



Janardan Bhagat Shikshan Prasarak Sanstha's
Changu Kana Thakur Arts Commerce & Science College
(Autonomous)

Re-accredited 'A+' Grade by NAAC
'College with Potential for Excellence' Status Awarded by UGC
'Best College Award' by University of Mumbai

Affiliated to University Of Mumbai

Revised syllabus of
Program: Bridge Course in Mathematics and
Statistics for Biotechnology

(w.e.f. the Academic Year 2019-2020)

Bridge Course in Mathematics and Statistics for Biotechnology

Eligibility: prerequisite course for Students without Mathematics at XI & XII standard

Duration: 15Hrs. (One Academic Year)

Fee:

Seats: As per demand of the students

Infrastructure Requirements:

- Well Equipped Lecture room
- Well Equipped Laboratory
- Library with relevant books
- LCD Projector

Staff Requirement:

- A coordinator who will be responsible for the smooth conduct of the course.
- Coordinator of the course may be paid an Honorarium of Rs.1000/- per year
- A lecture and practical can be conducted by the core faculty or visiting having expertise in concerned field. Guest Faculty/internal Faculty may be remunerated @ Rs.200/- per lecture of 1 hr. Duration.
- Faculty must possess at least a Bachelor Degree with a expertise respective filed.
- Faculty from industry and research institutes.

Theory Question Paper Pattern:

Question 1	Objectives Questions with options	20 marks
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Course content:

Course Name	Theory Hours
Bridge Course in Mathematics and Statistics	15Hrs

Bridge Course in Mathematics and Statistics for Biotechnology

Unit	Unit name	Topics	Lectures /Hrs
1	Review of algebra	<ol style="list-style-type: none"> 1. Arithmetic and geometric progressions. 2. Logarithm 3. Polynominal Equations, Rational roots 4. Functions: The Exponential Function, ax and $\log x$ 5. Exponential growth and Decay. 6. Graphs of Functions 7. Linear equations 8. Quadratic Functions and equations 9. Sequences 	6
2	Calculus	Differential calculus (limits, derivatives), integral calculus (integrals, sequences and series <i>etc.</i>).	5
2	Preliminary :Descriptive statistics	<ol style="list-style-type: none"> 1. Introduction 2. Frequency Tables, Histograms 3. Measures of Central tendency : Mean and Median 4. Measures of Dispersion: Variance and Standard deviation. 	2
3	Basic Probability	<ol style="list-style-type: none"> 1. Introduction: Sample Space and Events 2. Axioms of Probability and simple examples 	2

REFERENCE:

1. SCHAUM'S outline of Theory and Problems of College Mathematics 3rd edition, by Philip. A Schmidt and Frank Ayres, Tata McGraw Hill publication/Chapters 2, 3, 4, 5, 12, 39, 41, 45, 46, 48.
2. SCHAUM'S outline of theory and Problems of Introduction to Probability and Statistics by Seymour Lipschutz and John J. Schiller. Tata McGraw Hill publishing Ltd. Chapters 1.1, 1.2, 1.3, 1.4, 3.1, 3.2, 3.3, 3.4.
3. THOMAS CALCULUS 11th edition , by George B Thomas Maurice D. Weir, Joel Hass, Frank R. Giordano, Pearson Addison Wesley 1.3, 2.1, 2.2, 3.1, 3.2, 3.3, 5.3, 7.3, 7.4, 7.5, 8.1, 11.1.
4. Calculus & Analytical Geometry Thomas & Finney.

