

UNIVERSITY OF MUMBAI

No.UG/ 416 of 2004

CIRCULAR:

In continuation of this office Circular No.UG/245 of 2004 dated 11th June, 2004 in respect of Ordinances, Regulations and syllabi relating to the eleven short-term Certificate Courses for the under-graduate and post-graduate studies under the faculty of Science and the Principals of the affiliated colleges in the faculty of Science are hereby informed that the recommendation made by the Board of Studies in Bio-chemistry at its meeting held on 10th March, 2004 has been accepted by the Academic Council at its meeting held on 2nd April, 2004 vide item No.4.58 and subsequently approved by the Management Council at its meeting held on 17th April, 2004 vide item No.20 and that in accordance therewith the following eleven short-term Certificate Courses for the under-graduate and post-graduate studies under the faculty of Science have been introduced by this University with effect from the academic year 2004-2005.

1. Forensic Biochemistry
2. Environmental Biochemistry
3. Applied Biotechnology
4. Research Methodology
5. Drug Discovery and Development
6. Industrial Biochemistry
7. Instrumental Analytical Techniques
8. Clinical Biochemistry and Basics of Medical Laboratory Technology ✓
9. Nutrition and Dietetics
10. Food Processing and Preservation
11. Quality Control(OC), Good Manufacturing Practices (GMP) and Good Laboratory Practices (GLP)

They are further informed that in exercise of the powers conferred upon it under sub Section (i) of Section 54 of the Maharashtra Universities Act, 1994 and the Management Council has made Ordinances 5421, 5422, 5423, 5424, 5425, 5426, 5427 and 5428 and in exercise of the powers conferred upon it under sub Section (i) of Section 55 of the Maharashtra Universities Act, 1994 the Management Council has made the Regulations 4751, 4752, 4753, 4754, 4755, 4756, 4757, 4758, 4759, 4760, 4761, 4762 and 4763 relating to the Syllabus, Scheme of Papers and the Standard of Passing for eleven short-term Certificate Courses for the under-graduate and post-graduate studies under the faculty of Science have been passed as per Appendix and the same have been brought into force with effect from the academic year 2004-2005.

Mumb 400 032
30th September, 2004

[Signature]
for the REGISTRAR

- 2 -

To,

The Principals affiliated colleges in the faculty of Science

A.C.458 02.04.2004

M.C.20 17.04.2004

No.UG 416-A of 2004

30th September, 2004

Copy forwarded with compliments for information to :-

- 1) the Dean, Faculty of Science.
- 2) the Chairman, Board of Studies in Biochemistry.

for I/c REGISTRAR

Copy to :

The Director, Board of College and University Development, the Controller of Examinations the Deputy Registrar (Eligibility & Migration Section), the Director of Students Welfare, the Personal Assistants to the Vice-Chancellor, the Pro-Vice-Chancellor, the Registrar and the Assistant Registrar, Administrative sub-centre, Ramagiri, for informations.

The Controller of Examinations (10 copies), F. & A. O. (Accounts Section) For (2 copies), Record Section (5 copies), Publication Section (5 copies), D.R. (Enrollment, Eligibility & Migration Section - 3 copies), D.R., (Statistical Unit (2 copies), D. R., (Accounts Section), Vidyanagari, (2 copies), D. R. (Affiliatic Section) (2 copies), Director, U.C.C., I.D.E. Bldg. Vidyanagari, A.R., E.A.U. (2 copies), A. R., A. A. Unit (2 copies). He is requested to treat this as Action taken report on the concerned resolution adopted by the Academic Council/Management Council, referred to in the above Circular, and that a separate A.T.R. will be sent in this connection., A. R., CONCOL (2 copies) BUCTU (1 copy), Dy. Acct. (Unit V) (1 copy), In-charge, Central Computer Facility (1 copy), Receptionist (1 copy), Telephone Operator (1 copy), Secretary, MUASA (1 copy), Superintendent, P.G.Section (1 copy) D.R.(P.R.O.) (1 copy).

