MGM INSTITUTE OF HEALTH SCIENCES

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

M.Sc. Clinical Research

Amended upto BOM-55/2018, Dated 27/11/2018.

Amended History

1. Approved as per BOM- 28/2013.
2. Amended as per BOM-55/2018 [Resolution No.4.13], Dated 27/11/2018.

INSPIRING MINDS

Mission

To improve quality of the life for individuals and community by promoting health, preventing and curing disease, advancing biomedical and clinical research and educating tomorrow's Physicians and Scientists.

Vision

By 2020 the MGM University of Health Sciences will rank one of the top private Medical Institution. This will be achieved through ground breaking **discoveries in basic sciences and clinical research** targeted to prevent and relieve human suffering, **excellence in Medical Education** of the next generation of academic clinicians and intrinsic scientists.

MGM University of Health Sciences will transform the **Education of** tomorrow's Physicians and Scientists conducting Medical **Research** to advance health and improving lives by providing world-class patient care.

Many see the 21st Century as the golden age of biomedical research. The MGM University of Health Sciences will position for leadership at the horizon of this new era to promote and stabilise stand human health with a standard of excellence.

INTRODUCTION TO THE CURRICULUM

This curriculum is developed for the course leading to the award of M. Sc degree in Medical Clinical Research. This manual shall assist you in integrating important elements of the content with the selection of effective teaching strategies.
The curriculum is presented in three main sections:
CORE CURRICULUM: These modules are defined as **essential base** information about Clinical Research that all graduate professionals need to know.

Semester	Module No.	Title of the Paper	Total Lectures (hrs)	Exam marks			Duration of exam in Hrs
				Internals	Externals	Total marks	
I	CR-I (T)	Pharmacology I	40	40	60	100	3
	CR-II (T)	Research Methodologies	25	40	60	100	3
	CR-III (T)	Drug Analysis I	40	40	60	100	3
	CR-IV (T)	Computer Basics and Biostatistics	40	40	60	100	3
				Total marks		**400**	
II	CR-V (T)	Pharmacology II	40	40	60	100	3
	CR-VI (T)	Clinical Research Guidelines I	40	40	60	100	3
	CR-VII (T)	Drug Analysis II	40	40	60	100	3
	CR-VIII (T)	Introduction to Database and Oracle	40	40	60	100	3
				Total marks		**400**	
III	CR-IX (T)	Clinical Research Guidelines II	40	40	60	100	3
	CR-X (T)	Pharmaceutical Jurisprudence	40	40	60	100	3
	CR-XI (T)	Drug Analysis III	40	40	60	100	3
	CR-XII (T)	Advances to Database and Oracle	40	40	60	100	3
				Total marks		**400**	
IV	CR-XIII (T)	Clinical Research Management	40	40	60	100	3
	CR-XIV (T)	Communication Skills	40	40	60	100	3
	CR-XV (T)	Project	-			200	
				Total marks		**400**	

CR Curriculum Contents:

The MSc in Clinical Research course is four semester course of two years duration and contains 14 subjects spread through out the two years time span. These subjects are as given below:

Core Subjects:

1. Pharmacology I
2. Pharmacology II
3. Clinical Research Guidelines I
4. Clinical Research Guidelines II
5. Clinical Research Management
6. Research Methodologies
7. Pharmaceutical Jurisprudence

Analytical Science:

8. Drug Analysis I
9. Drug Analysis II
10. Drug Analysis III

Computer Sciences:

11. Computer Basics and Biostatistics
12. Introduction to Database and Oracle
13. Advances to Database and Oracle

Dissertation:

14. Communication Skills

Personality Development:

15. Project

Curriculum for M.Sc. in Clinical Research

Semesters	Modules	Marks
Sem - I		
Module CR-I	Pharmacology I	**100**
Module CR-II	Research Methodologies	**100**
Module CR-III	Drug Analysis I	**100**
Module CR-IV	Computer Basics and Biostatistics	**100**
Sem - II		
Module CR-V	Pharmacology II	**100**
Module CR-VI	Clinical Research Guidelines I	**100**
Module CR-VII	Drug Analysis II	**100**
Module CR-VIII	Introduction to Database and Oracle	**100**
Sem - III		
Module CR-IX	Clinical Research Guidelines II	**100**
Module CR-X	Pharmaceutical Jurisprudence	**100**
Module CR-XI	Drug Analysis III	**100**
Module CR-XII	Advances to Database and Oracle	**100**
Sem - IV		
Module CR-XIII	Clinical Research Management	**100**
Module CR-XIV	Communication Skills	**100**
Module CR-XV	Project	**200**

Details of Curriculum

Module CR-I

Pharmacology I

1. General Pharmacology

- History of Pharmacology
- Drug Sources
  - Drug and Active Principle
  - Drug Development
- Drug Administration
  - Various routes of drug administration
- Pharmacokinetics
- Pharmacodynamics
- ADRs

2. Drug Acting on the Autonomic Nervous System

- General Considerations
- Cholinergic system and cholinergic drugs
- Anticholinergic drugs and Drugs acting on Autonomic Ganglia
- Adrenergic system and drugs
- Antiadrenergic drugs

3. Drugs Acting on the Peripheral (somatic) Nervous System

- Skeletal Muscle relaxants
- Lacal anaesthetics

4. Drugs Acting on the Central Nervous System

- General Anaesthetics
- Sedatives and Hypnotics
- Antiepileptic drugs
- Antiparkinsonian drugs
- Opioid Analgesics and antagonists
- Nonopioids and NSAIDS
- CNS stimulants

5. Autocoids

- Histamines, 5-HT and their Antagonists
- Plasma kinins, Angiotensin and ACE inhibitors
- PGs, Leukotrienes and Platelet activating factors.