Evaluation System:

Sr. No	Exam No.	Name of the Students	Theory	Percentage %	Remarks	Grade
		Maximum Marks	50			
		Minimum Marks	17			
		Obtained Marks				

Slander of Passing: 40%

Grading System:

A Grade Above 75%

B Grade 60-74%

C Grade 40-59%



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Program: certificate course
Course: Certificate Course in Clinical Studies and
Data Analysis

(w.e.f. the Academic Year 2019-2020)

Eligibility:	XII (Science) Pass
Duration:	60Hrs. (One Academic Year)
Fee:	Rs. 5,000/-
Seats:	As per the demand of the students

Infrastructure Requirements:

- Well Equipped Lecture room
- Well Equipped Laboratory
- Library with relevant books
- 2-Computers with printer
- Licensed Software (SPSS/SAS)

Staff Requirement:

- A coordinator who will be responsible for the smooth conduct of the course.
- Coordinator of the course may be paid an Honorarium of Rs. 1000/- per year
- A lecture and practical can be conducted by the core faculty or visiting having expertise in concerned field. Guest Faculty/internal Faculty may be remunerated @ Rs.200/- per lecture of 1 hr. Duration.
- Faculty must possess at least a Bachelor Degree with an expertise respective filed.
- Faculty from industry and research institutes.

Theory Question Paper Pattern:

Question 1	From Unit 1, 2	20 marks
Question 2	From Unit 1	15 marks
Question 3	From Unit 2	15 marks
	Total	50 marks

Course content:

Course Name	Contact Hours				Credits			
	Paper-I	Paper-II	Practical	Project/ Industrial Visit	Theory	Practical	Project / I.V.	Total Credits
Certificate course in Clinical Studies and Data Analysis	15	15	15	15	02	01	01	04

Total Duration: 60 hrs (One academic Year).

Theory: 30 hrs.

Practical :15Hrs

Project/ I.V. / Case study: 15Hrs

Paper –I

Clinical Studies

(50marks)

Unit 1

Introduction to Clinical studies and research: Principles of ICH –GCP, declaration of Helsinki, Belmont report. Nuremberg code, World Health Organization (WHO)

Drug development and pharmaceutical research, Clinical research: Definition, design, type and scope of clinical studies and research. Phases of clinical trials. Regulations and Ethics committee. Protocol design and documentation in clinical trials.

Concept of research methodology: data handling, data processing, information seeking methods, data collection, processing, interpretation and applications. Careers in clinical research.

Unit 2

Preclinical and research: Requirement of Pre-clinical research. Number and types of animal studies in preclinical research, CPCSEA/OECD guidelines, recognition of animal house, food and diseases of experimental animals, understand protocols for pre- clinical studies, importance of these investigations, importance of ethical committee.

Physico-Chemical properties of drugs, different drug dosage forms, Formulation development and manufacture of drugs. Post Marketing Surveillance (PMS/Phase IV studies)

Paper –II (Data Analysis)

(50marks)

Unit 1

Basic Statistics: Requirement for clinical research. Central tendency, dispersion, variance, testing of hypothesis, tests of significance, regression, and correlation.

Clinical Data Management: Principles of Clinical Data Management (CDM), Data Entry, Queries & Data Clarification, Software in CDM

Medical Writing: Protocol writing, Literature Search & Medical Articles, Contract writing, Publication, Abstracts, Bibliography, Clinical Study Reports

Computer Skills: MS-Office: Introduction to MS- Office, Introduction to Word, Excel, PowerPoint, and Internet search engines

Unit 2

Pharma-industry overview: Structure, composition, operation of various departments in pharmaceutical industries, Safety Monitoring, judicial aspects of Pharma industry, patent, World Trade Organization (WTO), GATT Indian regulatory agencies such as FDA, schedule Y.

List of Practical:

1. MS -Word
2. MS-Power Point
3. Introduction to MS-EXCEL- Use of worksheet to enter data, edit data, copy data, move data.
4. MS-Excel with reference statistical applications
5. Use of Bar diagram, histogram, scatter diagram.
6. Internet usage
7. Case studies
8. Project work and presentation

Books and References:

1. Research in education by J W Best and J V Khan Prentice Hall of India, New Delhi.
2. Pharmaceutical Statistics by Sanford Bolton, Marcel Dekker, New York, USA.
3. Elementary Statistical quality control, I W Burr, Marcel Dekker, New York, USA.
4. Managing the clinical drug development process, C. Nardi, Marcel Dekker, New York, USA.
5. Basic managerial skills for all by E H Mcgrath, Prentice Hall of India, New Delhi.
6. Organization behavior by Pearson Education Asia, Tata Mc Graw Hill, New Delhi.
7. Clinical Research Environment in India by Umakanta Sahoo, Faiz Kermani, Icfai University Press.