Samudra Singh, num. 300904

UNIVERSITY OF MUMBAI



APPENDIX
SHORT-TERM
SELF-FINANCING VALUE-ADDED
CERTIFICATE COURSES
(ADD-ON COURSES)
FOR
U.G. AND P.G. STUDENTS
UNDER
FACULTY OF SCIENCE
OF THE
UNIVERSITY OF MUMBAI
ORDINANCES & REGULATIONS, SCHEME OF
EXAMINATION AND SYLLABUS OF
11 CERTIFICATE COURSES

(with effect from the academic year 2004-2005)

OBJECTIVES

- 1) To help UG and PG Students enrich their qualification through value-added short-term courses.
- 2) To give them opportunity to acquire additional training simultaneously in multiple areas.
- 3) To augment the knowledge and expertise gained at UG and PG levels.
- 4) To lay emphasis on entrepreneurial development with a view to inspiring and motivating students for self employment.
- 5) To enhance employment opportunities and career prospects in the job market.
- 6) To promote interaction between industry and academics.
- 7) To gain insight of the corporate world through industrial visits.
- 8) To work on industry-related projects.
- 9) To equip students for better survival in competitive world.
- 10) To help them identify the right type of career prospects suiting their aptitude.

Title

O. 5421

THE COURSE SHALL BE TITLED AS "CERTIFICATE COURSE IN"

THE FOLLOWING SHALL BE THE LIST OF SUCH CERTIFICATE COURSES.:

- 1) Forensic Biochemistry
- 2) Environmental Biochemistry
- 3) Applied Biotechnology
- 4) Research Methodology
- 5) Drug Discovery and Development
- 6) Industrial Biochemistry
- 7) Instrumental Analytical Techniques
- 8) Clinical Biochemistry and Basics of Medical Laboratory Technology
- 9) Nutrition and Dietetics
- 10) Food Processing and Preservation.
- 11) Quality Control (QC), Good Manufacturing Practices (GMP) and Good Laboratory Practices (GLP)

ELIGIBILITY :

- O. 5422** A candidate, for being eligible for admission to such Certificate Courses, shall have enrolled himself/herself with the University of Mumbai and taken admission to any of the undergraduate or post graduate courses under Faculty of Science in the constituent / affiliated colleges / recognised institutions of the University of Mumbai.
- O. 5423** A candidate, who has already successfully passed the B.Sc. or M.Sc. degree of this university or any other university equivalent thereto shall also be eligible to enroll himself / herself for such certificate courses being conducted in the constituent / affiliated colleges / recognised institutions of the university of Mumbai.
- O. 5424** Notwithstanding anything contained above in **O. 5422**, and **O. 5423**, a candidate shall have to fulfill minimum admission criterion for each of the Certificate Courses as given below, considering the contents of such courses and the minimum maturity level of the candidates to grasp, appreciate and derive maximum benefits from such courses :

Sr. No.	Name of certificate course	Minimum Entry / Admission Level required.
01	Forensic Biochemistry	TYB.Sc onwards
02	Environmental Biochemistry	FYB.Sc. onwards
03	Applied Biotechnology	---- " " ----
04	Research Methodology	TYB.Sc onwards
05	Drug Discovery and Development	---- " " --
06	Industrial Biochemistry	FYBSc onwards
07	Instrumental Analytical Techniques	---- " " ----
08	Clinical Biochemistry and Basics of Medical Laboratory Technology	---- " " ----
09	Nutrition and Dietetics	---- " " ----
10	Food Processing and Preservation.	---- " " ----
11	Quality Control (QC), Good Manufacturing Practices (GMP) and Good Laboratory Practices (GLP)	TYB.Sc onwards

- O. 5425** Candidate, who is a regular student, shall pursue such Certificate Courses simultaneously while he/she is studying for his/her B.Sc. or M.Sc. degree of University of Mumbai.

DURATION :

- O. 5426** The certificate course shall be an Add-on Course and shall be conducted for 12 weeks in each term of the academic year.
- O. 5427** Notwithstanding contained above in **O. 5426** the Summer / Diwali / X-mas vacation. if need be, shall be suitably utilised for the completion of such Certificate Courses.
- R. 4751** No of students : A batch shall consist of minimum 20 students :
- R. 4752** Each Certificate Course shall consist of Two Theory Papers (100 marks each X2=200 marks), Practicals (100 marks), Industrial visit and its report (30 marks), Project (50 marks) and Viva-voce (20 marks); thus totaling to 400 marks.
- R. 4753** Each Certificate Course shall be covered in 60 lectures (30 lecturer per paper i.e. 03 Lectures per unit), 12 practicals(3 Hours per week for 12 weeks) and 8 hours of project guidance per batch

FEES

- O. 5428** Each Student shall pay Rs. 3000/- for each certificate course.