6. Drugs Acting on Respiratory System

- Drugs for cough and Bronchial Asthma

7. Cardiovascular Drugs

- Cardiac Glycosides and drugs for CCF

- Antiarrhythmic Drugs
- Antianginal drugs
- Antihypertensive drugs

References:

1. **Satoskar and Bhandarkar**
2. **KD Tripathi**

Module CR-II

Clinical Research Methodologies

1. Research: A way of Thinking

   i) Research: A way of Thinking
   ii) Applications of Research
   iii) Definitions of Research
   iv) Characteristics of Research
   v) Types of research
      - Application
      - Objectives
      - Type of Information Sought
   vi) Paradigms of Research

2. Research Process: A quick Glance

   The Research Process an eight step model:
   - Step I: Formulating a research problem
   - Step II: Conceptualizing a Research Design
   - Step III: Constructing a instrument for data collection
   - Step IV: Selecting a sample
   - Step V: Writing a research Proposal
   - Step VI: Collecting Data
   - Step VII: Processing Data
   - Step VIII: Writing A research Report

3. Reviewing the Literature

   i) Reasons for Reviewing Literature
      - Bring Clarity and Focus to your Research Problem
      - Improve your Methodology
      - Broaden your Knowledge base in your Research area
   ii) Procedure for Reviewing the Literature
      - Search for existing Literature
      - Review the Literature selected
      - Develop a theoretical framework
      - Develop a conceptual framework
   iii) Writing up the literature reviewed

4. Formulating a Research problem

   i) The research problem
   ii) The importance of formulating a research problem
   iii) Sources of Research Problem
   iv) Considerations in selecting a research problem
   v) Steps in the formulation of a research problem
   vi) The formulation of a objectives
   vii) Establishing operational definitions

5. Identifying Variables

   i) The definition of a variable
   ii) The difference between a concept and a variable
   iii) Concepts, Indicators and Variables
   iv) Types of Variables
      - From the viewpoint of causation
      - From the viewpoint of study design
      - From the viewpoint of the unit of measurement
   v) Types of measurement scale
      - The normal or classificatory scale
      - The ordinal or ranking scale
      - The Interval scale
      - The ration scale

6. Constructing Hypothesis

   i) The definition of a Hypothesis
   ii) The function of a Hypothesis
   iii) The characteristics of a hypothesis
   iv) Types of Hypothesis
   v) Errors in testing a hypothesis

7. The Research Design

   i) The definition of a research design
   ii) The function of a research design

8. Selecting a Method of Data Collection

   i) Collecting data using primary sources
      - Observation
      - The Interview
      - The Questionnaire
   ii) Collecting data using secondary sources
      - Problems with using data from secondary sources

9. Collecting Data using Attitudinal Scales

   i) Functions of attitudinal scales
   ii) Difficulties in developing an attitudinal scale
   iii) Types of attitudinal scale
      - The summated rating or Likert scale
      - The equal-appearing-interval or Thurstone scale
      - The cumulative of Guttman scale
   iv) The relationship between attitudinal and measurement scales

10. Establishing the Validity and Reliability of a Research Instrument

   i) The Concept of Validity
      - Types of validity
   ii) The Concept of Reliability
      - Factors affecting the reliability of a research instrument
      - Methods of determining the reliability of an instrument

11. Sampling

   i) The Concept of Sampling
   ii) Sampling Technology
   iii) Principles of Sampling
   iv) Factors Affecting the Inference drawn from the a Sample
   v) Aims in selecting a Sample
   vi) Types of Sampling
      - Random Probability Sampling Design
      - Non Random Probability Sampling Design
      - The 'Mixed' Sampling Design
   vii) The Calculation of Sample Size

12. Writing a Research Proposal

i) The Research Proposal
ii) The Preamble (Introduction)
iii) The Problem
iv) The Objectives of the Study
v) The Hypothesis to be Tested
vi) The Study Design
vii) The Setting
viii) Measurement Procedures
ix) Sampling
x) Analysis of Data
xi) Structure of Report
xii) Problems and Limitations
xiii) Work Schedule
xiv) Appendix

13. Considering Ethical Issues in Data Collection

i) Ethics
ii) Stakeholders in Research
iii) Ethical Considerations Concerning Research Participants
- Collecting Information
- Seeking Consent
- Providing Incentives
- Seeking Sensitive Information
- The Possibility of Causing Harm to Participants
- Maintaining Confidentiality

iv) Ethical Issues Relating to the Researcher
- Avoiding Bias
  - Types of Bias
- Provision of Deprivation of a Treatment
- Using Appropriate Research Methodology
- Correct Reporting
- Using Information

v) Ethical Considerations Regarding the Sponsor Organization
- Restrictions Imposed by the Sponsoring Organization
- The use of Information

14. Processing Data

i) Editing Data
ii) Coding Data

- Developing a Code Book
- Pre-testing a Code Book
- Coding the Data
- Verifying the Coded Data

iii) Developing a Frame of Analysis

- Frequency Distribution
- Cross Tabulation
- Constructing the Main Concepts
- Statistical Procedures

iv) Analyzing Data
v) The Role of Computers in Research
vi) The Role of Statistics in Research

15. Displaying Data

i) Tables

- Structure
- Types of Tables
- Types of Percentages

ii) Graphs

- The Histogram
- The Bar Chart
- The Stacked Bar Chart
- The 100 per Cent Bar Chart
- The Frequency Polygon
- The Cumulative Frequency Polygon
- The Stem-and-Leaf Display
- The Pie Chart
- The Line Diagram or Trend Curve
- The Area Chart
- The Scattergram

16. Writing a Research Report

i) Research Writing in General
ii) Referencing
iii) Writing a Bibliography
iv) Developing an Outline
v) Writing about a Variable

17. Types of Clinical Trials

i) Treatment Trials
ii) Prevention Trials
iii) Diagnostic Trials
iv) Screening Trials
v) Quality of Life Trials

vi) Experimental Trial
- Randomized-Controlled Trial
- Double-Blind Trial
- Single-Blind Trial
- Non-Blind Trial
- Nonrandomized Controlled Trial
- Randomized Database Study
- Placebo Controlled Study

18. Non-Experimental Trial
- Cross-Sectional Study
- Longitudinal Study
- Cohort Study
  - Prospective Cohort
  - Retrospective Cohort
  - Time-trend Study
- Case-cohort Study
  - Case-control Study
  - Nested case-control Study
- Descriptive Trial

19. Clinical Trial Designs
i) Parallel Study Design
ii) Crossover Study Design
iii) Parallel-Crossover Study Design
iv) Sequential Study Design

20. Standard Operating Procedures (SOP's), Quality Policy
i) What are SOP's?
ii) Why SOP's are needed?
iii) How to write a SOP?
iv) Implementation of SOP's

References:

1. Guide to Clinical Trials. Author: Bert Spilker; Raven Press, New York, 1991. 1181 pages.
2. Becoming a Successful Clinical Research Investigator. Authors: Dr. David Ginsberg and Karen E. Woodin. Thomson Centerwatch Publication.
3. A Guide to Patient Recruitment and Retention. Author: Diana L. Anderson. Thomson Centerwatch Publication.
4. Protecting Study Volunteers in Research. Authors: Cynthia McGuire Dunn & Gary Chadwick. Thomson Centerwatch Publication.
5. The CRC's Guide to Coordinating Clinical Research Author: Karen E. Woodin. Thomson Centerwatch Publication.
6. The CRA's Guide to Monitoring Clinical Research. Author: Karen E. Woodin and John C. Schneider. Thomson Centerwatch Publication.