Evaluation System:

Sr. No	Exam No.	Name of the Students	Theory		Practical	Project/Industrial Visit /case study	Total Mark	%	Credits	SGPA
			Paper -I	Paper -II						
		Maximum Marks	50	50	50	50	200		04	
		Minimum Marks	20	20	20	20				

Credit Earned:

Grade:

Remarks:

Slander of Passing: 40%

Separate head of passing-Theory, Practical's, Project / Industrial Visit/Case study

Grading System:

A Grade	Above 75%
B Grade	60-74%
C Grade	40-59%



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Program: Diploma course
Course: Diploma Course in
Food Analysis and Quality Assurance

(w.e.f. the Academic Year 2020-2021)

PREAMBLE:

The present diploma course in food analysis and quality assurance has been designed with keeping in mind the enormous expansion of food sector and customer awareness, safety and quality assurance which has become a very vital hitch to be addressed in the current decade.

The course focused on the application of qualitative and quantitative techniques used in the physical, chemical, sensory and instrumental examination of food products. The aim of the laboratory sessions is to give students experience in performing food analysis experiments. In addition, students are expected to work in teams on a project where they will identify and critically assess the most appropriate analytical methods for analyzing the properties of a particular food product.

Food Safety Regulations in India has reached global standards with the introduction of Food Safety and Standards Act 2006 in the year 2011. With this, requirement of adequately trained manpower to be a part of Food Safety Quality Assurance and Regulatory Systems has increased immensely. This has opened an enormous job opportunity for adequately trained human resource in the area.

The Diploma programme is intended to prepare students for active job opportunities in food safety and quality assurance, monitoring and certification process in the food industry .

Course Objectives:

1. To impart knowledge of various areas related to Food Science and Technology.
2. To train students in the various techniques of food analysis and regulatory affairs.

Course Outcomes: students will learn:

1. The basic principles of gravimetric, colorimetric, titrimetric, chromatographic and spectrometric analyses as applied to foods.
2. Gain knowledge about food constituents and characteristics important in quality control and research laboratories.
3. Enable the students to understand food composition and its physicochemical, nutritional, microbiological and sensory aspects,
4. Familiarize the students about the processing and preservation techniques of pulses, oilseeds, spices, fruits and vegetables, meat, fish, poultry, milk & milk products,
5. Learn the importance of food safety, food quality, food plant sanitation, food laws and regulations, food engineering and packaging in food industry.

Title	:	Diploma course in Food Analysis and Quality Assurance.
Eligibility	:	<p>The minimum qualifications required for admission to the course are as follows: The applicant should possess a B.Sc. degree of University of Mumbai or any recognized University and should have offered the following subjects at the various examinations as shown below: -</p> <p>a) He/She must have offered Chemistry as one of the subjects at any one level of the three-year degree course.</p> <p>b) He/She must have offered one of the following subjects at least at the T.Y. B.Sc. level of the three-year degree course: - i) Physics ii) Botany, iii) Zoology, iv) Life Sciences, v) Micro-biology, vi) Bio-Chemistry vi) Biotechnology</p> <p style="text-align: center;">a. OR</p> <p>c) Possessing Bachelor's degree of Fisheries Sciences, Bachelor's degree in Horticulture/Agriculture from A Statutory University.</p>
Duration	:	One Year
Credits	:	20 (Total 300 Hours)
Seats	:	30 Students per Batch
Credits	:	Theory 12 Credits (180 Hours)
	:	Practical & Project 8 Credits (120 Hours)
Examination	:	Total Marks: 200 marks
	:	Theory Paper I: 50 Marks Paper II: 50 Marks
	:	Practical & Project Practical: 50 Marks Project & Presentation: 50 Marks
Passing Criteria :	:	To pass a diploma examination a student must obtain 45% marks in each paper and 50% as aggregate (University circular (No.UG /1 of 2012))

