



Shri Vile Parle Kelavani Mandal's
MITHIBAI COLLEGE OF ARTS, CHAUHAN INSTITUTE OF
SCIENCE & AMRUTBEN JIVANLAL COLLEGE OF
COMMERCE AND ECONOMICS (AUTONOMOUS)
NAAC Reaccredited 'A' grade, CGPA: 3.57,
Granted under RUSA, FIST-DST & Star College Scheme of DBT, Government of
India, Best College (2016-17), University of Mumbai

Affiliated to the
UNIVERSITY OF MUMBAI

Program: Master of Science-Biochemistry

Semester III & IV

Choice Based Credit System (CBCS) with effect
from the Academic year 2022-23

A.C. No: 13

Agenda No: 3 (ix)

Sl. No.	Details	Marks
1	Continuous Assessment (CA-1)	15 marks
2	Continuous Assessment (CA-2)	10 marks

The courses are as follows:

Semester III

PSMABC301	Food Science and Food Technology
PSMABC302	Management Process
PSMABC303	Soft Skills
PSMABC304	Sustainable Development and Community Hygiene
PSMABCP3	Research Project/Internship
PSMABCP31	Practical-XIII
PSMABCP32	Practical-XIV
PSMABCP33	Research Project

Semester IV

PSMABC401	Advances in Biochemical Sciences-II
PSMABC402	Advanced Immunology
PSMABC403	Pharmacology and Toxicology
PSMABC404	Entrepreneurship and IPR
PSMABCP41	Practical-IX
PSMABCP42	Practical-X
PSMABCP43	Practical-XI
PSMABCP44	Practical-XII

As per resolution of 11th Academic Council, Semester 3 of M.Sc.-Biochemistry programme (24 credits) will be for Internship/ Research project or both done during the tenure of the semester.

As per the recommendation of the Board of Studies -Biochemistry, it was suggested that alternative plan be prepared to accommodate a situation if all students are unable to get internship/ research project opportunity, under prevailing pandemic situation. In such circumstances, students can gain 24 credits in Semester 3 of the M.Sc.-Biochemistry program, by conducting a research project in the college (4 credits) and remaining 20 credits to be gained through theory and practical courses.

Evaluation Pattern

The performance of the learner will be evaluated in two components. The first component will be a Continuous Assessment with a weightage of 25% of total marks per course. The second component will be a Semester End Examination with a weightage of 75% of the total marks per course. The allocation of marks for the Continuous Assessment and Semester End Examinations is as shown below:

a. Details of Internal Continuous Assessment (ICA)

25% of the total marks per course:

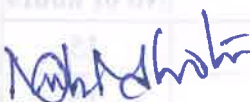
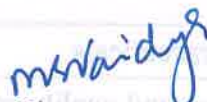

Continuous Assessment	Details	Marks
Component 1 (ICA-1)	Test (MCQ/Subjective) / Assignments/ Project/ Presentation	15 marks
Component 2 (ICA-2)	Test (MCQ/Subjective) / Assignments / Project/ Presentation	10 marks

b. Details of Semester End Examination

75% of the total marks per course. Duration of examination will be two and half hours.

Question Number	Description	Marks	Total Marks
Q1 to Q4	Compulsory question 10 marks +	10	(10 +5) x 4 = 60
	Answer any 1 out of 2 questions	05 x 1	
Q5	Answer any 3 out of 4 questions	05	15
Total Marks			75

- Note: (i) The duration of each theory lecture will be of 60 minutes. A course consists of 4 modules. For each module the number of hours allotted are 15. The total number of lecture hours for each course will thus be 60.
- (ii) There will be one practical per batch for each course. The duration of each practical will be of 4 hours, i.e., of 240 minutes.
For practical component the value of One Credit is double the number of theory hours.
- (iii) Thus, in a week, a student will study 4 hours of theory and 4 hours of practical's.

 Signature HOD	 Signature Approved by Vice –Principal	 Signature Approved by Principal

Program: M.Sc. Biochemistry			Semester : III	
Course: Food Science and Food Technology			Course Code: PSMABC301	
Teaching Scheme			Evaluation Scheme	
Lecture (Hours per week)	Tutorial (Hours per week)	Credit	Continuous Assessment and Evaluation (CAE)	End Semester Examinations (ESE)
4	-	4	25%	75%
<p>Learning Objectives: Given the fact that one of the main career opportunities of graduates in Biochemistry is within the industrial sector, the aim of this course is providing the students with basic knowledge about the applications of Biochemistry in the food industry and in food-related sectors. Besides, this course also offers contents and activities that will help the students to acquire skills needed for professional opportunities in research and education.</p>				
<p>Course Outcomes: At the end of the course learners will be able to</p> <p>CO1: Compare and contrast functional foods and nutraceuticals</p> <p>CO2: Explain the biochemistry of food spoilage</p> <p>CO3: Appreciate different food preservation techniques and quality control</p> <p>CO4: Compare food processing techniques and solve food safety problems</p> <p>CO5: Evaluate properties of different food packaging materials</p> <p>CO6: Compare different forms of packaging</p>				
Outline of Syllabus: (per session plan)				
Module	Description			No of hours
1	Functional foods and Nutraceuticals			15
2	Food spoilage, preservation and quality control			15
3	Food processing and food laws			15
4	Food packaging			15
	Total			60
PRACTICALS				60

Module	Food Science and Food Technology	No. of Hours/Credits 30/2
1	<p>Functional foods and Nutraceuticals</p> <p><i>Functional foods and Nutraceuticals</i> Definition, <i>Classification based on food source</i> Plants, herbs and flowers as functional foods, soya, olive oil, tea, grape wine, garlic, dietary fibre, and others <i>Natural occurrence of certain phytochemicals</i> antioxidants and flavonoids, omega 3 and 6 fatty acids, Carotenoids Phytoestrogens, Glucosinolates, organo sulphur compounds, isoprenoid derivatives, phenolic substances, fatty acids and structural lipids Carbohydrates and amino acid based derivatives-Isoflavones, terpenoids – saponins, tocotrienols and simple terpenes <i>Functional foods of microbial origin-</i> Concept of probiotics with examples, lactobacillus and bifido bacterium, Advances in probiotics, gut microflora and health benefits, Delivery of immune modulators through functional foods, guidelines for probiotics, probiotic microflora and functions, Prebiotics, ingredients in foods, types of prebiotics and its effect in gut microbes and health benefits <i>Role of functional foods and nutraceuticals in diseases:</i> Concept of dietary supplements, phytochemicals, phytosterols, dietary fiber, Role of nutraceuticals in health and management of diseases Inborn errors of metabolism/obesity/neurological disorder/ diabetes mellitus/ hypertension/ CVD/cancer/arthritis/AIDS Role of nutraceuticals in sports</p>	<p>15</p> <p>5</p> <p>5</p> <p>5</p>
2	<p>Food spoilage, preservation and quality control</p> <p><i>Bio Chemistry of Food Spoilage</i> Chemical and biochemical indices of food quality Factors causing food spoilage Chemical changes in nitrogenous and non-nitrogenous compounds in the food Food Poisoning by microorganisms and their products: Food borne diseases: Types and causative agents Food Poisoning: Staphylococcus food poisoning, <i>Clostridium perfringens</i> poisoning, <i>Clostridium Botulism</i> poisoning</p>	<p>15</p> <p>4</p> <p>2</p>

	<p>Poisoning due to salmonella</p> <p>Food Preservation</p> <p>General principles of food preservation</p> <p>Preservation by use of high and low temperatures, drying, radiations, chemical preservatives, inert gases, mechanical preservation techniques (vacuum packaging, tetra packs).</p> <p>Quality control</p> <p>General principles of Quality Control and Good Manufacturing Practices in food industry.</p> <p>Food Adulteration and additives</p> <p>Common food adulterants their harm effects and physical and chemical methods for their detection (any five food samples)</p> <p>Food additives (chemistry, food uses and functions in formulations)</p> <p>Preservatives, Antioxidants, Emulsifiers, sequestrants, stabilizers, Colours, flavours, sweeteners, acidulants</p> <p>Indirect food additives</p>	<p>4</p> <p>1</p> <p>2</p> <p>3</p>
3	Food processing and safety management	15
	<p>Food processing techniques:</p> <p><i>Heat processing:</i> Pasteurization technique, High Pressure processing, Dehydration by drying (contact, radiation, sublimation), retort processing technique</p> <p>Non-thermal processing</p> <p>Shelf life of processed food:</p> <p>Determination of shelf – life of food products,</p> <p>Transports of perishable food items.</p>	<p>5</p> <p>10</p>
	<p>Food Safety management</p> <p>Food Laws:</p> <p>Prevention of Food Adulteration (PFA) Act,</p> <p>Fruit Products Order (FPO),</p> <p>Meat Products Order (MPO)</p> <p>Food Safety and Standards Act, 2006,</p> <p>Food legislation: AGMARK, etc.</p> <p>International Food Safety Standards: ISO 22000: 2018 Standard, FSSC 22000</p> <p>Food Safety Initiatives Projects by FSSAI:</p> <p>BHOG,</p> <p>Clean street Food Hub,</p> <p>Eat right Movement,</p> <p>Clean & Fresh Fruits and vegetables</p> <p>Safe and Nutritious Food (SNF), Hygiene Rating</p> <p>Role of Food Safety Officer</p>	