Qualifications for teaching Certificate Course (s) :

- R. 4754** Minimum Post-graduate degree in Biochemistry, Microbiology, Life Sciences, Biotechnology, Chemistry, Botany, Zoology, Biophysics, Environmental Sc., Food and Nutrition, Statistics, Pharmacy, Engineering and any other subjects related to the subjects offered in Certificate Course(s).

INCOME AND EXPENDITURE STATEMENT FOR EACH CERTIFICATE COURSE

EXPENDITURE	Rs.	INCOME	Rs.
Lectures (60 X Rs.200)*	12,000/-	Fees @ Rs. 3,000/- per student for batch of min 20 students	60,000/-
Practicals (44** X Rs.200)	8,800/-		
Chemicals	10,000/-		
Non-teaching Staff	6,000/-		
Study Material	3,000/-		
Exam Stationery + Expenses	3,000/-		
Contingency	3,000/-		
University Share of Fees\$	3,000/-		
Total Expenditure (a)	48,800/-		
To Profit per batch (b)	11,200/-		
Total (a+b)	60,000/-	Total	60,000/-

* 05 lectures per week for 12 weeks = 60

** 03 practicals per week for 12 weeks (36) + 8 period of project = 44

\$ University Share of Fees @ 5% of Total Fees collected
 (0.05 X 3000 X 20 = Rs. 3000) to be remitted to the University within one week from the commencement of each batch

- a) The examination shall be conducted after 12 weeks from the commencement of the certificate course.
- b) The examination shall consist of the following Heads of Passing, maximum marks assigned to each head and minimum marks required for passing in each head as detailed in the following table :

Sr. No.	Heads of Passing	Maximum marks	Minimum marks for passing
1)	Theory Papers (2 papers of 100 marks each)	200	80 (40 marks per paper)
2)	Practicals	100	40
3)	Industrial Visit and Report	30	12
4)	Project	50	20
5)	Viva Voce	20	8
	Total	400	160

- a) There shall be two theory papers of 100 marks each.
- b) Each theory paper shall be divided into 10 units (Units I to X) of 10 marks each.

- a) Each theory paper shall be of three hours' duration.
- b) Each theory paper shall contain 10 questions based on Units I to X respectively.
- c) All questions shall be compulsory carrying 10 marks each.
- d) Each question shall have three sub-questions viz (i), (ii) and (iii) carrying 02, 03 and 05 marks respectively.
- e) Sub-questions (i), (ii) and (iii) shall have internal options.
- f) Sub-questions (i) shall be Objective Type, sub-question (ii) for Short Notes / Short Answers, and sub-question (iii) for Long / Descriptive Answers.

R. 4758 FORMAT OF PRACTICES

- a) There shall be 12 practicals of three hours' duration each per week.
- b) Each candidate shall maintain a Journal as a record of practicals performed by him/her.
- c) Each Journal, satisfactorily completed, shall be certified by the teachers and the Head of Department.

R. 4759 FORMAT OF PRACTICAL EXAM

- a) Practical Exam shall be of five hours' duration with a small break of 15 minutes after 03 hours.
- b) The distribution of experiments shall be as follows :

(i) Two short experiments of 20 marks each	40
(ii) One long experiment of 40 marks	40
(iii) Spot Test (5 spot of 2 marks each in 25 min)	10
(iv) Journal (duly certified)	10
Total	100

R. 4760 INDUSTRIAL VISIT AND REPORT

- a) Each batch of students shall go for a one-day visit along with the subject teacher to an Industrial Organisation or a Research Institution.
- b) Each student shall prepare a report (approx. 10 pages) of the Industrial Visit and submit it to the subject teacher for evaluation out of 30 marks.
- c) Each Industrial Visit Report shall be duly certified by the subject teacher and the Head of Department.
- d) Each Industrial Visit Report shall have to be submitted for evaluation within one week of the conclusion of the theory or practical exam whichever is later.

R. 4761 PROJECT (non-experimental based)

- a) Each candidate shall undertake a project (30-40 pages) carrying 50 marks.
- b) Project may be one of the following types :-
 - (i) Feasibility Report of any Industrial project
 - (ii) Literature survey on any industrially important compound

- (iii) Compilation of technical information with respect to any product / process / market.
- (iv) Legal aspect related to industry viz. Patents, IPR, FDA, AGMARK, ISI, ISO, WTO, GATT, etc.
- c) Each project shall be duly certified by the subject teacher and the Head of Department.
- d) Each project shall have to be submitted for evaluation within one week of the conclusion of the theory or practical exam whichever is later.