Infrastructure Requirements:

- Well Equipped Lecture room
- Well Equipped Laboratory
- Library with relevant books
- LCD Projector

Staff Requirement:

- A coordinator who will be responsible for the smooth conduct of the course.
- Coordinator of the course may be paid an Honorarium of Rs.1000/- per year
- A lecture and practical can be conducted by the core faculty or visiting having expertise in concerned field. Guest Faculty/internal Faculty may be remunerated @ Rs.200/- per lecture of 1 hr. Duration.
- Faculty must possess at least a Bachelor Degree with an expertise respective filed.
- Faculty from industry and research institutes.

Theory Question Paper Pattern:

Question 1	From Unit 1, 2	20 marks
Question 2	From Unit 1	15 marks
Question 3	From Unit 2	15 marks
	Total	50 marks

Course content:

Course Name	Contact Hours				Credits			
	Paper-I	Paper-II	Practical	Project / Industrial Visit	Theory	Practical	Project/I.V.	Total Credits
Diploma course in Food Analysis and Quality Assurance	90	90	60	60	12	04	04	20

Total Duration: **300 hrs.** (One academic Year). Theory: **180 hrs.** Practical :**60Hrs**; Project/ I.V. / Case study: **60Hrs**

Credit Earned:

Grade:

Remarks:

Standards of Passing: 40

Separate head of passing-Theory, Practical's, Project / Industrial Visit/Case study

Grading System:

A Grade	Above 75%
B Grade	60-74%
C Grade	40-59%

Syllabus

Paper-I Fundamentals of Food Sciences and Food Analysis		
Unit-I		Lectures (45)
Module -I Food Chemistry	<p>Food Chemistry of:</p> <ul style="list-style-type: none"> • Water in food, water activity, and shelf life of food. • Carbohydrates: Functional properties of sugars and polysaccharides in foods. Modified celluloses and starches • Lipids: Use of lipids in foods, physical and chemical properties. • Protein and amino acids: Functional properties of proteins- organoleptic, solubility, viscosity, binding gelation / texturization, emulsification, foaming. • Effect of processing on loss of vitamins and minerals. • Enzymes in food processing Browning Reactions in Food, Maillard reaction, Caramelization reaction and Ascorbic acid oxidation. 	15
Module -II Food Microbiology	<p>Importance and significance of microbes in food science:</p> <ul style="list-style-type: none"> • Sources of Microorganisms in foods, Some important food spoilage bacteria. • Types of microorganisms associated with food, their morphology and structure and Significance of spores in food microbiology • Food as a substrate for microorganism, factors affecting growth of microbes: pH, water activity, O-R potential, nutrient contents and inhibitory substance. • Spoilage of specific food groups- Milk and dairy products, Meat, poultry and seafoods, Cereal and cereal products, Fruits and vegetables and Canned products • Food borne intoxications and infections: bacterial, viral and protozoan food borne disease. 	15
Module -III Food Processing and Packaging	<p>Principles and practices in food processing.</p> <ul style="list-style-type: none"> • Principles and methods of preservation with their significance: Physical Methods of Food Preservation-thermal and non-thermal techniques Dehydration, Freezing, Cool Storage, Irradiation, and fermentation. • Principles and applications of hurdle technology in food preservation. • Separation methods used in food processing. 	15