4	Food packaging	15
	Introduction of Food packaging	1
	Objectives and need of food packaging,	
	Packaging materials for food packaging	3
	Wood, cloth, paper, metals, glass, plastic packaging, basic types of plastics used in packaging technology, edible packaging, additional packaging materials, adhesives used in food packaging, printing of packaging materials	
	Properties of packaging materials	1
	Food packaging systems	5
	Different forms of packaging such as rigid, semirigid and flexible forms, retortable pouches, tetrapack - packaging system for dehydrated foods, frozen foods, dairy products, fresh fruits and vegetables, meat, fish, poultry, sea foods, vanaspati ghee & basmati rice	
	Deteriorative changes in foodstuff and packaging methods for prevention, shelf life of packaged foodstuff, methods to extend shelf- life	1
	Package labeling	2
	Functions and regulations	
	Packaging Machinery	
	Bottling, can former, form fill and seal machines, bags, vacuum packs unit, shrink pack unit, tetra pack unit	2
	Advanced Packaging Technologies:	
	RFID, Bar Codes, ESD protective packaging	

To develop scientific temper and interest by exposure through industrial visits and study/educational tours is recommended in each semester

RECOMMENDED READING:

Essential reading:

1. SH Wiling & JR Stoker. 4th Editio. GMP for pharmaceuticals, A plan for TQC, Marul Dekker Inc, New York, 1997.
2. WA Gould & RW Gould. Total Quality Assurance for the Food Industries CTI Publications Inc, USA 1988
3. WA Gould. Current Good Manufacturing Practices for Food Plan Sanitation CTI Publications Inc. USA 1980
4. B. Srilakshmi. Dietetics. Seventh edition. New age international publishers
5. Booth, G.R. (1997). Snack Food, New Delhi: CBS Publishers and distributors.
6. Salunkhe, D.K. & Kadam, S.S. (2005). Handbook of Vegetable Science and Technology.

<p>Suggested reading:</p> <ol style="list-style-type: none"> 1. R.G. Hansen, B.W. Wyse, A.W. Nutritional Quality Index of Foods; Sorenson AVI Publishing Co., Inc., 1979. 2. Robert E.C.Wildman. Handbook of Nutraceuticals and Functional Foods Edited by, Routledge Publishers. 3. Nutraceuticals by L. Rapport and B. Lockwood, Pharmaceutical Press. 4. D'Cunha, J.F. (1998). Modern Food Packaging, Mumbai: IIP. 5. Duffy, J.I., (1981). Snack Food Technology, New Jersey: Noyes Data Corporation. 6. Smith, J.S. &Hui, Y.H. (2004).Food Processing Principles and Applications. Blackwell Publishing <p>Any other reference sources as recommended by the course instructor.</p>	<p>Food packaging</p> <p>Introduction of Food packaging</p> <p>Packaging materials for food packaging</p> <p>of plastic used in packaging technology, edible packaging</p> <p>addressing environmental concerns</p> <p>Different forms of packaging such as rigid, semi-rigid and flexible forms, retortable pouches, tetrapack - packaging systems</p> <p>in dry, liquid, semi-liquid, acid foods, vegetables, fruits & human use</p> <p>Distinctive changes in foodstuffs and packaging methods in preservation, shelf life of packaged foodstuffs, methods to extend shelf life</p> <p>Functions and regulations</p> <p>Packaging Machinery</p> <p>Bottling, can former, form fill and seal machines, paper, vacuum packs unit, shrink pack unit, twin pack unit</p> <p>Advanced Packaging Technologies:</p> <p>RFID, Bar Codes, ESD protective packaging</p>
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RECOMMENDED READING:

Essential reading:

1. SH Waring & JR Stokes. All About GMP for pharmaceuticals. A plan for TOC. Manual Dekker, New York, 1997.
2. WA Gould & RW Gault. Total Quality Assurance for the Food Industry. IT Publications Inc, USA 1988
3. WA Gould. Current Good Manufacturing Practices for Food Plant Sanitation. CFI Publications Inc, USA 1980
4. B. Salunkhe. Dietetics. Seventh edition. New age international publishers
5. Bhatia G R (1997). Snack Food. New Delhi: CBS Publishers and distributors
6. Salunkhe, D.K. &Kadam, S.S. (2002). Handbook of Vegetable Science and Technology

Practical PSMABCP31	
Practical (Hours per week)	Credit
4	2
1	Estimation of Vitamin C by Iodometry/ DCPIP method
2	Isolation of Lycopene from tomato
3	Estimation of Reducing and Non reducing sugar
4	Estimation of Protein
5	Determination of microbial load in food sample
6	Estimation of two macro minerals
7	Estimation of two microminerals
8	Determination of antinutritional factor
9	Estimation of Sodium Benzoate from Jam/Jellies/Sauces
10	Food adulteration test

After completion of the course, learners would be able to:

CO1: Apply the importance, the role and the content of soft skills through instruction, knowledge acquisition demonstration and practice

CO2: Translate the importance of employing perfect body language in communication

CO3: Develop an ability to participate in group discussion, technical interviews and prepare & deliver presentation

CO4: Continue and apply managerial skills in routine life to get adapted in any work environment

Sl. No.	Module	Description	Outline of Syllabus (per session plan)
1	1	Soft Skills Development-I	12
2	2	Soft Skills Development-II	12
3	3	Health & Fitness	12
4	4	Managerial and marketing skills	12
		Total	60
			60

Program: M.Sc. Biochemistry			Semester: III	
Course: Social Skills			Course Code: PSMABC302	
Teaching Scheme			Evaluation Scheme	
Lecture (Hours per week)	Tutorial (Hours per week)	Credit	Continuous Assessment and Evaluation (CAE)	End Semester Examinations (ESE)
4	-	4	25%	75%
Learning Objectives:				
<p>Soft Skills, a buzz word today has attracted the attention of all professionals. Employability, being the major concern today, every individual aims at getting coveted jobs. Employability today is commensurate with proving multiple skills in varied situations in a fast-changing world. Hence, everyone aspiring for jobs today has to prove one's mettle in various situations where one requires to be armed with different skills, which, collectively come under Soft Skills. One may be armed with good competence of one's subject but one cannot compete with his peer groups unless one has the potential of performance. Performance can be ensured with the demonstration of certain abilities that can help a professional communicate, corroborate, convince, evaluate and look into the continuing as well as the upcoming trends of the corporate world from time to time,</p> <p>The objective of the programme is to inculcate potential skills in the learners to prepare them to deal with the external world in a collaborative manner, communicate effectively, take initiative, solve problems, and demonstrate a positive work ethic so as to hold a good impression and positive impact.</p>				
Course Outcomes:				
After completion of the course, learners would be able to:				
CO1: Apply the importance, the role and the content of soft skills through instruction, knowledge acquisition, demonstration and practice.				
CO2: Translate the importance of employing perfect body language in communication				
CO3: Develop an ability to participate in group discussion / meetings / interviews and prepare & deliver presentation				
CO4: Correlate and apply managerial skills and computing skills in routine life to get adapted to any work environment.				
Outline of Syllabus: (per session plan)				
Module	Description			No of hours
1	Soft Skills Development-I			15
2	Soft Skills Development-II			15
3	Health Awareness			15
4	Managerial and computing skills			15
	Total			60
PRACTICALS				60

Module	Social Skills	No. of Hours/Credits 60/4
1	Soft Skills Development-I	15
	<p>Personal Skills Personality Development- Self Esteem, Positive Thinking, Johari Window, Physical Fitness</p> <p>Emotional Intelligence (EI) & Quotient (EQ) Meaning, Components of EI, IQ v/s EQ, Components of EI, Skills to develop EI</p> <p>Etiquettes & Manners – Meaning, Professional & Technology etiquettes.</p> <p>Communication Skills Process & Significance of Communication, Verbal, Non- verbal, formal & informal communication, Barriers, Techniques to improve LSRW, Intercultural & Digital Communication</p> <p>Interpersonal Communication: Interpersonal relations; communication models, process and barriers; team communication; developing interpersonal relationships through effective communication; listening skills; essential formal writing skills; corporate communication styles – assertion, persuasion, negotiation.</p>	<p>3</p> <p>4</p> <p>3</p> <p>5</p>
2	Soft Skills Development-II	15
	<p>Creativity at Workplace Types of Workplace, Creativity/ Motivation/Innovativeness/ Initiative at Workplace</p> <p>Ethical Values Ethics/ Values/ Morals, Nurturing work ethics, Gender, neutrality, Human Rights</p> <p>Capacity Building Learn, Unlearn & Relearn, Skills for capacity building, Zones & Ideas for Learning, Strategies for capacity building.</p> <p>Group Discussion Ambience & Seating arrangements for GD, Importance & significance of GD, GD/ Panel Discussion/ Debate, Types of GD (Topics – based & Case- based), Analysis of personal traits in GD.</p> <p>Employment Communication CV & Resume Building, Scannable CV, Formats of CV/ Resume/ Job Application/ Covering Letter, professional presentations.</p> <p>Job Interviews Background information, Types & preparatory steps for Interviews, developing interview Skills, Mock Interviews, FAQs in Interviews.</p>	<p>3</p> <p>2</p> <p>3</p> <p>4</p> <p>3</p>