Module CR-III

Drug Analysis I

1. Introduction to Chemical Analysis:

- Chemical Analysis
  - Qualitative Analysis
  - Quantitative Analysis
- Applications of Chemical Analysis
- Sampling
- Types of Analysis
  - Proximate Analysis
  - Partial Analysis
  - Trace Constituent Analysis
  - Complete Analysis
- Use of Literature
- Common Techniques
  - Volumetry
  - Atomic Absorption Spectroscopy
  - Emission Method
  - Chromatography
- Other Technique
  - X- ray Method
  - Radioactivity
  - Mass Spectroscopy
  - Optical Method
  - Thermal Method
- Factors affecting the choice of Analytical Methods
- Interference
- Data Acquisition and Treatment

2. Common Apparatus and Basic techniques

- Introduction,
- Balances
  - Analytical Balance
  - Electronic Balance
  - Other Balances
- Weight, References Masses
- Care & use of Analytical Balances
- Error in Weight Balances
- Graduated Glassware
  - Units of Volume
  - Graduated Glassware

- Cleaning of Glassware
- Temperature Standard
- Graduated Flask
- Pipettes
- Burettes

- Water for Laboratory Use
  - Purified Water
- General Apparatus
  - Glassware, Ceramics, Plastic Wares
  - Heating Apparatus
  - Desiccators & Dry Boxes
  - Stirring Apparatus
  - Filtration Apparatus
  - Weighing Bottles
- Reagents and Standard Solutions
  - Reagents
  - Purification of Substance
- Some Basic Techniques
  - Preparation of the Substance for Analysis
  - Weighing the Sample
  - Solution of the Sample
- Precipitation
  - Filtration
  - Filter Papers
  - Crucibles with Permanent Porous Plates
  - Washing Precipitate
  - Drying & Ignition Precipitate

3. Titrimetry

- **Aqueous Acid - Base Titrations**
  - Acid – Base Theories
  - Law of Mass Action
  - Acid Base Equilibrium
  - Buffer Solutions
  - End Point Detection
  - Neutralization Curves

- **Complexation Titration**
  - Complexation
  - Detection of End Point
  - Metallochromic Indicators

- **Precipitation Titration**
  - Theory of Precipitation
  - Solubility of Product
  - Fractional Precipitation

- Titration Curves
- End Point Detection
- Mohr's Method
- Volhard Method

- **Oxidation – Reduction Titration**
  - Oxidation – Reduction Reaction
  - Redox Potential
  - End Point Detection
  - Permanganate Titrations
  - Iodine Titration

4. Electro-analytical methods of Analysis

- Electro-Gravimetry
  - Introduction
  - Theory
  - Apparatus
  - Applications
- Conductimetry
  - Introduction
  - Apparatus & Measurements
  - Conductimetric Titrations
  - Applications
  - High Frequency Measurements
- Potentiometry and Potentiometric Titration
  - Introduction
  - Instrumentation
  - Types
  - Variations in Potentiometry
  - Advantages Potentiometric Titration

5. Photometric Techniques

- Flame Photometry and Atomic Absorption Photometry
  - Introduction
  - General Principle
  - Instrumentations
  - Operational Procedures

- Nephelometry and Turbidimetry
  - Introduction
  - Instrumentation
  - Turbidimetric Titrations
  - Applications
- Fluorimetry
  - Principle
  - Molecular Structure and Fluorescence
  - Factors affecting Fluorescence
  - Instrumentation
  - Applications
- Refractrometry
  - Introduction
  - Refractive Index
  - Instrumentation
  - Application
  - Optical Exaltation
- Polarimetry
  - Introduction
  - Plane Polarized Light
  - Optical Activity
  - Types of Molecules Analyzed by Polarimetry
  - Polarimetry
  - Application of Optical Activity

Reference:

1. **"Pharmaceutical Analysis", Kasture AV; Wadodkar SG; Volume I, Nirali Prakashan.**

Computer Basics and Biostatistics

1. Introduction to Biostatistics:

- Basic Definitions and Applications.
- Sampling
  - Representative Sample
  - Sample Size
  - Sampling Bias
  - Sampling Techniques
- Data Collection and Presentation
  - Types of Data
  - Methods of Collection of Primary and Secondary Data
  - Methods of Data Presentation
  - Graphical Representation by:
    - Histogram
    - Polygon
    - Ogive curves
    - Pie Diagram.

2. Measures of Central Tendency

- Measures of Central Tendency
  - Mean
  - Median
  - Mode
- Measures of Variability
  - Standard Deviation
  - Standard Error
  - Range
  - Mean Deviation
  - Coefficient of Variation.
- Correlation and Regression
  - Positive and Negative Correlation
  - Calculation of Karl-Pearson's Co-efficient of Correlation
  - Linear Regression and Regression Equation
  - Multiple Linear Regressions
- ANOVA: Definition and Classification.

3. Tests of Significance

- Tests of Significance
- Small Sample Test (Chi-Square test, t-test, F-test)
- Large Sample Test (Z-test)
- Standard Error
- Introduction to Probability Theory
- Distributions
  - Binomial
  - Poison
  - Normal
- Computer Oriented Statistical Techniques
  - Frequency Tables of:
    - Single Discrete Variable
    - Bubble Spot
    - Computation of Mean
    - Variance and Standard Deviations
    - t-test
    - Correlation Coefficient

4. Introduction to Computers and Computer Applications

- Introduction to Computers
- Generation of Computers
- Computer Applications
- Types of Computers
- Concept of Hardware and Software
- Overview of Computer Viruses
- Operating Systems
- File, Folders, Directories and Commonly used Commands
- Flow-charts and Programming Techniques
- Introduction to C
- Introduction to MS Office

5. Networking Concepts

- Networking Fundamentals
- Client and Server
- Types of Networking (LAN, WAN, MAN)
- Network Topologies, Gadgets & Protocols
- Data Communication and Communication Links
- TelNET, INTERNET and NICNET
- WWW, HTML, E mail

- Introduction to MEDLINE, CCOD and PUBMED (for Accessing Biological Information)
- Introduction to Bioinorganic Software- bioperl, biojava, bioXML, bioORACLE

References:

1. Statistics in biology, Vol. 1 by Bliss, C.I.K. (1967) Mc Graw Hill, New York.
2. Practical Statistics for experimental biologist by Wardlaw, A.C. (1985).
3. Programming in C by E. Ballaguruswamy
4. How Computers work - 2000. By Ron White. Tech. Media
5. How the Internet Work 2000 by Preston Gralla Tech. Media.
6. Statistical Methods in Biology - 2000 by Bailey, N.T. J. English Univ. Press.
7. Biostatistics - 7th Edition by Daniel
8. Fundamental of Biostatistics by Khan
9. Biostatistical Methods by Lachin
10. Statistics for Biologist by Campbell R.C. (1974) Cambridge University Press, UK.
11. INTERNET – CDC publication, India