R. 4762 VIVA-VOCE

- a) Each candidate shall have to appear for a viva-voce exam carrying 20 marks
- b) Viva-voce exam shall be based on the entire course content i.e. theory, practical, industrial visit and project report.
- c) Viva-voce exam shall be conducted by the subject teacher on the specified day after the conclusion of theory and practical exam and the submission of Industrial Visit Report and the Project Report.

R. 4763 PASSING STANDARDS

- a) A candidate shall be declared to have successfully passed the Certificate Course, if he/she has scored minimum marks in each Head of Passing i.e. 40 marks in each Theory Paper, 40 Marks in practicals, 12 Marks in Industrial Visit and its report, 20 marks in Project and 08 marks in Viva-voce.
- b) If a candidate fails to score minimum marks for passing in any two or more Heads of Passing, he / she will be declared unsuccessful for the award of the certificate.
- c) However, the candidate shall be given the exemption in the heads in which he/she has passed and he/she shall be allowed to appear for the examination again only for the Heads in which he / she has failed.
- d) The candidate shall be permitted, after initial failure, only three more attempts to clear the Heads of passing, after which the candidate shall have to re-register (if he/she desires) for the same course by paying the full amount of fees.
- e) The candidate shall have to pay Rs. 500/- (Rs. Five Hundred Only) as the Examination Fees for every attempt (maximum three) he / she appears after initial failure.

FORMAT OF CERTIFICATE

The following shall be the format of the Certificate to be awarded by the College to the successful candidates :

(LOGO OF COLLEGE)

(NAME AND ADDRESS OF COLLEGE)

This Certificate is awarded to

Ms./Mr. _____

of _____ College

for successfully completing the

Certificate Course

approved by the **University of Mumbai**

in

“ _____ ”

during _____ to _____

and securing _____ marks out of _____

Signature

Prof. / Dr. (Course Co-ordinator)

(SEAL OF COLLEGE)

DATE _____

(Signature)

Principal of College

FORMAT OF MARKSHEET

The following shall be the format of the Marksheet to be given to each successful candidate :

(LOGO OF COLLEGE)

(NAME AND ADDRESS OF COLLEGE)

Statement showing number of marks obtained in each Head of Passing at

Certificate Course Examination in _____ (subject) _____

held in _____ (month) _____ (year)

Seat No.	Candidates' Name	Remarks : PASSES / FAILS
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Sr. No.	Heads of Passing	Maximum Marks	Minimum Marks for Passing	Marks scored
I)	Theory Papers			
a)	Paper I	100	40	
b)	Paper II	100	40	
II)	Practicals	100	40	
III)	Industrial Visit and Report	30	12	
IV)	Project	50	20	
V)	Viva-voce	20	08	
	Total	400	160	
Percentage :				

Place : _____

Date : _____

(Seal of College)

Signature of
Subject Teacher

Signature of
Head of Dept.

Signature of
Principal

**PROCEDURE FOR AFFILIATION OF
CERTIFICATE COURSES (i.e. ADD-ON COURSES)
TO THE UNIVERSITY OF MUMBAI :**

Procedure to apply for Add-on Courses :

- 01) The College, which desires to start such Add-on courses, shall apply to the Affiliation Section of the University of Mumbai by paying Rs. 5000/- only per Add-on Course through a DD/ PO drawn in favour of "The Registrar, University of Mumbai" as a one time Application Fees.
- 02) The Affiliation Section shall forward such applications to the BOS in the Biochemistry which shall appoint a two member committee, consisting of the Chairperson of BOS and one more member of the BOS to visit the applicant college to inspect and determine the availability and adequacy of the facilities and infrastructure at such Colleges for the successful implementation of newly framed add-on courses.
- 03) The two member committee shall submit its report to the Affiliation Section within one week after the visit.
- 04) The Affiliation Section shall intimate to the applicant College the recommendations of the two member committee, whether to start or not to start the Add-on Courses as the case may be, within one week after the receipt of the report of two member committee.
- 05) The BOS in Biochemistry shall draft a format of the report to be submitted by the two member committee to the Affiliation Section.
- 06) The College may discontinue one or more Add-on courses, for which the University has granted the permission, due to the fluctuating demand of students for such courses or any other administrative constraints. However, the college may revive such courses later by applying afresh to the University to restart such courses by paying Rs. 1000/- per course as the fees for its revival. Nevertheless it shall be mandatory on the College to inform the University about the discontinuation of such courses and be subject to the visit of a two member committee for re-inspection of the facilities and the infrastructure at the College for granting the revival of discontinued courses.
- 07) The members of the two member committee shall be eligible to receive the TA/DA as per the University rules while visiting the applicant Colleges.
- 08) The BOS in Biochemistry may be permitted to include a subject specialist, who is not the member of the BOS, in a two member committee to avail of his / her expertise to assess the infrastructure of the applicant college to start Add-on courses.
- 09) It shall be mandatory that both the members of the two member committee shall visit the applicant College for inspection to grant permission to or revival of such certificate courses.