3	Health Awareness	15
	Personality and mental disorder	5
	Definition	
	Assessment of Personality,	
	Personality Disorders	
	Personality Traits and Abilities and Seafaring	
	Introduction to the most common mental disorders	
	Risk Factors associated with poor mental health	
	internalizing and externalizing behaviors	
	Diagnosis of mental health problems	
	Stress	5
	Definition	
	Eustress and Distress	
	Work related stress factors,	
	Manifestations of stress	
	Stress Management	
	Stress coping skills	
	Stress inoculation training	
	Management of various forms of fear (examination fear, stage fear or public speaking anxiety)	
	Dealing with crisis and disasters	
	Anger	3
	Definition	
	Comparative account of hostility and Aggression	
	dealing with anger effectively and productively	
	Anger as a Social Script	
	Biological clock	1
	Importance of sleep	1
4	Managerial and computing skills	15
	Time management	2
	Time wasters- Procrastination.	
	Time management tips and strategies.	
	Advantages of time management	
	Spreadsheets	5
	Introduction to workbook, Building, Modifying, navigating	
	Worksheet: Autofill, copying and moving cells, inserting and deleting rows, printing	
	Formulas and functions:	
	Troubleshooting formulas	
	Functions and its forms- database, financial, logical, reference, mathematical and statistical	
	Databases – Creating, sorting, filtering and linking	
	Introduction to R and SPSS software	3

	<p>Information Management Email-reading, composing, responding, attachments, signature, junk mail</p> <p>Word Processing Formatting – Paragraph and character styles, templates and wizards, table and contents and indexes, cross referencing Tables and Columns – Creating, manipulating and formatting Important feature of word processing tools Understanding Toolbars Word Art, Mail- Merge, Hyperlink Additional Features (Drop Cap, Auto-Correct, Word Count, Change Case, Book Marks) Split & Arrange Screen, Protect Document</p>	<p>5</p>
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To develop scientific temper and interest by exposure through industrial visits and study/educational tours is recommended in each semester

RECOMMENDED READING:

Essential reading:

1. Gajandra S Chavan& Sangeeta Sharma Soft Skills- An Integrated Approach to Maximize Personality Development, Wiley India
2. A Guide to Mental Health & Psychiatric Nursing by Sreevani R
3. Mansfield, Ron. Working in Microsoft Office, Tata McGraw Hill, 2007.
4. Davis, Guy Hart. Microsoft Excel 2007, Tata McGraw Hill, 2007.
5. Hurlock, E.B. Personality Development, 28th Reprint. New Delhi: Tata McGraw Hill, 2006.

Suggested reading:

1. Barun K Mitra Personality Development and Soft Skills, Oxford.
2. M S Rao Soft Skills- Enhancing Employability, I K International
3. Ricky W. Griffin, Cornerstone: Developing Soft Skills by Sheffield, Person India Management: Principles and Practices

Any other reference sources as recommended by the course instructor

Practical PSMABCP32	
Practical (Hours per week)	Credit
4	2
Practical PSMABCP32	
1	Estimate your time commitment of the week
2	Do Self WOT analysis
3	CV Writing
4	Group discussions
5	Personal interview
6	Case studies on personality development
7	Case studies on stress management
8	Case studies on time management
9	Tutorials on computing skills based on concepts in syllabus

RECOMMENDED READING:

Essential reading:

1. Chapman S. Career & Success: Success Skills - An Integrated Approach to Maximizing Personality Development, Wiley India.
2. A Guide to Mental Health & Psychiatric Nursing by Sreevani R.
3. Personality: From Working in Microsoft Office, Tom McGraw Hill, 2007.
4. David Gray, Just Microsoft Front 2007, Tom McGraw Hill, 2007.
5. Lunick, R. B. Personality Development, 28th Edition, New Delhi, Tom McGraw Hill, 2006.

Suggested reading:

1. Person & Self Personality: Development and Self Skills, Oxford.
2. M S Rao Self Skills - Enhancing Employability, I K International.
3. Macky W. Griffin, Careerwise: Developing Self Skills by Selffield, Person India Publications.
4. Principles and Practices

All other reference sources as recommended by the course instructor.

Program: M.Sc.-Biochemistry	Semester: III
Course: Virology and Emerging Trends	Course Code: PSMABCH303

Teaching Scheme		Evaluation Scheme		
Lecture (Hours per week)	Tutorial (Hours per week)	Credit	Continuous Assessment and Evaluation (CAE)	End Semester Examinations (ESE)
4	--	4	25%	75%

Learning Objectives: The learner is acquainted to virology. The life cycle of viruses is dependent on the type of nucleic acid composition matter and its replication is mediated through different mechanisms. This guides way to understanding the most effective modality for viral control. The learner will gain insight into the emergence of recent endemic and pandemic due to new species of viruses. The basic concepts of ethics and safety that are essential for different disciplines of science. This course helps to adhere to the ethical practices appropriate to the discipline at all times and to adopt safe working practices relevant to the bio-industries & field of research.

Course Outcomes:

After completion of the course, learners would be able to:

- CO1:** Explain general virus life cycle
- CO2:** Predict replication strategy of viruses based on genome composition
- CO3:** Describe the emergence of new viral infections
- CO4:** Evaluate therapeutic modalities for emerging viral diseases
- CO5:** Identify appropriate guidelines related to engineering, professional and biotechnology research ethics
- CO6:** Interpret basics of biosafety and bioethics and its impact on all the biological sciences and the quality of human life

Outline of Syllabus: (per session plan)

Module	Description	No of Hours
1	Virology	15
2	Emerging Diseases	15
3	Biosafety and Bioethics	15
4	Quality Management	15
	Total	60

Module	Virology and Emerging Trends	No. of Hours/Credits 60/4
1	Virology	15
	<p>Classification & General properties of viruses Structure of viruses, capsid, assembly of viral membrane. Lytic cycle & lysogeny. Baltimore Classification</p> <p>Life cycle and replication of viruses: T4 Phage RNA-negative strand (VSV), Positive strand (Polio), Segmented (Influenza) Retrovirus- HIV DNA- adenovirus and SV-40</p> <p>Mechanism of interferon and antiviral therapies Plaque assay</p>	4 7 3 1
2	Emerging Diseases	15
	<p>HIV infection Structure of HIV virus, mechanism of HIV infection, role of T cells in infection development, therapy - anti-retroviral therapy, HAART, economic loss by HIV at national & international level.</p> <p>Hepatitis virus Types of hepatitis infection, spread and prevention, vaccines</p> <p>Viral outbreaks SARS-CoV-2, MERS, Ebola, H1N1, and Zika virus, Nipah Concept of Variants Preparedness and Response for emerging infections and outbreaks:</p>	4 3 8
3	Biosafety and Bioethics	15
	<p>Introduction Historical Background</p> <p>Biological Safety Cabinets Working of biosafety cabinets, using protective clothing, specification for BSL-1, BSL-2, BSL-3.</p> <p>Primary Containment for Biohazards Discarding biohazardous waste – Methodology of Disinfection, Autoclaving & Incineration</p>	1 3 2 2

	<p>Biosafety Levels Recommended Biosafety Levels for Infectious Agents and Infected Animals Classification of microorganisms based on the risk</p> <p>Biosafety guidelines Overview of National Regulations, Cross border movement of germplasm; Risk management issues - containment. Definition of GMOs & LMOs; Roles of Institutional Biosafety Committee, RCGM, GEAC etc. for GMO applications in food and agriculture; Environmental release of GMOs; Risk Analysis; Risk Assessment; Risk management and communication;</p> <p>Bioethics Ethical implications in diversity, GMO's, medicine and research. Social and ethical implications of biological weapons.</p>	<p>4</p> <p>3</p>
4	Quality management	15
	<p>Total Quality Management and its importance</p> <p>Good Practices in QC laboratory Schedule L1, standardization of reagents, labeling of reagents, control samples, controls on animal house, data generation and storage, QC documentation,</p> <p>Microbial contamination spoilage and hazard Sources of contamination, factors affecting survival and growth,</p> <p>Principles of sterilizations with respect to pharmaceutical industries. Methods of sterilization: Steam, dry heat, Radiation, Gaseous and Filtration</p> <p>Quality Control of a) Vaccines (any three) b) Sera c) In-vivo diagnostics</p> <p>ICH Q8 guideline Objectives, scope, Introduction, Pharmaceutical Development- Drug Products and their components</p>	<p>2</p> <p>2</p> <p>2</p> <p>2</p> <p>3</p> <p>4</p>