Module CR-V

Pharmacology II

1. Drugs acting on Kidneys

- Diuretics
- Antidiuretics

2. Drugs acting on GIT

- Drugs used for Peptic ulcers
- Emetics, Antiemetics
- Drugs for Constipation and Diarrhea

3. Antimicrobial drugs

- Beta lactum Antibiotics
- Tetracyclins and Chloramphenicol
- Aminoglycoside
- Anti TB
- Drugs used for UTI
- Antileprotic Drugs
- Antifungal Drugs
- Antiviral Drugs
- Antimalerial Drugs
- Antiamoebic and Antiprotozoal Drugs
- Anthelmintics

4. Hormones and Related Drugs

- Anterior Pituitary Hormones
- Thyroid Hormones and Thyroid Inhibitors
- Insulin, Oral Hypoglycaemics and Glocagon
- Corticosteroids
- Oxytocin and Drugs acting on Uterus

References:

1. **Satoskar and Bhandarkar**
2. **KD Tripathi**

Module CR-VI

Clinical Research Guidelines I

1. CDSCO Guideline Published by Ministry of Health and Family Welfare, *Guideline for Bioavailability and Bioequivalence Studies.*
2. World Medical Association Declaration of Helsinki : Ethical Principles for Medical Research Involving Human Subjects.
3. Drugs and Cosmetics Act, Schedule Y
4. *Guideline For Good Clinical Practice E6(R1)*
5. EMEA Guideline: *BA BE Studies for Veterinary Medicines.*
6. ASEAN Guidelines For *The Conduct Of Bioavailability And Bioequivalence Studies*
7. E2A: Clinical Safety Data Management: Definitions And Standards For Expedited Reporting.
8. E2B (M): Maintenance Of The ICH Guideline On Clinical Safety Data Management, Data Elements For Transmission Of Individual Case Safety Reports
9. E2B (R3): Revision Of The ICH Guideline On Clinical Safety Data Management Data Elements For Transmission Of Individual Case Safety Reports.
10. E2C (R1): Clinical Safety Data Management, Periodic Safety Update Reports For Marketed Drugs.
11. E7: Studies In Support Of Special Populations, Geriatrics.
12. E9: Statistical Principles For Clinical Trials.
13. FDA Comment for highly variable drugs.
14. FDA Guideline for, Waiver of In Vivo Bioavailability and Bioequivalence Studies for Immediate-Release Solid Oral Dosage Forms Based on a Biopharmaceutics Classification System.
15. EU Guidelines For, *Evaluation Of Bioequivalence Of Highly Variable Drugs And Drug Products*
16. FDA Guideline for, *Guideline For The Monitoring Of Clinical Investigations*

Module CR-VII

Drug Analysis II

1. Spectro-Analytical Methods

- IR Absorption Spectroscopy
  - Introduction
  - The Range of Infrared Radiation
  - Nomenclature of Infra spectra
  - Theory of Infrared Absorption Spectroscopy or Requirement for Infrared Radiation Absorption
  - Mathematical Theory of IR Absorption Spectroscopy
  - Linear Molecules
  - Symmetric Top Molecules
  - Asymmetric Top Molecules
  - Instrumentation
  - Single Beam and Double Beam Spectrometers
  - Mode of Vibrations of Atoms in Polyatomic Molecules
  - Factors Influencing Vibrational Frequencies
  - Selection Rules
  - Position And Intensity of Bands
  - Intensity of Absorption Bands
  - Units of Measurements
  - Application of IR Spectroscopy to Organic Compounds
  - Application of IR Spectroscopy to In-organic Complexes
  - Miscellaneous Examples
  - Attenuated Total Reflectance
  - Non-dispersive IR
  - Polythermal Beam Deflection Spectroscopy
  - Application of IR Spectroscopy to Quantitative Analysis
  - Limitations of IR Spectroscopy

- Visible Spectroscopy Colorimetry
  - Introduction
  - Theory of spectrophotometer and Colorimetry
  - Deviations from Beer's law
  - Instrumentation
  - Obtaining and Interpreting Data
  - Applications of Colorimetry and Spectrophotometry
  - Molar Compositions of Complexes
  - Spectrophotometry Titrations

- UV Spectroscopy
  - Introduction
  - Origin and Theory of UV Spectra
  - Types of Transitions of In-organic Molecules
  - Types of Transitions of Organic Molecules
  - The Shape of UV Absorption Curves
  - Transition Probability
  - Chromospheres and Related Terms
  - Effect of Conjugation
  - Solvent Effects
  - Woodward-Feiser Rules for Calculating Absorption Maximum
  - Instrumentation
  - Application of Spectroscopy to Organic Compounds
  - General Application of UV Absorption Spectroscopy

- NMR Spectroscopy
  - Introduction
  - Quantum Description of NMR
  - Rules Predicting Spin Numbers of Nuclei and Calculation of Spin Numbers of Elements Responding to NMR
  - Width of Absorption Lines in NMR
  - Number of Signals: Equivalent and Non-equivalent Protons
  - Chemical Shift
  - Chemical Shift of Different Types of Protons & Positions of PMR Signals
  - Spin-Spin Coupling: Splitting of Signals
  - Coupling Constants
  - Instrumentations
  - Relationship between Area of Peaks & Molecular Formula
  - Solvents Used in NMR
  - Interpretations of NMR Spectra
  - Application of NMR Spectroscopy
  - Limitations of NMR Spectroscopy
  - Fluorine-9 NMR
  - Phosphorus-31 NMR
  - Carbon-13 NMR

- Mass Spectroscopy
  - Introduction
  - Theory
  - Components of Mass Spectrometer
  - Recordings of Mass Spectrogram
  - Resolution of Mass Spectrometer
  - Types of the Ions Produced in Mass Spectrometer
  - General Rule for the Interpretations of Mass Spectra
  - Typical Example of Interpretation of Molecular Mass Spectra
  - Some Examples of Mass Spectra

- Quantitative Analysis
- Applications of Mass Spectroscopy

2. Chromatography

- Introduction
  - Definition
  - Types of Chromatography
  - Theoretical Principles Underlying Chromatographic Techniques
  - Theories of Chromatography
  - Development of Chromatogram
  - Qualitative and Quantitative Analysis by Chromatography