SYLLABUS OF CERTIFICATE COURSE IN FORENSIC BIOCHEMISTRY

Paper I - Basic Forensic Sciences

Unit No.	Topic No.	Topic
I	1.0	Forensic Medicine
	1.1	Introduction
	1.2	Terminology - Forensic medicine, medical jurisprudence, forensic pathology, medical ethics and etiquette
	1.3	History of Forensic Medicine
II	2.0	Legal procedures in medico-legal cases
	2.1	Inquest - its types
	2.2	Offences – types
	2.3	Witness - kinds and functions
	2.4	Types of evidences
III	3.0	Medico Legal aspects
	3.1	Criminal courts in India and their powers
	3.2	Medical certificate and medico-legal report
	3.3	Dying declaration and dying disposition
IV	4.0	Forensic Identity
	4.1	Identification of an individual's
	4.1.1	Race
	4.1.2	Sex
	4.1.3	Religion
	4.2	Estimation of age and stature of an individual for medico-legal purposes by
	4.2.1	Teeth
	4.2.2	Classification of bones
	4.2.3	Height and weight
	4.2.4	Miscellaneous - birth record, changes occurring at puberty and due to old age
	4.3	Identification based on scars and tattoo marks
	4.4	Identification of an individual from hair
	4.5	Identification of an individual from occupational marks
V	5.0	Forensic Biology and Serology
	5.1	Forensic examination of
	5.1.1	Blood - general considerations
	5.1.2	Blood group systems
	5.1.3	DNA profiling / Finger printing
	5.1.4	Blood stains
VI	6.1	Forensic examination of biological fluids :
	6.1.1	Semen
	6.1.2	Saliva
	6.1.3	Urine

	6.1.4 6.1.5 6.1.6	Faecal matter Milk Hair
VII	7.0 7.0.1 7.0.2 7.0.3 7.0.4 7.0.5	Collection and preservation of biological materials Blood Saliva Swabs and smears Hair Nails
VIII	8.0 8.1 8.2	Thanatology (Scientific study of death) Types of death Post mortem changes - immediate, early and late.
IX	9.0 9.1 9.2 9.2.1	Post Mortem Lividity Biochemical changes occurring in putrefaction Estimation of post mortem interval Changes in biological fluids
X	10.0 10.1 10.2 10.3	Sexual Jurisprudence Biochemical tests for detection of pregnancy Biochemical tests for diagnosis of disputed maternity & paternity Rape

Paper II - Forensic Toxicology

Unit No.	Topic No.	Topic
I	1.0	Toxicology
	1.1	General principles
	1.2	Occupational and environmental toxicology
II	2.0	Legal aspects of toxicology
	2.1	Laws related to poisons
	2.2	Toxicological evidence
	2.2.1	Forensic aspects
	2.2.2	Analytical aspects
	2.2.3	Interpretation
III	3.0	Poisons
	3.1	Definition
	3.2	Classification sources and properties and fatal doses of poisons
IV	4.0	Corrosive poisons (mechanism of serological testing of the blood – precipitin test
	4.0.1	Strong acids (weak and strong action and clinical features)
	4.0.2	Strong alkalis
V	5.0	Irritant Poisons (Mech of action and clinical features)
	5.1	Inorganic metallic (arsenic, mercury, lead, copper, iron, zinc and thallium, Na)
	5.2	Inorganic non-metallic (phosphorus and halogens)
	5.3	Organic vegetable (ergot, capscicum, dhature)
	5.4	Animal poisons (snakes, scorpions, bees, spider)
VI	6.0	Neurotoxics
	6.1	Enebriant poisons (methyl alcohol, ethylene glycol, barbiturates)
	6.2	Somniferous poisons (narcotics) - opium, morphine and heroin
VII	7.0	Asphyxiants
	7.1	carbon dioxide, carbon monoxide, hydrogen sulphide, war gases and hydrogen cyanide
VIII	8.0	Analytical Toxicology
	8.1	Laboratory Setup
	8.2	Qualitative and quantitative analytical methods - bedside tests, chromatography, spectrometers
	8.3	Viscera and chemical examination
IX	9.0	Precautionary Measures in toxicology in handling
	9.1	Precautions in handling biological material, HIV infected hepatitis B +ve
	9.2	Radioactive exposed bodies
X	10.0	Project report
	10.1	Typical format and organization of forensic laboratory