	<ul style="list-style-type: none"> • Packaging: Properties of packaging material, factors determining the packaging requirements of various foods and brief description of packaging of frozen products, dried products, fats and oils and thermally processed foods. Advances in food packaging. • Food shelf life, factors affecting shelf life and Methodologies to determine foods' shelf life 	
Unit-II Module -IV Food Toxicology	<ul style="list-style-type: none"> • Principles of Toxicology: classification of toxic agents; toxicity: risk vs. benefit, Legal requirements and specific screening methods: LD50 and TD50: in vitro and in vivo studies; clinical trials. • Toxins of plant and animal origin; microbial toxins (e.g., bacterial toxins, fungal toxins and Algal toxins, mushroom toxin). • Food allergens; potential toxicity and allergenicity of GM foods, Safety of children consumables. • Food adulteration and potential toxicity of food adulterants. Fungicide and pesticide and heavy metal residues in foods and their health impacts; radioactive contamination of food. 	15
Module -V Food additives	<ul style="list-style-type: none"> • Intentional and unintentional food additives, their toxicology and safety evaluation; • Food colors and dyes: Regulatory aspects of dyes, food color (natural and artificial), • Pigments and their importance and utilization as food color; food flavors. • Acidity regulators; Emulsifiers. • Analytical methods of determination of basic food components, anti-nutritive and natural toxic compounds, food additives and food adulteration. 	15
Module -VI Analytical method of food analysis	<ul style="list-style-type: none"> • Analytical method used for quality determination: chemical and physical, microbiological, biochemical and sensory analysis. • Methods for shelf life determination. • Advanced laboratory techniques: principle, working and application of GC, HPLC, HPTLC, LC/MS, inductively coupled Plasma Mass Spectroscopy and PCR, real time PCR, ELISA, Triple Quadrapole system; chemosensors, biosensors, immunosensors. 	15

Syllabus

Paper-II Food Quality Control and Quality Assurance		
Unit-I		
Module -I Quality control and Quality assurance	<ul style="list-style-type: none"> • Quality Assessment: Quality of products during processing and after processing: Factors influencing the food qualities: Soil, field practices, harvesting practices, procedures, packaging, transportation, storage, conditions, processing conditions, packaging and storage conditions of finished products. • Concepts of quality control and quality assurance functions in food industries. Total Quality management: Quality evolution, quality gurus, defining TQM, principals of TQM. 	15
Module -II Biosafety and GLP	<ul style="list-style-type: none"> • Good Laboratory Practices (GLP)- history of GLP, areas of application, facilities, test systems, test and reference items, Standard Operating Procedure (SOP), study performance and reporting Food • Sanitation and safety: Factors contributing to physical, chemical and biological contamination in food chain, prevention and control of food borne hazards, definition and regulation of food sanitation, sources of contamination, personal hygiene-food handlers, cleaning compounds, sanitation methods, waste disposal strategy (solid and liquid waste) and pest control. • Good Manufacturing Practices (GMP), Good Hygienic Practices (GHP), Good Agricultural Practice (GAP), Good Veterinary Practice (GVP). 	15
Module -III Food Standards and Quality Control	<ul style="list-style-type: none"> • Codex Alimentarius Commission (CODEX): Introduction, standards, guidelines and recommendations, National Codex Committee of India • International Organization of Standardization (ISO): Overview, structure, ISO-22000, ISO-9001:2000, ISO22000:2005, ISO 17025/CODES/GLP, Retailers standards: BRC food and BRC IOP standards, IFS, SQF: 1000, SQF: 2000. • Hazard Analysis Critical Control Point (HACCP): principles, HACCP applications, HACCP based SOPs. • FSSAI Indian Food Regulations and Certifications: Food Safety and Standards Act FSSAI Rules, food 	15