- Paper Chromatography
  - Introduction
  - Principle
  - Migration Parameter
  - Types of Paper Chromatography
  - Experimental Details for Qualitative Analysis
  - Experimental Details for Quantitative Analysis
  - Application

- Thin Layer Chromatography
  - Introduction
  - Superiority of TLC Over other Chromatographic Techniques
  - Experimental Techniques
  - Applications of TLC
  - Applications of Some Other Forms of TLC
  - Limitations
  - Scope
  - High Performance Thin Layer Chromatography

- Liquid-Liquid Partition Chromatography
  - Introduction
  - Theory
  - Solid Supports
  - Selection of Mobile and Stationary Phases
  - Solvent Systems
  - Reversed Phase Chromatography
  - Choice of Adsorption or Partition
  - Applications of Partition Chromatography

- HPLC
  - Introduction
  - Principle
  - Instrumentation

- Apparatus & Materials
- Column Efficiency And Selectivity
- Comparison of HPLC & GLC
- Applications
- HPLC Adsorption Chromatography
- HPLC Partition Chromatography

- Column Chromatography
  - Introduction
  - Principle
  - Experimental Details
  - Theory of Development
  - Column Efficiency
  - Applications of Column Chromatography

- Gel Chromatography
  - Introduction
  - Principle
  - Materials
  - Gel Preparation, Column Packing and Detectors
  - Applications
  - Advantage of Gel Chromatography

- Ion Exchange Chromatography
  - Introduction
  - Definition
  - Principle
  - Cation Exchangers
  - Anion Exchangers
  - Regeneration
  - Ion Exchange Column Used in Chromatographic Separations
  - Selection of Suitable Systems
  - Ion Exchange Capacity
  - Ion Exchange Techniques
  - Applications of Ion Exchangers

- Gas Chromatography
  - Introduction
  - Principle of Gas Chromatographic Separations
  - Gas-Liquid Chromatography
  - Instrumentation
  - Evaluation
  - Retention Volume
  - Resolution
  - Branches of Gas Chromatography
  - Applications

- Gas-Solid Chromatography
- Gas Chromatography-Mass Spectrometry (GC-MS)

Reference:

1. "Pharmaceutical Analysis", Kasture AV; Wadodkar SG; Volume II, Nirali Prakashan.

Module CR-VIII

Introduction to Database and Oracle

1. Database Architecture:

- Data Architecture
- Data Abstraction
- Instances & Schemes.

2. Data model:

- E-R Model
- Network Data Model
- Hierarchical Data Model
- Relational Data model

3. Database Storage Structure:

- Indexing
- Hashing
- ISAM
- B+ Tree indexed files & B Tree indexed files
- Static Hash functions and Dynamic Hash functions

4: ORACLE Objects:

- Tables
- Views
- Indexes
- Sequences
- Synonyms
- Snapshots

5. Oracle Architecture:

- Database
  - Table space
  - Data files
  - Blocks
  - Extents
  - Segments
- Oracle Background Processes:
  - PMON
  - SMON
  - LGWR
  - CKPT
- Oracle Instance Startup, Shutdown/Init.ora, Control files:

6. Oracle Memory Management –

- SGA

- Rollback Segments
- Redo logs/Archival
- Transaction Control & Locking / Dead Lock
- Security
- Grants
- Roles
- Privileges

7. Oracle Utilities

- Oracle Server Manager
- Export-Import/SQL Monitor Backup & Recovery (Archiving)
- Physical Storage & Logical Storage

8. Oracle Reports

- Reports Features
- Full Integration with Forms and Graphics
- Data Model and layout editors

9. Layout Objects

- Frames & Repeating Frames
- Fields and Anchor
- Interface Components
- Report Formats
- Single Query and Multi Query
- User Defined Columns
- PL/SQL Interface/ Triggers
- Packaged Procedure
- Calling Report from a Form

10. Menus

- Default Menus, Custom Menus
- Menu Objects, Menu Module
- Main Menu, Individual Menus, Sub Menus
- Menu Items;
  - Menu Editor
  - PL/SQL in Menu Modules
  - Menu Security

11. SQL (Structured Query Language)

- Data Definition Statements
- Data Manipulation Statements
- Data Control Statements
- Other Database Objects
- Transaction control statements.
- Joins
- Unions

- Views
- Sequences
- Synonyms

References:

1) Database System Concepts; Hanery Korth and Abraham Silberschatz; Tata Mac-Graw Hill Publications

2) Parallel and Distributed Databases; Wilteach et.al.

3) Simplified approach to DBMS; Parteek Bhatia and Guruvinder Singh

4) Introduction to Database Systems; C.J.Date

5) Database system organization; J.M. Martin; Princeton-Hall.

6) Introduction to Database systems; J.M. Martin; Princeton-Hall

Module CR-IX

Clinical Research Guidelines II

1. E1: The Extent of Population Exposure to Assess Clinical Safety for Drugs Intended for Long-Term Treatment Of Non-Life-Threatening Conditions
2. E2B: Implementation Working Group Questions & Answers (R5)
3. E2D: Post-Approval Safety Data Management Definitions and Standards for Expedited Reporting
4. E2E: Pharmacovigilance Planning
5. E3: Structure and Content of Clinical Study Reports
6. E4: Dose-Response Information To Support Drug Registration
7. E5 (R1): Ethnic Factors in the Acceptability of Foreign Clinical Data
8. E5: Implementation Working Group, Questions & Answers
9. E8: General Considerations for Clinical Trials
10. E10: Choice Of Control Group And Related Issues In Clinical Trials
11. E11: Clinical Investigation of Medicinal Products in the Pediatric Population
12. E12A: Principles for Clinical Evaluation of New Antihypertensive Drugs
13. E14: The Clinical Evaluation of QT/QTC Interval Prolongation and Proarrhythmic Potential for Non-Antiarrhythmic Drugs
14. Guidance for Industry Pharmacogenomic Data Submissions
15. Attachment to Guidance on Pharmacogenomic Data Submissions Examples of Voluntary Submissions or Submissions Required under 21 CFR 312, 314, or 601
16. Guidance for Clinical Trial Sponsors Establishment and Operation of Clinical Trial Data Monitoring Committees
17. RatioPharm, Highly Variable Drugs and Drug Products (HVD/HVDP) overview
18. Guidance for Industry Part 11
    - Electronic Records
    - Electronic Signatures — Scope and Application

Module CR-X

Pharmaceutical Jurisprudence

1: Man and His Laws

- Religion
- Ethics
- Law

2: Pharmaceutical Legislations

- Advent of Allopathic System
- The 19th and early 20th Centuries
- Drugs Enquiry Committee and Aftermath
- The Drugs Act
- Pharmacy Act and other Legislations