To develop scientific temper and interest by exposure through industrial visits and study/educational tours is recommended in each semester

RECOMMENDED READING:

Essential reading:

1. Pharmaceutical Microbiology – Edt. by W.B.Hugo & A.D.Russell Sixth edition. Blackwell scientific Publications
2. Prescott's Microbiology 8th Edition by Willey, Joanne, Sherwood, Linda, Woolverton, Chris
3. Pharmaceutical Microbiology by Ashutosh Kar

4. Goel and Parashar, IPR, Biosafety and Bioethics, Pearson education, India (2013)
5. "Bioethics & Biosafety" by Sateesh MK, IK International publications, 2008
6. Sree Krishna V (2007) Bioethics and Biosafety in Biotechnology, New age international publishers

Suggested reading:

1. Safety Assessment by Thomas, J.A., Fuch, R.L. (2002), Academic Press.
2. Biological safety Principles and practices) by Fleming, D.A., Hunt, D.L., (2000). ASM Press.
3. Biotechnology - A comprehensive treatise. Legal economic and ethical dimensions VCH.Bioethics by Ben Mephram, Oxford University Press, 2005.
4. Bioethics & Biosafety by R Rallapalli & Geetha Bali, APH Publication, 2007
5. Biosafety And Bioethics Rajmohan Joshi Publishers
6. <https://bch.cbd.int/protocol>

Any other reference sources as recommended by the course instructor.

12	Quality management	4
5	Total Quality Management and its importance	
3	Good Practices in QC laboratory	
	Schedule I, standardization of reagents, labeling of reagents, control samples, controls on animal house, data generation and storage, QC documentation	
5	Microbial contamination: sources and hazard	
3	Sources of contamination, factors affecting survival and growth	
	Principles of sterilization with respect to pharmaceutical industries	
3	Methods of sterilization: steam, dry heat, Radiation, Gasous and filtration	
	Quality Control of	
4	a) Vaccines (any three)	
	b) In-vivo diagnostics	
	ICH Q8 guideline	
	Bioprocess, scope, formulation, Pharmaceutical Development: Drug products and their components	

To develop scientific temper and interest in exposure through industrial visits and study in industrial tour is recommended in each semester.

RECOMMENDED READING:

Essential reading:

1. Pharmaceutical Microbiology - Text by W. Hugg & A.D. Russell (Sixth Edition), Blackwell Scientific Publications
2. Prescott's Microbiology 8th Edition by Willey, Joines, Prescott (with) Woelke, Ciba
3. Pharmaceutical Microbiology by Zahradsky Km

Program: M.Sc. Biochemistry			Semester: III	
Course: Management Process			Course Code: PSMABC304	
Teaching Scheme			Evaluation Scheme	
Lecture (Hour per week)	Tutorial (Hours per week)	Credit	Continuous Assessment and Evaluation (CAE)	End Semester Examinations (ESE)
4	--	4	25%	75%
Learning Objectives: This course is designed to be an overview of the major functions of management. Emphasis is laid on planning, organizing, directing and controlling. Six Sigma skills are widely sought by employers both nationally and internationally and have been proven to help improve business processes and performance. This course will introduce the learners to the purpose of Six Sigma and its value to an organization. Learners will be able to apply cost concepts and cost behaviours in the solving of management decision and understand individual and group behaviour in organizations, including personality, thinking, learning & perception. It aims at enabling the students to develop a holistic and a critical understanding of sustainability around issues related to the environment.				
Course Outcomes: After completion of the course, learners would be able to: CO1: Apply knowledge about management models and practices, enabling the learners to become effective professionals CO2: Identify situations where Six Sigma methodology could give an important contribution to quality improvement with regard to product and process development within industrial and service contexts CO3: Develop peer-based learning and working in groups and cross-functional skills CO4: Identify causes and effects of human behaviour in an organizational set-up CO5: Understand the basic concept of Sustainable Development (SD), the environmental, social and economic dimensions. CO6: Examine critically the 17 newly minted UN Sustainable Development Goals and suggest methods for assessing the achievement of sustainable development CO7: Articulate the major issues affecting sustainable development and how sustainable development can be achieved in practice.				
Outline of Syllabus: (per session plan)				
Module	Description			No of hours
1	Principles of Management			15
2	Organizational behavior			15
3	Auditing in food industry and Accreditations			15
4	Environmental Management and Sustainable Development			15
	Total			60

Module	Management Process	No. of Hours/Credits 60/4
1	Principles of Management	15
	Nature of Principles of Management Significance of Management Principles <i>Theories of Management</i> <i>Henry Fayol's Administrative Theory of Management</i> 14 Principles of Management <i>Fredrick Winslow Taylor's scientific Management Theory</i> <i>Overview of Functions of Management</i> Planning Organizing Staffing Directing Co-ordinating Controlling <i>Case studies on the above principles</i>	3 6 6
2	Organizational behavior	15
	<i>Organisational behavior</i> Significance & Theories <i>Individual Behaviour</i> Personality, Perception, Values, Attitude, Learning and Motivation <i>Group Behaviour</i> Team Building, Leadership, Group Dynamics Interpersonal Behaviour & Transactional Analysis Organizational Culture & Climate Work Force Diversity & Cross Culture <i>Personality types:</i> <ul style="list-style-type: none"> • 16 Personality Factors • Big 5 and MBTI • 6 Personality factors affecting OB <i>Six sigma</i> Foundations and Principles Origin of Six sigma Purpose and Methodology <i>Case studies on the above concept</i>	2 3 5 3 2
3	Auditing in food industry and Accreditations	15

	<p>Food auditing Definition and overview of food auditing Types of audits: internal audit, second party audit, third party audit Seven principles of ISO Auditing, ISO 19011 Requirements Aspects of food safety- Legal aspects, Prevention of Food adulteration act of 1954; HACCP, role of FDA, AGMARK, ISI, FSSAI Good manufacturing practices and ethics in food and pharma industry Standard Operating Procedures Preparing scope, quality policy and operating procedure – purpose Accreditations – IAF, QCI, National Accreditation Board for Testing and Calibration Laboratories (NABL)</p>	<p>5 5 2 3</p>
4	Environmental Management and Sustainable Development	15
	<p>Introduction to energy economics Regulatory approach to environmental management Carbon footprint Economic instruments for pollution control-Carbon Credit, Green Audit Nuclear energy and climate change International climate change agreements – UNFCCC, The Kyoto Protocol, Doha Amendment, Paris Agreement Introduction, Need and concept of Sustainability Social, Environmental and economic sustainability Challenges for social development Sustainability metrics: criteria and indicators Sustainable Development Goals (SDGs) Evolution of SD perspectives (MDGs AND SDGs) over the years 1987 Brundtland Commission and outcome- later UN summits (Rio summit, etc.) and outcome Ideation for SDG attainment from a Indian Perspective Modern business models for sustainable development Sustainable cities Green Buildings Case studies/Experiential learning on the above concepts</p>	<p>6 3 6</p>

To develop scientific temper and interest by exposure through industrial visits and study/educational tours is recommended in each semester

RECOMMENDED READING:

Essential reading:

1. Organizational Behavior by Stephen Robbins 4th Ed
2. Business Ethics: Concepts and Cases by Manuel G.
3. Management: Principles and Practices by Ricky W. Griffin
4. Six Sigma for dummies Craig Gygi, Neil DeCarlo Bruce Williams
5. Management Principles and Practices, N.K.Sharma, Mangal Deep Prakashans, Jaipur
6. Principles and Practice of Management, T.N.Chabbra, S. Chand & Company Ltd. New Delhi

Suggested reading:

1. Financial Management- Prassanchandra
2. Business Ethics: Text and Cases by C.S.V. Murthy 010 Ed
3. Organizational Behaviour by Fred Lathan's Ed

Any other reference sources as recommended by the course instructor

12	Investment Management and Sustainable Development	4
1	<p>Introduction to energy economics Regulatory approach to environmental management Carbon footprint Economic instruments for pollution control-Carbon Credit Green Audit Nuclear energy and climate change International climate change agreement - UNFCCC, The Kyoto Protocol, Paris Agreement Paris Agreement Introduction, Need and concept of Sustainability Social, Environmental and economic sustainability</p>	3
8	<p>Challenges for social development Sustainability metrics, criteria and indicators Sustainable Development Goals (SDGs) Evolution of SD perspectives (MDGs AND SDGs) over the years 1987 Brundtland Commission and ongoing- later UN summit (Rio summit, etc.) and outcome Idea for SDG attainment from a Indian perspective Modern business models for sustainable development Sustainable cities Green buildings Green studies in corporate learning on the above concepts</p>	8

To develop scientific temper and interest by exposure through industrial visits and study-observational tour is recommended in each semester.