PRACTICALS

Practical No.	List of Experiments
1.0	Collection of forensic samples and qualitative test for blood - stains : benzidine test and phenolphthaline test
2.0	Microscopic and microchemical examination of blood stains, red corpuscles, haemin crystal test (Teichmann's test), Haemochromogen crystal test (Takayama test)
3.0	Spectroscopic examination of blood pigments oxyhemoglobin, reduced Hb, Carboxy Hb, MetHb, Acid Haematin, Alkaline haematin, Haemochromogen, cyanhaemochromogen, acid haematoporphyrin, alkaline haematographrin
4.0	Detection of the blood groups
5.0	Qualitative tests for normal urinary constituents like urea, uric acid, creatinine in stain
6.0	Detection of amylase (ptyalin) activity in saliva
7.0	Biochemical analysis of semen : Florence test, Barberia's test, Acid phosphatase test, Creatine phosphokinase test
8.0	Biochemical tests for pregnancy : Inhibition (indirect) latex slide test Direct latex slide test
9.0	Estimation of acetyl salicylic acid from serum, Estimation of barbiturates from serum
10.0	Estimation of lead by colorimetric method
11.0	estimation of phenol from serum, Estimation of iron by 2,2 dipyridyl method
12.0	Identification of poisons

list of spots

1. Spectroscope
2. Identify the gen blood pigments
3. Slides - microscopic examination of blood
4. Blood group detection
5. Pregnancy test

Demonstration

1. DNA fingerprinting
2. Autopsy (histopathology)
3. Breath test for alcohol and other quantitative estimation of alcohol - specify
4. chromosomal analysis - kanjotyping
5. aboric absorption spectrophotometer

Project Report on the following topics :

1. Biochemical tests to detect disputed maternity
2. Biochemical tests to detect paternity
3. Biochemical tests to detect rape
4. Biochemical tests to detect inembriation
5. Thermal injuries
6. Laws applicable to Medico-legal cases

Industrial visits to :

1. Govt. Forensic Laboratory, Kalina
2. Pathology Dept. of Medical College

SYLLABUS OF CERTIFICATE COURSE IN ENVIRONMENTAL BIOCHEMISTRY

Paper I - Introduction to the Ecosystem and Pollution of Air, Water and Soil in the Environment

Unit No.	Topic No.	Topic
I	1.0	Introduction to air pollution and types of air pollutants Sources, fate and effects of sulphur oxides, nitrogen oxides and carbon monoxide in the environment
II	2.1	Sampling, monitoring, analyses and control of sulphur oxides, nitrogen oxides and carbon monoxide
	2.2	Air quality standards – an overview
III	3.0	Formation, effects and control of photochemical smog
IV	4.0	Greenhouse gases, greenhouse effect : causes, consequences and abatement, Ozone depletion : causes, mechanism, consequences and abatement (CFCs to be included)
V	5.1	Water resources : Introduction to
	5.1.1	Surface and ground water
	5.1.2	Water quality parameters i.e. potability
	5.1.3	Water treatment & distribution
VI	6.1	Water quality monitoring techniques : (only theory to be covered, procedures done in practicals)
	6.2	Physical and biological parameters ; pH, specific conductance, TS, TSS, TDS E. Coli & total bacteria, MPN
	6.3	Chemical parameter : acidity, alkalinity, sulphates, phosphates nitrates/nitrites, chlorides, fluorides, hardness, DO, BOD, COD
VII	7.1	Water pollution : Types of pollutants :
	7.2	Domestic
	7.3	Industrial
	7.3.1	Metal - Pb / Hg / Cd / Cr
	7.3.2	Organic - paper & pulp / tanning / soaps & detergents / oil refinery / cane sugar (one example from each category)
VIII	8.0	Waste water treatment, water quality assessment, bioremediation
IX	9.1	Soil profile and composition (organic & inorganic)
	9.2	Properties of soil - color, density, permeability, water retention, pH, soil quality indicators
X	10.1	Instrumental techniques in environmental chemical analysis : Atomic absorption spectroscopy, TLC, GLC, HPLC, Ion selective electrodes.