3: The Pharmacy Act

- Introduction
- Objectives of the act
- The Pharmacy Council of India
- State Pharmacy Councils
- Preparation of the First Registers by State Governments
- Offences and Penalties
- Miscellaneous

4: Narcotic and Psychotropic Substances Act and Rules

- Introduction
- Narcotic Drugs and Psychotropic Substances
- Controlled Operations
- Offences and Penalties
- Procedures
- Miscellaneous
- Cultivation. Production, Sales, etc. of Opium
- Manufacture of Manufactured Drugs and Psychotropic Substances
- Import, Export, Transshipment of Narcotic Drugs and Psychotropic Substances

5: Drugs and Cosmetic Act

- Introduction
- Import of Drugs
- Manufacture of Drugs
- Sales of Drugs
- Labeling and Packaging of Drugs
- Administration of the Act
- Provisions applicable to Ayurvedic, Siddha and Unani Drugs
- Provisions applicable to Homeopathic Drugs
- Provisions applicable to Cosmetics
- Miscellaneous

6: Poison Act

- Introduction
- Import of Poisons
- Possession and Sales of Poisons
- Penalties for Offences under the Act
- Issue of Warrants
- Rules

7: Medical Termination of Pregnancy Cat, 1971

- Introduction
- Termination of Pregnancies
- Offences and Penalties
- Rules and Regulations

8: Drugs and Magic Remedies (Objectionable Advertisements) Act and Rule

- Introduction
- Definitions
- Prohibited Advertisements
- Prohibition of Import and Export of Advertisements
- Penalties
- Miscellaneous

9: Prevention of Cruelty to Animals Act

- Introduction
- Experimentation on Animals
- Penalties

Reference:

1. 'Pharmaceutical Jurisprudence' by BM Mittal, BITS Pilani.

Module CR-XI

Drug Analysis III

1. Modern Pharmaceutical Analysis: An Overview

- Identity and Purity Requirements
- Bioavailability/Dissolution Requirements
- Regulatory Considerations
- Regulatory Compliance
- International Conference on Harmonization
- Global CMC NDA
- Highlights of Modern Pharmaceutical Analysis

2. Combinatorial Chemistry and High-Throughput Screening in Drug Discovery and Development

- Introduction
- Combinatorial Methods
- Methods for Structural Assignment
- Diversity
- Drug-likeness
- Designing Combinatorial Libraries with Optimal ADME Properties
- Existing Computational Methods for ADME Properties
- Optimization Philosophy
- Applying Existing ADME Models to Combinatorial Library Design
- The Future of ADME Modeling
- High-Throughput Screening and Combinatorial Chemistry
- Assay Plate Formats: Move to Miniaturization
- Non-separation or Homogeneous Assays
- Identification of Receptor Antagonists for Chemokine Receptor and Bradykinin-1 by Screening a 150,000-Member Combinatorial
- Library
- Structure-based Design of Somatostatin Agonists

3. Preformulation Studies

- Introduction
- Preformulation Studies
- Analytical Techniques and Instruments for Preformulation Studies
- Regulatory Requirements for Preformulation

4. Solid Dosage-Form Analysis

- Introduction
- Physicochemical Characterization Techniques
- Near-Infrared Analysis
- Automation
- Future Directions

5. Parenteral Dosage Forms

- Characteristics of Parenteral Dosage Forms
- Pharmaceutical Analysis During Formulation and Process Development
- Analytical Testing for Finished Parenteral Products
- Packaging Components Testing
- Process Development Support
- In-Process Testing
- Release Testing
- Raw Material Testing
- Validation of Analytical Procedure
- Stability-Indicating Methods
- Method Transfer
- Cleaning Method Validation
- Admixture Studies
- Microbiological Testing of Parenteral Formulations
- Sterility Testing

6. New Drug Delivery Systems

- Introduction
- Oral Drug Delivery
- Direct Drug Delivery
- Dermatological Delivery System
- Tumor-Targeted Drug Delivery Systems
- Biodegradable Drug Delivery System
- Protein Drug Delivery System
- Devices

7. Validation of Pharmaceutical Test Methods

- Background and Chapter Overview
- Validation Terminology and Definitions
- Method Development and Its Influence on Method Validation
- Validation Requirements of The Method
- Validation Documentation

- Validation Experimentation
- Method Transfer
- Revalidation
- Reference Standards

8. Stability Studies

- Introduction
- Operational Issues
- Excipients
- Drug Substance
- Drug Product

9. Pharmaceutical Analysis Documentation

- Scope
- Introduction
- Pharmaceutical Analysis During Product Life Cycle
- Regulatory Documents
- Compliance Documents
- Research Documents

Reference:

1. **'HANDBOOK OF MODERN PHARMACEUTICAL ANALYSIS' Satinder Ahuja** *Ahuja Consulting, Calabash, North Carolina;* **Stephen Scypinski,** *RW Johnson Pharmaceutical Research Institute, Raritan, New Jersey.*

Module CR-XII

Advances to Database and Oracle

1: Basic Concepts

- Introduction to Database
- Database System Concepts and Architecture
- Entity-Relationship Model

2: Relational Databases

- Relational Model
- Relational Algebra & Calculus
- Relational languages SQL and QBE
- RDBMS Systems: SQL server and MS Access

3: Object-Oriented Database Systems

- Object-Oriented Concepts
- Object-Oriented Databases
- Object Database Languages
- Object Database Design
- Object-Relational and Extended Relational Database Systems

4: Database Design

- Functional Dependencies
- Normalization

5: System Implementation Techniques

- Query Processing and Optimization
- Transaction Processing
- Concurrency Control
- Recovery
- Security and Authorization

6: Advances in Database Environment

- Distributed Databases
- Data Fragmentation, Replication and Allocation
- Distributed Query Processing
- Distributed Concurrency Control
- Client-Server Architecture
- Program Evaluation
- Multimedia Databases
- Data Warehousing
- Data Mining
- OLAP

7: PL/SQL

- Procedural Statements
- Database Triggers
- Built-in and User-defined Functions
- Package to organize PL/SQL code
- Expressions with Operators
- Cursors in PL/SQL blocks
- Types of cursors: Implicit and Explicit cursors.

References:

1. Database Management and Design by G. W. Hansen and J. V. Hansen, Prentice-Hall of India, Eastern Economy Edition, Latest Edition.

2. Database System Concepts by A. Silberschatz, H.F. Korth and S. Sudarshan, 3rd edition, McGraw-Hill, Latest International Edition.