Program: M.Sc. Biochemistry	Semester: III
Course: Research Project	Course Code: USMABCP33
Teaching Scheme	Evaluation Scheme
Credit	End Semester Examinations (ESE)
4	200

Program: M.Sc. Biochemistry	Semester: III
Course: Internship	Course Code: USMABCP3
Teaching Scheme	Evaluation Scheme
Credit	End Semester Examinations (ESE)
24	600

Practical PSMABCP3/33	
GUIDELINES TO CARRY OUT INTERNSHIP / PROJECT IN SEMESTER III	
1.	The goal of the internship / research project (04 credits) course is to be supplement the national education policy mission to enrich skills set in students. The current course is an opportunity to connect the students to the industry to bridge the industry-academia gap and to give them hands on experience for research.
2.	Duration of Internship / Project: Depending on the nature of internship, the duration of internship/ project is recommended as minimum 600 hours during Semester III.
3.	Nature of Work: The learner should submit a thesis for the work conducted.

Program: M.Sc. Biochemistry			Semester : IV	
Course: Advances in Biochemical Sciences-II			Course Code: PSMABC401	
Teaching Scheme			Evaluation Scheme	
Lecture (Hours per week)	Tutorial (Hours per week)	Credit	Continuous Assessment and Evaluation (CAE)	End Semester Examinations (ESE)
4	-	4	25%	75%
<p>Learning Objectives: It is vital to familiarize the student with emerging field of biotechnology i.e. Recombinant DNA Technology as well as to create understanding and expertise in wet lab techniques in genetic engineering, Hence the course objective is to offer detailed knowledge about the fundamentals of recombinant DNA technology, in terms of reagents, techniques and strategies along with their applications. It is an important aspect of course to familiarize students with the basic concepts in nutritional genomics and to develop an understanding of genomics and gene regulation with respect to diet and to obtain an appreciation for the role and importance of nutrition in prevention of polygenic diseases. Immunochemistry is an advanced area of immunology that deals with the chemical components and chemistry (chemical reactions) of immunological phenomena, Immunochemical methods are processes utilizing the highly specific affinity of an antibody for its antigen which are highly important in diagnostic and clinical context. Therefore, the course structure us designed to give an insight into immunochemical and histochemical techniques.</p>				
<p>Course Outcomes: At the end of the course learners will be able to:</p> <p>CO1: Explore and appreciate the applications of Recombinant DNA Technology (RDT)</p> <p>CO2: Realize the essentials of the science of nutritional genomics differentiating between nutrigenomics and nutrigenetics.</p> <p>CO3: Develop an advanced understanding of the unique roles that foods, nutrients, and micro-compounds therein play in chronic diseases with a focus on their role in nutritional genomics</p> <p>CO4: Appreciate the applicability of the science in practice with an emphasis on the current testing that is available, and the ethics and legality involved with nutrigenomic.</p> <p>CO5: Describe and distinguish the types of immunochemical techniques</p>				
Outline of Syllabus: (per session plan)				
Module	Description			No of hours
1	Recombinant DNA Technology-I			15
2	Recombinant DNA Technology-II			15
3	Recent advances in Biochemical science			15
4	Immunological Techniques			15
	Total			60
PRACTICALS				60

Module	Advances in Biochemical Sciences-II	No. of Hours/Credits 30/2
1	Recombinant DNA technology-I	15
	<p>Restriction and modification system Restriction and modification enzymes: Types, properties and uses restriction enzymes and methylases Ligases Construction of restriction maps (Numericals and case studies) Plasmid cloning vectors; Properties of ideal plasmid cloning vectors. Vectors for cloning large fragments of DNA- Cosmids, PAC, YAC, BAC Eukaryotic cloning vectors: YIp, YEp, YRp, Mammalian Artificial Chromosome</p> <p>Construction of recombinant DNA Formation of cDNA from RNA, Construction of DNA library; genomic vs cDNA library</p> <p>Screening of RDNA Libraries Preparation of nucleic acid probes (5' and 3' end labelling, random primer labelling, nick translation, biotinylated probes) and their use in screening gene libraries. Immunological screening. Subcloning of genes Chromosome walking.</p> <p>Applications of RDT: Medical and Biological applications Agricultural Environmental Commercial Antisense technology and therapeutics</p>	<p>6</p> <p>2</p> <p>4</p> <p>3</p>
2	Recombinant DNA Technology-II	15
	<p>Sequencing in RDNA technology Agarose gel electrophoresis of nucleic acids Pulsed field gel electrophoresis. Southern, Northern and Western blotting Gel retardation assay DNA foot printing by DNase I DNA sequencing by Maxam-Gilbert and Sanger's methods automated DNA sequencers Sequencing of RNA. Introduction to next generation sequencing (NGS): Pyro Sequencing, SMRT, Nanopore sequencing Hierarchical shotgun</p>	6

	<p>sequencing and whole genome shotgun sequencing</p> <p>Amplification of DNA:</p> <p>PCR- Basic Principle</p> <p>Types of PCR - end point PCR, real time PCR, qPCR, Reverse transcription PCR, inverse PCR</p> <p>Primer designing, 5' and 3' RACE</p> <p>Polymorphism at genetic level and their detection techniques</p> <p>DNA markers- VNTR, STR, microsatellite, SNP</p> <p>RAPD</p> <p>RFLP</p> <p>SNP</p> <p>AFLP</p> <p>DNA finger printing</p>	4 5
3	Recent advances in Biochemical science	15
	<p>Nutrigenomics:</p> <p>Scope and basic concept</p> <p>Nutrigenomics v/s Nutrigenetics</p> <p>Nutrient-Gene Interaction</p> <p>Nutrition-induced diseases- genetic aspects.</p> <p>Role of Leptin, Ghrelin, Adiponectin in food intake</p> <p>Nutrigenomics and personalized Nutrition.</p> <p>Beyond Nutritional Genomics and Genetics: -</p> <p>Metabolomics, proteomics, and microbiome (The intestinal microbiota)</p> <p>Nutrigenomics in food safety evaluation. - Ethical and legal considerations.</p> <p>Genome editing by CRISPER/Cas9 technology-working and its applications</p> <p>Micro/siRNA technology and applications in studying gene functions</p>	7 8
4	Immunological techniques	15
	<p>Factors affecting antigen antibody binding</p> <p>Immunotechniques</p> <p>Immunoprecipitation and Immunodiffusion</p> <p>Agglutination</p> <p>Immunodiagnosics:</p> <p>Antigen-antibody binding and assays.</p> <p>Cytotoxicity and cytokine assay</p> <p>Immunoassays- types (RIA, ELISA, ELISPOT, Chemiluminescent IA, FIA, DOT blot, Immunofluorescence) and specific applications.</p> <p>Immunohistochemistry: Principle and techniques.</p> <p>In situ localization technique- FISH and GISH</p>	1 2 12

	Immunodiagnosics for detection of infectious agents-Widal, VDRL, HIV, Measle, Immunosensors		
	Immunoscreening of gene library		
	Determination of total IgE, RIST, RAST		
	Vaccines: types, their advantages and disadvantages; new vaccine strategies		
	Techniques related to hypersensitivity; leukocyte migration inhibition		
	Flow cytometry		
	Fluorescence activated cell sorter technique (FACS).		

To develop scientific temper and interest by exposure through industrial visits and study/educational tours is recommended in each semester

RECOMMENDED READING:

Essential Reading:

1. Glick, B. R. and Pasternak, J. J. 1994. Molecular Biotechnology: Principles and applications of recombinant DNA. ASM Press, Washington D.C.
2. Brown, T. A. 1995. Gene Cloning: An introduction. Chapman and Hall, London
3. Goldsby, R. A., T. J. Kindt and B. A. Osborne. 2000. Kuby Immunology. W. H. Freeman and Company, N. Y

Suggested Reading:

1. Kreuzer, H. and A. Massey. 2001. Recombinant DNA and Biotechnology. ASM Press, Washington D.
2. Devlin TM. Textbook of Biochemistry with Clinical Correlations. New York: John Wiley, 2016-2018/ Latest edition.
3. Carlberg C., Ulven SM & Molnar F. Nutrigenomics. Springer International Publishing Switzerland 2016.
4. Shils M.C., Olson T.A. & Shike M. Modern Nutrition in Health and Disease. Philadelphia: Lea and Febiger, Latest edition
5. Most Recent Nutritional Genomics and Molecular Biochemistry Textbooks and Articles.
6. Brody T. Nutritional Biochemistry. New York: Academic Press, Latest edition.