Paper II - An introduction to Toxicology and Environmental Protection

Unit No.	Topic No.	Topic
I	1.0	Industrial Toxicology
	1.1	Polymers and plastics _ their uses, classification and characteristics (in brief), environmental consequences, abatement procedures for polymer and plastic pollution
	1.2	Food additives and contaminants : Uses, classification, risk analysis of : sodium nitrate and nitrite, BHA & BHT, Brominated vegetable oils, saccharin, monosodium glutamate
II	2.0	Agriculture toxicology
III	3.0	Pesticides : classification on the basis of mode of entry, mode of action, chemical nature
IV	4.0	Uptake, conversions and elimination of pesticides (only general routes, no specific pesticide to be covered)
V	5.0	Antidotal therapy
VI	6.1	Toxicity tests
	6.2	Types of toxicity tests (definition of mutagenesis, teratogenesis, carcinogenesis) LD50, LC50
	6.3	Teratogenicity test : characteristics mechanism, procedure, evaluation and analysis
	6.4	Carcinogenicity : types of carcinogens, test, evaluation
	6.5	Ames test
	6.6	Current issues, environmental restoration and legislation
VII	7.0	Earth Summit (1991) (to be covered as assignments, seminars, group presentations)
VIII	8.0	Economic and legal questions : economics of pollution, cost of a clean environment, legal aspects of pollution. Agenda 21 of the UN resolution
IX	9.0	Environmental action : National and International problems and programs, environmental protection agencies.
X	10.1	A detailed report on the requirements to set up a fully functional environmental safety/testing laboratory. The report should be prepared by students in groups of not more than three students. Details of the finances, minimum space required, instruments, consumables (budgeting only), personnel etc. should be specified. Consultation with any existing environmental labs or departments is recommended
		or A detailed proposal for a specific project should be planned. The proposal should show details of the financial requirement, economic viability and feasibility, of the project.

Practicals

Water analysis (samples to be collected from any natural water body, well etc.)

Determination of

1. pH
2. Specific conductance
3. Acidity and Alkalinity
4. dissolved oxygen and BOD
5. Chemical oxygen demand
6. MPN and gram stain

Estimation of

7. Hardness
8. Chlorides
9. Fluorides / nitrites
10. Phosphates / sulphates

11. **Air Analysis** : Determination of the sulphur dioxide content in air (demonstration)
12. **Toxicology**
Qualitative tests for the detection of food additives / adulterants in the given samples :
Dal, turmeric, chilly powder, sugar, milk, tea, pepper

or

Determination of the LD50 / LC50 of any pesticide by using Daphnia (any animal system)

Spots

Chemicals, reagents and instruments used in all the experiments can be kept as spots.

Identification of a Gm positive - Gm negative organism on the slide

Simple problems based on any of the experiments. E. g. data given, calculate the result, or result given, interpretation to be carried out.

Projects :

Selection of an ecosystem / industry / locality to study the causes and effects of pollution and recommendations of control measures.

Industrial Visits

To Pollution Control Dept. of Chemical, Pharmaceutical, Food, Pesticides, Paints, Dyes, Textiles, Oils/ Soaps/Detergents, Rubber, Tannery industries etc., Sewage Treatment Plant, Water Purification Plant.

References

- 1) A textbook of environmental chemistry and pollution control 1995, Dara S. S.
- 2) Environmental chemistry 2000, 4th Ed., De A. K.
- 3) Environmental Pollution 1997, 2nd Ed., Hodges L.
- 4) Fundamental concepts of environmental chemistry 2000, Sodh G. S.
- 5) Water technology : an introduction for environmental scientists and engineers 1999, Gray N. F.
- 6) An introduction to toxicology 1991, Prasad S. N. And Kashyap V.
- 7) Concepts of toxicology 1994, Omkar
- 8) Pollution control in process industries 1990, Mahajan S. P.

References for Practicals

- 1) Standard methods for the examination of water and wastewater 1989, 17th Ed., Eds Clesceri L. S. Greenberg A. S., Russell R. R.
- 2) Chemical and biological methods for water pollution studies 1986, Trivedi R. K. and Goel P. K.
- 3) Environmental Chemistry 2000, 4th Ed., De A. K.