3. Database Systems: The Complete Book by Garcia-Molina, J. D. Ullman, and J. Widom. , Prentice Hall, Latest Edition.

4. Fundamentals of Database Systems by Ramez Elmasri and Shamkant B. Navathe, Addison- Wesley. Latest Edition

5. Database Management Systems by R. Ramakrishnan and J. Gehrke., McGraw-Hill.

6. Database Systems by T. Connolly and C. Begg. , Addison-Wesley, Latest Edition.

Module CR-XIII

Clinical Research Management

1. The Food and Drug Administration Past and Present

- The Establishment of the Food and Drug Administration;
- The History of the Legislation and Regulations, which Govern the Clinical Research Process
- The History of the Legislation and Regulations, which Protect the Rights, Safety, and Well-Being of Human Subjects.

2. Overview of Medicinal Product Research and Development

- Drug Discovery and Pre-Clinical Research;
- The Clinical Research and New Drug Application Approval Process;
- The Biologics Research, Development, and Licensing Process;
- Medical Device Research, Development, and Marketing.

3. Good Clinical Practice (GCP)

- Investigational New Drug Application 21 CFR 312: Sponsor's Obligations;
- Investigational New Drug Application 21 CFR 312: Investigator's Obligations;
- Institutional Review Boards 21 CFR 56;
- Protection of Human Subjects 21 CFR 50;
- Financial Disclosure 21 CFR 54.

4. International Conference of Harmonization

- The History of the International Conference of Harmonization;
- The ICH Good Clinical Practice Consolidated Guideline (E6);
- The ICH Clinical Safety Data Guideline (E2).

5. Clinical Trial Development

- Protocol Design and Development;
  - Bioavailability and Bioequivalence study
  - Clinical Trials
- Case Report Form Design and Development;
  - Bioavailability and Bioequivalence study
  - Clinical Trials
- Principles of Data Management and the Query Resolution Process;
- The Study Types Providing Expanded Access to Investigational Products.

6. Clinical Trial Management

Investigator Site Perspective: Coordinating a Clinical Trial at the Site

- Essentials of Source Documentation;
- Maintaining and Managing Essential Documents;
- Recording and Reporting Non-Serious and Serious Adverse Events.

Sponsor's Perspective: Managing a Clinical Trial

- Selecting Investigators and Monitors;
- Maintaining and Managing Essential Documents (e.g. FDA Form 1572);
- Case Report Form Data Transmission and Generation of the Clinical Study Report;
- Reviewing and Reporting of Serious Unexpected Adverse Drug Experiences;
- Implementing a Monitoring Plan and Performing Quality Control.

7. Monitoring Obligations and Methods

- Monitoring Role and Responsibilities According to the FDA Guideline;
- Monitoring Role and Responsibilities According to ICH Good Clinical Practice Consolidated Guideline (E6);
- Monitoring Responsibilities: Type of Monitoring Visits, Monitoring Activities Pre-Visit, On-Site, and Post Visit;
- Monitoring Method: Implementing a Systematic Monitoring Approach to Effectively Monitor a Multi-Center Trial;
- Problem Solving and Trouble Shooting GCP / ICH Issues;
- Writing Strategic Monitoring Reports and Follow-Up Visit Letters.

8. Project Management

- Timelines
- Gantt Chart (Microsoft Project)
- Budgeting

References:

1. **'Conducting GCP-Compliant Clinical Research' W. Bohaychuk and G. Ball**
2. **ICH GCP E6 Guidelines by US FDA**

Module CR-XIV

Communication Skills

1. Language And Communication
2. Non-Verbal Communication
3. Communication In Organization
4. Dyadic Communication
5. Meetings
6. Seminars and Conferences
7. Group Discussions
8. Audio-visual Aids
9. Formal Reports
10. Style
11. Technical Proposals
12. Business correspondences
13. Notices, Agenda and Meetings
14. Handbooks and Manuals
15. Research Papers and Articles
16. Advertising and Job Descriptions
17. Graphic Aids
18. Copy Editing
19. Punctuation and Capitalization
20. Words commonly misspelt
21. Abbreviations and Numerical.

Reference:

1. "Developing Communication Skills'; by Krishna Mohan and Meera Banerji; BITS Pilani, Rajasthan.

Chancellor's Message

It is my pleasure to welcome you to join constituent colleges of Mahatma Gandhi Misson's (MGM) University of Health Sciences, Navi Mumbai. I wish to avail this opportunity to apprise you and your parents about the academic excellence of the deemed university.

The MGM University of Health Sciences was established u/s 3 of UGC Act, 1956 vide HRD Notification No.F.9-21/2005-U.3(A) dated 30-8-2006. The MGM University is an outcome of untiring efforts of our educationists, professionals, social activists, technocrat, students and parents. The Mahatma Gandhi Mission Trust that manages the University of Health Sciences and over 40 institutions in Navi Mumbai, Aurangabad, Nanded, and Noida has the vision to empower the masses with the availability of state-of-the-art education. Most of our institutions have ISO certifications that further endorse our commitment to stringent quality standards. I am proud to state that we have succeeded in these accomplishments during our journey of the past 25 years.

I recollect the memories of struggle and determination when the MGM Trust established its two medical colleges, one each at Navi Mumbai and Aurangabad some twenty years ago. Both the medical colleges have grown into institutions imparting both undergraduate and postgraduate courses, and delivering quality health care to communities in their respective areas. While both colleges are engaged in their primary functions of teaching, also excelled in their pursuit for advancement of science and in taking health services to communities through extension programmes. A shining example is the establishment of the Department of Infectious Diseases in 1993 in collaboration with the University of Texas-Houston, USA. This department has established the state-of-the-art clinical services and laboratories for research and care of infectious diseases and received the acclaim of Director General of ICMR when he stated "MGM is the first medical college in India to establish a separate department of infectious diseases. This is the need of the hour." The department has undertaken path-breaking research and shaped the course of our national control programmes on HIV/AIDS and tuberculosis. The original research of the constituent colleges has been acclaimed among the scientific world globally.

In an era of economic liberalization and the competition among varsities, both in and out of India, the task of grooming professionals who will compete with the best in the world , is tough. To aid our efforts to excel, MGM University of Health Sciences has the latest research facilities, a dedicated research faculty, as well as an array of distinguished visiting faculty members. The quiet ambience of our campuses, the well filled library with subscriptions to international and national journals, and the lush-green gardens add to our accomplishments.

educational, industrial agricultural, and health sector to maintain their steady growth, several fresh M.Sc. courses have courses have been launched. M.Sc. courses introduced at the
University from the current academic year shall provide knowledge, skills and subsequent employability that are at par with the counterparts in India and abroad. The curricula of the courses have been designed by experts and peer-reviewed with an emphasis on the job requirements of educational institutions, industries, health care, and research institutions. These courses will empower the students to choose a career in a classroom, a research laboratory or an industry. I am happy that the university is ticking towards the pinnacle with the introduction of these value-added postgraduate courses in medical biotechnology, medical genetics and other basic sciences.

