrition, M.Sc. Clinical Embryology, Master in Hospital Administration, Master of Public Health, and M.Optometry). [**Annexure-8A, 8B]**

CURRICULUM FOR M. Sc. IN BIOSTATISTICS

FIRST YEAR

Semester I						
Syllabus Ref. No.	**Subject**	**Credits (C)**	**Teaching (hrs.)**	**Marks**		
Theory				**Internal Assessment (IA)**	**University Semester Exam (UEX) / Internal Semester Exam (INT)**	**Total**
MBS 101 T	Basic Mathematics and Introduction to Statistical Methods	4	4	20	80 (UEX)	100
MBS 102 T	Epidemiology	4	4	20	80 (UEX)	100
MBS 103 T	Health Economics	4	4	20	80 (UEX)	100
MBS 104 T	Demography	4	4	20	80 (UEX)	100
MBS 105 T	Health Care System and Policies & Health Surveys	4	4	20	80 (UEX)	100
Practical						
MBS 101 P	Basic Mathematics and Introduction to Statistical Methods	2	4	10	40 (UEX)	50
MBS 102 P	Epidemiology	2	4	10	40 (UEX)	50
MBS 103 P	Health Economics	2	4	10	40 (UEX)	50
MBS 104 P	Demography	2	4	10	40 (UEX)	50
Total		**28**	**36**	**140**	**560**	**700**

Semester II							
Syllabus Ref. No.		**Subject**	**Credits (C)**	**Teaching (hrs.)**	**Marks**		
Theory					**Internal Assessment (IA)**	**University Semester Exam (UEX) / Internal Semester Exam (INT)**	**Total**
MBS 106 T		Research Methodology-I	4	4	20	80 (UEX)	100
MBS 107 T		Sampling Techniques in Health	4	4	20	80 (UEX)	100
MBS 108 T		Estimation and Testing of Hypothesis	4	4	20	80 (UEX)	100
MBS 109 T		Applied Multivariate Analysis	4	4	20	80 (UEX)	100
Practical							
	MBS 106 P	Research Methodology-I	2	4	10	40 (UEX)	50
	MBS 107 P	Sampling Techniques in Health	2	4	10	40 (UEX)	50
	MBS 108 P	Estimation and Testing of Hypothesis	2	4	10	40 (UEX)	50
	MBS 109 P	Applied Multivariate Analysis	2	4	10	40 (UEX)	50
	MBS 110	Seminar	1	2	-	50 (INT)	50
Total			**25**	**34**	**120**	**530**	**650**

SECOND YEAR

Semester III						
Syllabus Ref. No.	**Subject**	**Credits (C)**	**Teaching (hrs.)**	**Marks**		
Theory				**Internal Assessment (IA)**	**University Semester Exam (UEX) / Internal Semester Exam (INT)**	**Total**
MBS 111 T	Biostatistics and Research Methodology-II	4	4	20	80 (UEX)	100
MBS 112 T	Survival Analysis	4	4	20	80 (UEX)	100
MBS 113 T	Design of Experiment and Clinical Trial	4	4	20	80 (UEX)	100
Core Elective Course**						
MBS 114 T	Non parametric Test	4	4	20	80 (UEX)	100
MBS 115 T	Advance Statistical Computing					
MBS 116 T	Time Series Analysis					
MBS 117 T	Operations Research					
MBS 118	Dissertation/Project*	6	12	-	50 (INT)	50
Practical						
MBS 111 P	Biostatistics and Research Methodology-II	2	4	10	40 (UEX)	50
MBS 112 P	Survival Analysis	2	4	10	40 (UEX)	50
MBS 113 P	Design of Experiment and Clinical Trial	2	4	10	40 (UEX)	50
***Core Elective Course**						
MBS 114 P	Non parametric Test	2	4	10	40 (UEX)	50
MBS 115 P	Advance Statistical Computing					
MBS 116 P	Time Series Analysis					
MBS 117 P	Operations Research					
MBS 119	Seminar	1	2	-	50 (INT)	50
Total		**31**	**46**	**120**	**580**	**700**