Any other reference sources as recommended by the course instructor.

Practical PSMABCP41- Practical-IX	
Practical (Hours per week)	Credit
4	2
Sr. No.	Topic
1	Case studies and Numericals on restriction digestion
2	Plasmid isolation (mini prep method)
3	Isolation of plasmid by agarose electrophoresis
4	Polymerase chain Reaction (PCR)
5	Molecular weight determination of proteins by SDS PAGE
6	Ouchterlony's double diffusion method
7	Manicini radial immunodiffusion method
8	Dot Blot (Kit Method)
9	Western blotting
10	Tm of DNA
	Demonstration Experiments
A	Immunofluorescence
B	Flow Cytometry
C	RIA, ELISA
D	Blood spectroscopy, (only oxy Hb, meth Hb, acid and alkali hematin, reduced Hb)

Program: M.Sc.-Biochemistry			Semester: IV	
Course: Advanced Immunology			Course Code: PSMABCH402	
Teaching Scheme			Evaluation Scheme	
Lectures (Hours per week)	Tutorial (Hours per week)	Credit	Continuous Assessment And Evaluation(CAE)	End Semester Examinations (ESE)
4	--	4	25%	75%
<p>Learning Objectives: The learner is introduced to cells and organs of the immune system and the mechanism including mechanism of differentiation, maturation and role of receptors. In addition, the learner grasps insight into development of the immune system and the interaction of cell mediated and humoral immunity. Antibody are central to the immune system and the learner gains knowledge regarding its structure, organization, expression and regulation of the immune response. Other molecules involved in immune response including MHC, complement system and the role of antigen presenting cells are also dealt with. Cytokines are being crucial for the body's immune system, its role and their application for therapeutic purposes is transacted. The learner also recognises the different types of immunological responses to different infectious agents, and during transplant rejection. Types of immune response associated with allergy and autoimmunity is also studied.</p>				
<p>Course Outcomes: After completion of the course, learners would be able to: CO1: Compare and contrast the mediators of innate and acquired immunity. CO2: Describe the structures and functions of immunoglobulins, MHC and complement components CO3: Categorize the phenomenon leading to diversity of antibodies, T-cell receptor and MHC. functions and CO4: Relate the immunological functions of complement system and MHC molecules CO5: Apply the knowledge of cytokines for their application in clinics CO6: Analyse the immune response elicited to infectious diseases caused by bacteria, viruses, fungus and protozoa CO7: Describe autoimmunity and immunological response in transplantation</p>				
Outline of Syllabus: (per session plan)				
Module	Description			No of Hours
1	Elements of Immunology			15
2	Humoral Immunity and Cell Mediated Immunity			15
3	Immunological molecules and Immune response			15
4	Transplant Immunology, Hypersensitivity and Autoimmunity			15
	Total			60
PRACTICALS				60

	<p>General structure and functions</p> <p>Cytokine secretion by TH1 and TH2 subsets</p> <p>Cytokine related diseases</p> <p>Therapeutic uses of cytokines</p>	
3	Immunological molecules and Immune response	15
	<p>Major Histocompatibility Complex (MHC)</p> <p>General organization and inheritance of MHC.</p> <p>Structure of Class I and Class II HLA</p> <p>Polymorphism of MHC Expression</p> <p>Complement System</p> <p>Complement activation by Classical, alternative and lectin pathways</p> <p>Biological consequences</p> <p>Complement deficiency</p> <p>Immune Response to infectious diseases</p> <p>Viral</p> <p>Bacterial</p> <p>Fungal</p> <p>Protozoal</p> <p>Cancer and immune system and immunotherapy</p> <p>Immune responses directed to tumors</p> <p>Cell mediated response and B cell response to tumors</p> <p>Tumor specific antigens, escape mechanisms and potential immunotherapy</p>	<p>3</p> <p>3</p> <p>5</p> <p>4</p>
4	Transplant Immunology, Hypersensitivity and Autoimmunity	15
	<p>Immune Response in Transplantation</p> <p>Types of graft, immunological basis of graft rejection- 1st set, 2nd set rejection- role of T lymphocytes</p> <p>Tissue typing and laboratory investigations- microcytotoxicity test, mixed lymphocyte reaction (HLA Typing)</p> <p>Clinical manifestation of graft rejection,</p> <p>General and specific immunosuppressive therapy</p> <p>Autoimmunity and autoimmune diseases their etiology</p> <p>Immunological tolerance; tolerance vs. activation of immune response, B and T cell tolerance and their general characteristics; mechanism of tolerance induction.</p> <p>Organ specific autoimmune diseases (Hashimoto's thyroiditis, insulin dependent diabetes mellitus, Graves disease and hemolytic anemia)</p> <p>Systemic specific autoimmune diseases (Rheumatoid Arthritis, Multiple Sclerosis,</p> <p>Theories for autoimmune response</p> <p>Immune Responses</p>	<p>4</p> <p>7</p> <p>4</p>

	<p>Inflammation mediators of inflammation and process of inflammation Hypersensitivity, Gell and coombs classification Types I to IV with mechanisms</p>	
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To develop scientific temper and interest by exposure through industrial visits and study/educational tours is recommended in each semester

RECOMMENDED READING:

Essential Reading:

1. Kuby, Janis, Immunology. 3rd Ed., 1997, W.H. Freeman Co.
2. Roitt Ivan and others, Immunology, 6th Ed., Mosby, Edinburg.

Suggested Reading:

1. Weir D.M., Immunology, 5th ed., ELBS and Churchill Livingston.
2. Chakravathy A.K. Immunology, Tata McGraw Hill, New Delhi.
3. Callaghan Richard B. Immunology, Academic Press
4. Weir D.M., Immunology: Student's Notes, ELBS- Oxford.
5. Bowry T.R., Immunology Simplified, 2nd Ed., ELBS and Oxford.
6. Hood Leroy E., Immunology, 2nd Ed., 1976, Benjamin Cummings Publication
7. Topley Wilson, Topley and Wilson's Principle of Bacteriology, Virology and immunity Edward Arnold Ltd., London
8. Bruce Alberts. Molecular Biology of Cell. 5th edition. Publisher Garland Science
9. Ian R. Tizard. Immunology: An Introduction. Saunders College publishing.

Any other reference sources as recommended by the course instructor.

Practical PSMABCP42- Practical-X	
Practical (Hours per week)	Credit
4	2
Sr. No.	Topic
1	Estimation of C- reactive protein
2	Widal-Qualitative and Quantitative
3	VDRL
4	Pregnancy test
5	Function Tests: Urea and Creatinine Clearance Test with Clinical Interpretation (case study)
6	Ghost membrane preparation from RBC
7	Preparation and Estimation of Aspirin (Volumetric Method)
8	Isolation and Estimation of Oxalates from spinach/ <i>Aloe vera</i>
9	Demonstration Experiments
	<ol style="list-style-type: none"> 1. Immunofluorescence 2. Flow Cytometry 3. RIA, ELISA 4. Blood spectroscopy, (only oxy Hb, meth Hb, acid and alkali hematin, reduced Hb), <ol style="list-style-type: none"> 1. Allergen Testing 2. HLA typing 3. HIV detection- screening tests

To develop scientific temper and interest by exposure through industrial visits and study/educational tours is recommended in each semester

Sr. No.	Topic	Hours
1	Pharmaceuticals and Clinical Research	1
2	Pharmaceuticals and Health Care (Drug Registration)	1
3	Pharmaceuticals and Health Care (Drug Quality Control)	1
4	Pharmaceuticals and Health Care (Drug Safety)	1
5	Pharmaceuticals and Health Care (Drug Development)	1
6	Pharmaceuticals and Health Care (Drug Marketing)	1
7	Pharmaceuticals and Health Care (Drug Distribution)	1
8	Pharmaceuticals and Health Care (Drug Use)	1
9	Pharmaceuticals and Health Care (Drug Abuse)	1
10	Pharmaceuticals and Health Care (Drug Misuse)	1
11	Pharmaceuticals and Health Care (Drug Dependence)	1
12	Pharmaceuticals and Health Care (Drug Withdrawal)	1
13	Pharmaceuticals and Health Care (Drug Interactions)	1
14	Pharmaceuticals and Health Care (Drug Contraindications)	1
15	Pharmaceuticals and Health Care (Drug Precautions)	1
16	Pharmaceuticals and Health Care (Drug Warnings)	1
17	Pharmaceuticals and Health Care (Drug Cautions)	1
18	Pharmaceuticals and Health Care (Drug Contraindications)	1
19	Pharmaceuticals and Health Care (Drug Precautions)	1
20	Pharmaceuticals and Health Care (Drug Warnings)	1
21	Pharmaceuticals and Health Care (Drug Cautions)	1
22	Pharmaceuticals and Health Care (Drug Contraindications)	1
23	Pharmaceuticals and Health Care (Drug Precautions)	1
24	Pharmaceuticals and Health Care (Drug Warnings)	1
25	Pharmaceuticals and Health Care (Drug Cautions)	1
26	Pharmaceuticals and Health Care (Drug Contraindications)	1
27	Pharmaceuticals and Health Care (Drug Precautions)	1
28	Pharmaceuticals and Health Care (Drug Warnings)	1
29	Pharmaceuticals and Health Care (Drug Cautions)	1
30	Pharmaceuticals and Health Care (Drug Contraindications)	1