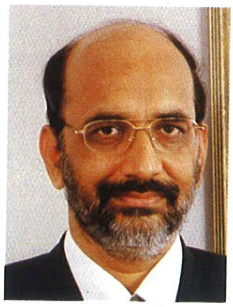
Finally, I wish to place on record my gratitude to the founder members, stake-holders, faculty, staff, students and their parents for providing the MGM Trust with your advice and support.

Once again, it is my pleasure to welcome you to join constituent colleges of MGM University of Health Sciences' at Navi Mumbai and Aurangabad.

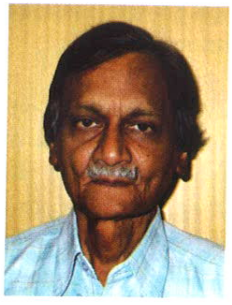
Kamal Kishore Kadam

Dr R.D.Bapat
Vice Chancellor

Dr S.N.Kadam
Pro Vice Chancellor



Dr N.N.Kadam
Director (Examination)



Dr Ajit shroff
Dean (Aurangabad Campus)

Dr Z.G. Badade
Registrar

Dr G.S.Narshetty
Dean (Navi Mumbai Campus)

Module CR-XV

Project

IN PURSUIT OF EXCELLENCE

MGM DEEMED UNIVERSITY OF HEALTH SCIENCES

Constituent Colleges

Navi Mumbai

M.G.M. Medical College
M.G.M School of Biomedical Science
M.G.M School of Physiotherapy
M.G.M New Bombay College of Nursing
M.G.M College of Nursing

Aurangabad

M.G.M. Medical College
M.G.M School of Biomedical Science
M.G.M School of Physiotherapy
M.G.M College of Nursing

MAHATMA GANDHI MISSION

AURANGABAD

- MGM's Jawaharlal Nehru Engineering College
- MGM's Institute of Management
- MGM's Mother Teresa College of Nursing
- MGM's Mother Teresa Institute of Nursing Education
- MGM's College of Journalism & Media Science
- MGM's Medical Center & Research Institute
- MGM's College of Fine Arts
- MGM's Dr. D. Y. Pathrikar College of Comp. Sc. & Tech.
- MGM's Hospital & Research Center
- MGM's College of Agricultural Bio-Technology
- MGM's Dept. of Bio-Technology & Bio-informaties.
- MGM's Inst. of Hotel Management & Catering Tech.
- MGM's Institute of Indian & foreign Languages & Comm.
- MGM's College of Physiotherapy
- MGM's Hospital, Ajabnagar
- MGM's Sangeet Academy (Mahagami)
- MGM's Institute Naturopathy & Yoga
- MGM's Sports Club & Stadium
- MGM's Institute of Vocational Courses
- MGM's Horticulture
- MGM's Health Care Management
- MGM's Junior College of Education (Eng. & Mar.)
- MGM's Sanskar Vidyalaya (Pri. & Sec. - Mar.)
- MGM's Clover Dale School (Pri. & Sec. - Eng.)
- MGM's First Steps School (Pre-Primary - English)
- MGM's Sanskar Vidyalaya (Pre-Priamary - Marathi)
- MGM's School of Biomedical Sciences

NAVI MUMBAI

- MGM's College of Engineering & Technology
- MGM's Institute of Management Studies & Research
- MGM's Dental College & Hospital
- MGM's College of Physiotherapy
- MGM's College of Media Science
- MGM's Institute of Research
- MGM's New Bombay Hospital, Vashi
- MGM's Hospital, CBD
- MGM's Hospital, Kamothe
- MGM's Hospital, Kalamboli
- MGM's Infotech & Research Centre
- MGM's Pre-Primary School (English & Marathi)
- MGM's Primary & Secondatry School (Eng. & Mar.)
- MGM's Junior College Science
- MGM's Junior College of Vocational Courses
- MGM's Florence Nightingale Inst. Nursing Edu.
- MGM's College of Nursing
- MGM's College of Law

NANDED

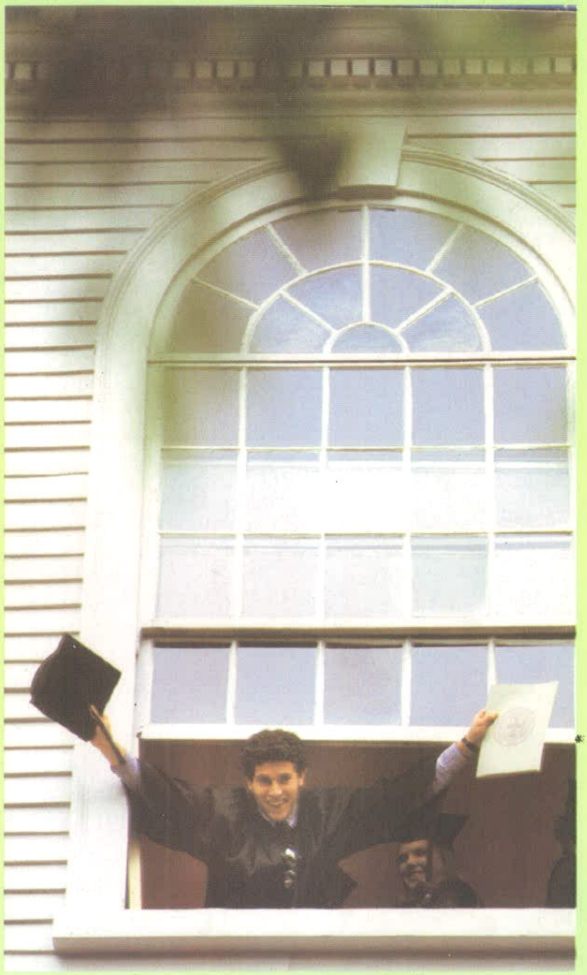
- MGM's College of Engineering
- MGM's College of Fine Arts
- MGM's College of Computer Science
- MGM's College of Journalism & Media Science
- MGM's Centre for Astronomy & Space Tech.
- MGM's College of Library & Information Science

PARBHANI

- MGM's College of Computer Science

NOIDA (U.P.)

- MGM's College of Engineering & Technology



MGM University of Health Sciences
(Education - Health Services - Research)
A Mission started, nurtured and Managed
by Professional Doctors, Scientists Engineers...

MGM INSTITUTE OF HEALTH SCIENCES
(Deemed University u/s 3 of UGC Act, 1956)

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Website: www.mgmuhs.com

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.

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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