Semester IV						
Syllabus Ref. No.	**Subject**	**Credits (C)**	**Teaching (hrs.)**	**Marks**		
Theory				**Internal Assessment (IA)**	**University Semester Exam (UEX) / Internal Semester Exam (INT)**	**Total**
General Elective **						
GE 001 T	Pursuit of Inner Self Excellence (POISE)	4	4	-	100 (INT)	100
GE 002 T	Bioethics, Biosafety, IPR & Technology Transfer					
GE 003 T	Disaster management and mitigation resources					
GE 004 T	Human rights					
MBS 118	Dissertation / Project*	18	36	-	200 (UEX)	200
Practical						
MBS 120 P	Educational Tour / Field Work/Industrial Visit/Hospital Visit*	2	0	-	50 (INT)	50
Total		**24**	**40**	**0**	**350**	**350**

12.1 : Minutes of CBCS meeting held on 3.02.2021 I. Courses titled as elective, seminar, clinical posting etc. will be evaluated at university level, only:	**Decision taken by CBCS Committee:** Members agreed that all courses (core, elective, seminar, clinical posting etc) in all programs with CBCS curriculum under MGM School of Biomedical Sciences (MGMSBS-UG & PG), MSc Medical Programme under MGM Medical College and MGM School of Physiotherapy (MGMSOP) (BPT & MPT) will be evaluated at the level of the University at the end during semester examination. (Detailed included as 1, 2,3,4 points)
1. Courses which were evaluated at constituent units titled as elective, seminar, clinical posting etc. will be evaluated at university level for UG & PG of MGMSBS, Navi Mumbai:	MGM School of Biomedical Sciences (MGMSBS-UG) :First year B.Sc. (Semester I & Semester II) (core-1.1 & 1.2) and (elective-1.3) common for all seven programs **(B.Sc. DT, B.Sc. AT & OT, B.Sc. CCT, B.Optometry, B.Sc. PT, B.Sc. MRIT, B.Sc. MLT)** which were having 100 marks previously will be changed to 50 marks (40 marks university Semester End Exam-(SEE) and 10 marks Internal Assessment – (IA) as per below format - 1.4) w.e.f AY 20-21. (**Annexure 1**) Clinical Directed posting allotted 50 marks will be assessed as university end semester exam w.e.f AY 20-21. **(Annexure 1.1)** **(request to add** **a) evaluation pattern of seminar - 50 marks– BSc Dialysis- sem IV** **b) Boptometrysem III – course : geometrical optics and visual optics I/II** **sem IV – optometric instrumentation** **10 IA + 40 SEE – format submitted)**
	2.1 Courses which were evaluated at constituent units titled as elective, seminar, clinical posting etc. will be evaluated at university level. Members agreed that all courses (core, elective, seminar, clinical posting etc) in all programs with CBCS curriculum under MGM School of Biomedical Sciences (MGMSBS- PG), will be evaluated at the level of the University end semester examination w.e.f. AY 2020-21. ***** For PG program (M.Sc. 2 year including allied program, MHA, MPH) having courses like seminar/education tour & Industrial visit which were allotted **50 marks** will be assessed as university end semester exam. a. Amended 10 marks in seminar **(Annexure-2.1A)** b. Amended 20 marks for Educational Tour/Field Work/Hospital Visit/ Industrial Visit **(Annexure-2.1B)** c. 50 marks for Clinical Directed Posting (no change) **(Annexure-2.1C)** **(request to add the evaluation pattern for MPH – sem I,II, III)** **MOptometry – Sem I – evaluation pattern to be added)** **2.2** PG Courses which were evaluated at constituent units titled as elective carrying 100 marks as only similar to that of core courses, will be evaluated at university level. Similar pattern which is being followed for core Subjects (IA - 20 Marks + university exam - 80 marks) will be followed.**(Annexure-2.2)**

Resolution No. 10.4 of Academic Council (AC-42/2022):

i) "Resolved to accept "50% eligibility in internal assessment" pattern for all the CBCS programs (UG & PG) running under the constituent units of MGMIHS.(MGM School of Biomedical Sciences, MGM School of Physiotherapy, MGM Medical College (M.Sc. Medical 3 year courses).

This will be applicable to all existing batches (for remaining regular examinations) and forthcoming batches from June 2022 onwards"

Resolution No. 3.10 of Academic Council (AC-49/2024):

Resolved and approved to collect the Dissertations/Projects 60 days before the University examination for all 2-year M.Sc. programs under MGM School of Biomedical Sciences to fulfil the credit allotted for project work, to be effective from batch 2023-24 onwards.

MGM INSTITUTE OF HEALTH SCIENCES

(Deemed to be University u/s 3 of UGC Act, 1956)

Grade 'A' Accredited by NAAC

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