Program: M.Sc. Biochemistry			Semester: IV	
Course: Pharmacology and Toxicology			Course Code: PSMABC403	
Teaching Scheme			Evaluation Scheme	
Lecture (Hours per week)	Tutorial (Hours per week)	Credit	Continuous Assessment and Evaluation (CAE)	End Semester Examinations (ESE)
4	--	4	25%	75%
Learning Objectives:				
<p>The objective of this course is to make the students' understand the basics of pharmacokinetics and the concept of clinical research. The learner also gains knowledge about the molecular basis of drug action, drug receptor theory as well as classification of receptors. The learner acquires knowledge of pharmacodynamics of NSAIDs and will get acquainted with the nutritional significance of various macronutrients. Diet and nutrition play an important role in maintaining health. The learner will get insight into the sports nutrition, nutrition during exercise, for therapeutic conditions and other physiological states also</p> <p>This course also includes a module on molecular toxicology to acquaint students' with skills for recognition of exposure of toxicants in man and animal as well as to potentially hazardous environmental factors of chemical, biological and physical nature.</p>				
Course Outcomes:				
After completion of the course, learners would be able to:				
CO1: Explain the fundamental concepts in pharmacodynamics and pharmacokinetics.				
CO2: Describe the molecular basis of drug action & pharmacological selectivity with special a. reference to structure-Function Relationship				
CO3: Critically evaluate the technicalities of clinical trials and ethical issues pertaining to the same.				
CO4: Follow the stepwise procedure of New Drug Investigation and Application.				
CO5: Analyse dose response relationship, LD ₅₀ , LC ₅₀ and TD ₅₀ and therapeutic response, delivery and detoxification of a xenobiotic.				
CO6: Classify toxic substances on the basis of duration, frequency, route and site of exposure				
CO7: Prepare a diet plan for the management in various conditions of health and disease				
CO8: Discuss the interactions between food and drug, supplement and drug and drug-drug				
Outline of Syllabus: (per session plan)				
Module	Description			No of hours
1	Pharmacokinetics and Clinical Research			15
2	Pharmacodynamics and Investigational New Drug Application			15
3	Toxicology and Xenobiotic Biotransformation			15
4	Role of Drug and Diet in Health and Disease			15
	Total			60
PRACTICALS				60

	<p>Molecular basis of drug action</p> <p>Drug receptor theory- antagonist and agonists- types ; Structure-function relationship with respect to proteins, enzymes, ion, channels and other drug targets Classification of receptors- Cellular location & function Non-specific interactions Receptor binding kinetics Computer-based drug designing</p> <p>Pharmacodynamics of: Anti-inflammatory – Non Steroidal Anti-inflammatory (NSAID) [Ibuprofen], Salicylates – [Aspirins], Paracetamol Cardiovascular drugs- CVS [Ca channel blocker - Amlodipine, and Beta blocker – Propranolol Antibiotic – Penicillin and Sulphonamide Antacid- Proton pump blocker –Omeprazole Anti-malarial, Anti-coagulants, Antimalarials, Antidiabetic</p>	4
	<p>Investigational New Drug and Application</p> <p>Documents/ Information for filing NDI- animal pharmacology & toxicology studies, manufacturing information, clinical protocols and investigator information</p> <p>New Drug Application (NDA)</p> <p>Introduction to NDA, NDA forms, contents of NDA, Preparation & Submission of documents, guidance documents for NDAS</p>	6
3	<p>Toxicology and Xenobiotic Biotransformation</p> <p>Introduction and toxic response</p> <p>Different areas of modern toxicology, classification of toxic substances Effect of duration, frequency, route and site of exposure of xenobiotics on their toxicity. Characteristics and types of toxic response. Tolerance and addiction</p> <p>Evaluation And Mechanism of Toxicity</p> <p>Various types of dose response relationships, assumptions in deriving dose response; LD₅₀, LC₅₀, TD₅₀ and therapeutic index Mechanism of action and resultant toxicities of lead, arsenic, organophosphates and carbamates</p> <p>Management of poisoned patients, clinical methods to decrease absorption and enhance excretion of toxicants from the body, Use of antidotes.</p> <p>Xenobiotic biotransformation</p>	3
		2
3		15
		5
		5
		5
		5

	Significance, Phases of xenobiotic metabolism Types of reactions involved- enzymes Factors affecting Biotransformation, Induction, Toxicity testing system- CYP assays, Cell based assays Preclinical phase 1 and phase 2 assays Diagnosis of toxic effects in liver and kidney	
4	Role of Drug and Diet in Health and Disease	15
	Anti-nutritional Factors Trypsin Inhibitors, Pressor Amines, Phytates, Oxalates Recent trends in Nutrition: Types of Drug-nutrient interactions Drug Nutrient interactions Food-drug interactions Herbal and Dietary Supplement–Drug Interactions Drug-drug interactions Non-starch polysaccharides Prebiotics and Probiotics Sugar alcohols in human nutrition Sweeteners Fat replacers Diet Nutrition during pregnancy, adolescence Sports Nutrition (ANY TWO SPORTS) Nutrition for Exercise Nutrition for Bone health Nutrition for therapeutic conditions Hypertension, GI disorders, (peptic ulcer. <i>H. Pylori</i>) Diabetes mellitus: Glycemic Index and its significance Anaemia Renal disorders Jaundice Eating Disorders: Anorexia Nervosa, Bulimia Nervosa	2 4 4 5

RECOMMENDED READING:

Essential Reading:

1. F.S.K. Barar. Essentials of Pharmacotherapeutics, 3rd Ed., S chand & Company Ltd. 2005.
2. B. Srilakshmi Dietetics, 7th Edition, New Age International Publishers
3. Swaminathan M., Essentials of food and Nutrition, 2nd Ed., 1985, Ganesh and Co.
4. Robinson C. et al, Normal and Therapeutic Nutrition, 16th Ed., 1982, Macmillan Publi. Co
5. Cassarett and Doull's Essentials of Toxicology (2015) by Klaassen and Watkins, Third edition, McGraw Hill

Suggested Reading:

1. Anderson I et al. Nutrition in Health and Disease, 17th ed., 1982, J.B. Lippincott Co.,
 2. Anita F.P., Clinical Dietetics and Nutrition's, 4th ed., 1997 Oxford University Press, New Delhi.
 3. Bennion H., Clinical Nutrition, 1979, Harper Row, New York.
 4. Carolyn E., et al, Nutrition and Diet Therapy, 7th Ed.,2000, Delmer Publishers
 5. Gopalan C et al, Dietary Allowances for Indians, NIH, Hyderabad.
 6. Gopalan C et al, Nutritive Value of Indian Foods, 1988, NIH, Hyderabad.
 7. Halpern S.L., Quick reference to Clinical nutrition, 2nd Ed., 1987, J.B. Lippincott Co.
 8. Kinney J.M. et.al, Nutrition and Metabolism in Patient Care, 19thed., 1999, W.B. Saunders and Co.
 9. Pharmacology, B Suresh, 1st Ed. Shanti, Publication.
 10. Pike R.L. and Brown M.L., Nutrition: An Integrated Approach, 1987, John Wiley and Sons.
 11. Shils M.E.et al, Modern Nutrition in Health and Disease, 1998, Lea and Febiger, Philadelphia.
 12. Williams S., Nutrition and Diet Therapy, 4th Ed., The C.V. Mosby Co., Missouri.
 13. Pharmaceutical chemistry, G Melentyeva L L Antonova Mir Publishers, Moscow
 14. Chemical Pharmacology, R B Barlow, 2nd Ed, Methven and CO. New Feters Lane
 15. Medicinal Chemistry, Vol I, 3rd Ed, Alfred Burga, Wiley Inter sciences
 16. Textbook of paramedical chemistry, Jayshree Ghosh, S Chand and company, New Delhi
 17. Cassarett and Doull's Toxicology: Basic Science of The Poisons (2013) by C.D. Klaassen. Eighth edition, McGraw Hill.
- Any other reference sources as recommended by the course instructor.