	adulteration, misbranding, common adulterants in foods, Duties and responsibilities of Food Safety Authorities	
UNIT-II		
Module -IV Food Safety and Standards Act 2006	Salient features of: <ul style="list-style-type: none"> • Food safety and standards Act ,2006. • Food safety standards of licensing and registration of food Business regulations, 2011, Food safety standards of packaging and labeling regulations, 2011 • Food safety standards of food product standards and food additives regulations 2011 • Food safety and standards of contaminants, toxins and residues regulation 2011- • Food safety standards of laboratory and sample analysis, 2011 	15
Module -V Sensory Evaluation of food Food quality Indices	<ul style="list-style-type: none"> • Introduction to quality attributes of food Appearance, flavor, textural factors and additional quality factors. • Methods of Sensory Evaluation. • Food Quality Indices: Meat and meat products, fish and fish products, milk and dairy products, vegetables, fruits and their products, grain, pulses and oil seeds, coffee, tea and spices. 	15
Module -VI Food safety auditing	<ul style="list-style-type: none"> • Food surveillance: international and national practices, procedure and protocols, • Need for auditing, • Import and export policies, FDA import policy, • Inspection of food establishments, manufacturing units • Milk and milk products, meat and meat products, fish, frozen food establishments. 	15



Practiclas Paper-I

1. Food Tests for: presence of moisture content, proteins, starch, carbohydrates, fats (Qualitative or/and Quantitative) from the given food sample.
2. Determination of fat content in food by Soxhlet method.
3. Determination of flour gluten.
4. Isolation of bacteria and molds from foods; vegetable and fruits/meat and meat products/fish and other sea foods/ eggs and poultry/ milk and milk products/ sugar, salts and spices/Fermented foods.
5. Study of Thermal and rheological properties of food materials.
6. Determination and enumeration of pathogenic and indicator organisms in foods (Coliform/Enterococcus).
7. Detection of coliforms from milk by MPN method.
8. Analysis of heavy metals using atomic absorption spectrophotometer.
9. Detection of adulterants in different food samples.
10. Analysis of foods for drug and pesticide residues in milk / milk products/ fruit/ vegetable/ spices.
11. Detection and quantification of food colorants, emulsifiers and stabilizers
12. Shelf life calculations for food product.
13. Estimation of chemical preservatives by TLC (organic and inorganic).

Practiclas Paper II

1. Sampling plan; Sample collection and preparation for analysis.
2. Sensory evaluation of various food products: Hedonic Scale, Duo-trio Tests, Ranking difference, Triangle Tests.
3. Sensory evaluation quick test: -Black pepper coated with kerosene, Exhausted cloves punched smell is not there, Sugar with urea or ammonia, Chili powder soap or talc or brick powder, Synthetic milk - soapy appearance.
4. Determination of brix value, pH and acidity of beverages.
5. Assessment of surface sanitation by swab/rinse method.
6. Texture evaluation of various food samples- crispies/ cookies/ biscuits/ snack foods
7. Quality evaluation of various food stuffs- cereals, pulses, honey, jaggery, sugar, tea, coffee etc.
8. Hazard Analysis and Critical Control Point (HACCP) of Milk and milk products / Cereals and cereal products /Meat and meat products/ Bakery products / Fruits and vegetables
9. Data Preparations for food safety audit. Review, recommendations and corrective actions from the food safety audits.
10. Visit to a Food processing or food packaging Industries.

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3.	Bawa. A.S, O.P Chauhan etal. Food Science. New India Publishing agency, 2013
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12.	Foreign Trade Policy (27th August 2009 to 31st March 2014), Department of Commerce, Ministry of Commerce and Industry, Government of India.
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14.	The training manual for Food Safety Regulators. (2011) Vol.III, Food Safety regulations and food safety management. Food Safety and Standards Authority of India. New Delhi.
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28.	Meilgard (1999). Sensory Evaluation Techniques, 3rd ed. CRC Press LLC, 1999.
29.	Meyer LH, Food Chemistry, CBS Publication, New Delhi, 1987
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32.	Paine FA and Paine HY, Handbook of Food Packaging, Thomson Press India Pvt Ltd, New Delhi- 1992.
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37.	Ramaswamy H and Marcott M, Food Processing Principles and Applications CRC Press, 2006
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