Practical		Credit
(Hours per week)		
4		2
S.No.	Topic	
1	Monograph of Vitamin C.	
2	Monograph of Acetyl salicylate	
3	Monograph of Sucrose	
4	Estimation of vitamin C by Iodimetry method	
5	Assignment / Report writing on diet planning	
6	Analysis of Antinutritional factors	
7	Estimation of Isothiocyanate content	
8	Determination of catalase activity	
9	Determination of peroxidase activity	
10	Determination of superoxide dismutase activity	
11	Glucose Tolerance Test	

To develop scientific temper and interest by exposure through industrial visits and study/educational tours is recommended in each semester

Module	Description	No. of hours
1	Entrepreneurship-I	12
2	Entrepreneurship-II	12
3	Practical (Entrepreneurship and IIR)	12
4	IIR	12
	Total	48

Program: M.Sc. Biochemistry			Semester : IV	
Course: Entrepreneurship and IPR			Course Code: USMABC404	
Teaching Scheme			Evaluation Scheme	
Lecture (Hours per week)	Tutorial (Hours per week)	Credit	Continuous Assessment and Evaluation (CAE)	End Semester Examinations (ESE)
4	--	4	25%	75%
Learning Objectives:				
<p>This course will provide learners with excellent foundation of the concepts as well as advancement in the field of industrial and applied biochemistry. In addition to the theoretical knowledge the learner will be getting hands on experience which will allow them to use various tools and methods for their career ahead. The students will be empowered with clear understanding of the basic concepts of entrepreneurship and will provide them knowledge of the recent advances so that they can independently assess the vast scope in the field. The learners will be prepared to discuss why new product development is such a critical process to manage, what the key activities in new product development entail, and whether the NPD process should differ in start-up vs. traditional enterprise settings.</p>				
Course Outcomes:				
<p>After completion of the course, learners would be able to:</p> <p>CO1: Develop the concept of entrepreneurship mindset and entrepreneurship process.</p> <p>CO2: Get insight into theories of entrepreneurship and role of socioeconomic environment.</p> <p>CO3: Classify the types of entrepreneurs and create the entrepreneurial venture and formulate the business plan</p> <p>CO4: Explore the basic structures and methodologies that are used to manage new product development in different environments.</p> <p>CO5: Discuss the basic concepts of intellectual property.</p> <p>CO6: Differentiate between copyright, patents, trademark and implement remedies after infringement of them.</p> <p>CO7: Conceptualize design, geographical indication and other forms of IPs.</p>				
Outline of Syllabus: (per session plan)				
Module	Description			No of hours
1	Entrepreneurship-I			15
2	Entrepreneurship -II			15
3	Product Development and AI			15
4	IPR			15
	Total			60
PRACTICALS				60

Module	Entrepreneurship and IPR	No. of Hours/Credits 60/4
1	<p>Entrepreneurship -I</p> <p><i>Introduction</i> Entrepreneurship Mindset, Entrepreneurship process; Factors impacting emergence of entrepreneurship</p> <p><i>Theories of entrepreneurship</i> Role of Socioeconomic environment. Managerial and characteristics</p> <p><i>Qualities of Entrepreneurs</i> Entrepreneurs versus inventors; Entrepreneurial Culture, Entrepreneur as a leader.</p> <p><i>Classification and Types of Entrepreneurs</i> Women Entrepreneurs; Social Entrepreneurship; Corporate Entrepreneurs, characteristics of entrepreneur: Leadership; Risk taking; Decision-making and business planning.</p> <p><i>Role of Entrepreneur</i> Role of an entrepreneur in economic growth as an innovator; generation of employment opportunities; complimenting and supplementing economic growth; bringing about social stability and balanced regional development of industries.</p> <p><i>Creating Entrepreneurial Venture</i> Generating Business idea - Sources of Innovation, generating ideas, Creativity and Entrepreneurship</p> <p><i>Challenges in managing innovation; Entrepreneurial strategy,</i> Business planning process; Drawing business plan; Business plan failures. Promotion of a Venture: External environmental analysis-economic, social and technological, Competitive factors:</p> <p><i>Legal requirements for establishment of new unit and raising of funds</i> Venture capital sources and documentation required.</p>	<p>15</p> <p>1</p> <p>2</p> <p>1</p> <p>2</p> <p>3</p> <p>2</p> <p>2</p> <p>2</p>
2	<p>Entrepreneurship -II</p> <p><i>Entrepreneurial Management</i> Basic forms of Business Ownership; Special forms of ownership: Franchising, Licensing, Leasing; Choosing a form of Business ownership; Corporate Expansion: mergers and acquisitions, diversification, forward and backward integration, joint ventures, Strategic alliance. Managerial functions and Roles. Insights from Indian practices and ethos.</p> <p><i>Planning</i> Objective, Nature and process of planning, SWOT Analysis, formulation of plans, Decision making process. Organizing: Objectives, nature and process of organizing formal and informal</p>	<p>15</p> <p>2</p> <p>3</p>

	<p>organization, authority and responsibility, delegation and empowerment, centralization and decentralization, concept of departmentation, Organization Chart, Line, Divisional, Staff and functional relationships, Top Management, process and principles of delegation</p> <p>Staffing Concept, Manpower Planning, recruitment, selection, training and development, performance appraisal. Directing: Concept and techniques of Motivation and Leadership. Process and barriers to communication. Controlling: Concept, Need and Techniques. Controlling: concept, process and techniques and control,</p> <p>Management by Objectives (MBO) Management by Exception (MBE) Essentials of effective control, Managerial effectiveness. Management Culture: Beliefs and Perceptions. Corporate Philosophies: Bigger is better, Small is beautiful, creating new businesses within existing corporates. Strategic Business Units.</p> <p>Managing Entrepreneurship Creativity, Innovations, IPR (example of 3M) and entrepreneurial ventures. Entrepreneurial effectiveness and efficiency, Entrepreneurial leadership including Hersey & Blanchard's theory, contemporary leadership roles and Use of control techniques in small business.</p> <p>Entrepreneurship as empowerment High technology entrepreneurship and women entrepreneurs, science and technology enterprises, gender and technology, entrepreneurship, gender and empowerment, entrepreneurial opportunities for women, motivating women entrepreneurs.</p> <p>Financial agencies- funding agencies</p>	<p>3</p> <p>2</p> <p>2</p> <p>2</p> <p>1</p>
3	Product Development and AI	15

	Concept and Components of Marketing Program; Product Development and Brand Positioning	3
	Repositioning the Product in the Market through Product Life-Cycle Analysis; Selecting the Pricing	
	Objective and Pricing Methods	1
	Adoption of Appropriate Pricing Strategies	
	Global production	2
	outsourcing, logistics and supply chain; Global marketing strategy- global positioning, branding, product development, pricing, communication, and distribution strategic; Global e-business; market development, and diversification. Methods of strategy development:	2
	Product development for international markets	
	Quality, green marketing, and adaptation issues. Marketing opportunities in services. Challenges of managing brands globally. International marketing channels – distribution patterns in international markets	2
	Fundamentals of Artificial Intelligence	
	Introduction, A.I. Representation, Non-AI & AI Techniques, Basic principles of AI, Representation of Knowledge, Knowledge Base Systems,	2
	Intelligent Agents and Environments	
	Concept of rationality, the nature of environments, structure of agents, problem solving agents, problem formulation, various application domains AI	2
	Machine Learning	
	Examples of Machine Learning applications, Training versus Testing, Positive and Negative Class, Cross-validation.	1
	Types of Learning	
	Supervised, Unsupervised and Semi-Supervised Learning.	
	IPR	15
	Basic concept of Intellectual Property	2
	Characteristics and Nature of Intellectual Property right, Justifications for protection of IP Co,	
	IPR and Economic Development	2
	Major International Instruments relating to the protection of IP i. Berne Convention ii. Paris Convention iii. TRIPS Module	
	Copyright	1
	Ownership of copyright	
	Term of copyright	
	Rights of owner Economic Rights, Moral Rights	
	Infringement of copyright	
	Patents	2

6. Taxmann's Entrepreneurship development-CA Dr. Abha Mathur

7. Entrepreneurship New Venture Creation-David H. Holt, Pearson

Practical PMABT PM Program-211

Any other reference sources as recommended by the course instructor.

Sl. No.	Topic	Hours per week
1	Formulation of entrepreneurial venture and business plan	1
2	Formulation of business plan	1
3	Development of a product	1
4	Practical applications of computer, financial and time management	1
5	Case studies-Practical based on IPR	1
6	AI related products-case studies	1
7	Application AI and non-AI technologies	1
8	Quizzes and surveys - Future of AI in healthcare	1

To develop scientific temper and interest in research through industrial visits and institutional visits as recommended in each semester.

Practical PSMABCP44 Practical-XII	
Practical (Hours per week)	Credit
4	2
S. No.	Topic
1.	Formulation of entrepreneurial venture and generate business idea.
2.	Formulate a business plan
3.	Development of a product
4.	Practical applications of copyright, trademark and filing patent
5.	Case studies-Presentations based on IPR
6.	AI related products- case studies
7.	Implement AI and Non-AI techniques
8.	Blogs and surveys –Future of AI, AI in healthcare

To develop scientific temper and interest by exposure through industrial visits and study/educational tours is recommended in each semester.