SYLLABUS OF CERTIFICATE COURSE IN APPLIED BIOTECHNOLOGY

Paper I – Recombinant DNA Technology

Unit No.	Topic No.	Topic
I	1.0	Structure of RNA & DNA Structure and biological functions of Nucleic Acids
II	2.0	Microbial Biotechnology & Applications (Commercial production of micro-organisms.
	2.1	Bioconversions products from micro-organisms.
	2.2	Oil and mineral recovery & applications.)
III	3.0	Plant Biotechnology & Applications (Plant tissue culture and genetic engineering.)
IV	4.0	Animal Biotechnology & Applications
	4.1	Gene transfer methods in animals, transgenic animals.
	4.2	Conservation biology. Regulation of transgenic animals and applications.
V	5.0	Marine Biotechnology & applications. Aquaculture, Algal products, Fuels from algae. Algal cell culture.
VI	6.0	Medical Biotechnology
	6.1	Gene Therapy, Gene delivery methods, Viral Delivery, Gene therapy models. Commercialization of gene therapy
	6.2	Vaccines, Synthetic DNAs, Therapeutic Ribozymes. Synthetic drugs, Tissue engineering, Antibody engineering. Drug delivery
VII	7.0	Basic principles of recombinant DNA technology.
	7.1	Cutting and joining DNA, separating restriction fragment and visualizing DNA. Cloning Vectors, polymerase chain reaction, DNA sequencing,
	7.2	Application of recombinant DNA.
VIII	8.0	The Human Genome Project
	8.1	The human genome, Goals of the human genome project, Polymorphic DNA markers, Physical maps, DNA Sequencing
	8.2	Ethical, legal and social implications.
IX	9.0	Forensic and DNA Profiling
	9.1	Satellite DNA Population genetics and alleles, Multi-Locus Minisatellite VNTRs, Single-Locus Minisatellite VNTRs, Restriction Fragment Length
	9.2	Polymorphisms (RFLPs)
	9.3	Method of DNA profiling. Digital DNA typing, Population comparisons, The frye test, DNA databases.
X	10.1	Environmental Biotech in The 21st Century
	10.1	Future challenges and applications.

Paper II – Industrial Applications of Biotechnology

Unit No.	Topic No.	Topic
I	1.0	Fermentation Biotechnology
	1.1	Bioreactors-types and construction.
	1.2	Fermentation as a biochemical process, Microbial processing and raw material
	1.3	Microbial production of cheese, Production of ethanol,
	1.4	New steps in antibiotic fermentation, Production of vitamins.
II	2.0	Energy From Microbial And Other Sources
	2.1	Biogas and methanogenic microbes
	2.2	Biophotolysis and hydrogen photoprduction,
	2.3	Other nonconventional bioenergy sources.
III	3.0	Techniques of immobilisation of enzymes & cells
	3.1	Historical background, nitrogen molecule, oxidized and reduced, symbiotic and asymbiotic nitrogen fixing systems, leg hemoglobin and nitrogen fixation in nature, nitrogenase - The key enzyme, control of biosynthesis of nitrogenase, substrate and hydrogen - deuterium reactions, cross – reactions and hybridization studies,
	3.2	Hydrogenase, the hydrogen donating system, Ferredoxin and Flavodoxin, The hydrogen donating system, Phosphoroclastic dissimilation, six electrons requirement, oxygen sensitivity, hydrogen evolution and biotechnological operation, Aerobic and anaerobic system, energetics,
	3.3	Organisation of nif genes, Regulation of nif expression, biotechnological programme and current status
IV	4.0	Biotechnological spotlights :
	4.1	Hybrid antibiotics : Release of Hybrid antibiotics bioactive agents.
	4.2	Bioreactors and production of L-amino acids
		L-malic acid by immobilized cells
	4.3	Thaumatococcus - The intense sweetener High temperature resistant proteases Production of Human plasminogen activators, biofuels, biofilters, biosensors and biochips, endorphin, hepatic vaccine production
V	5.0	Biotechnological Methods of Pollution Detection and Abatement.
	5.1	General bioassay in pollution monitoring, Molecular biology in environmental monitoring.
	5.2	Algal photosynthesis in waste water treatment, Eutrophication, algal bloom and biological phosphorus removal.
	5.3	Cell immobilization as a tool in waste treatment.
VI	6.0	Biotechnology And Biodegradation
	6.1	Biodegradation of herbicides and pesticides, cellulose, hydrocarbons. Synthetic polymers.
	6.2	Testing of biodegradability, Military application of biodegradation.
VII	7.0	Genetically Engineered Microbes In Biotreatment Of Wastes And nvironment
	7.1	Genetic concept in environment management, Gene transfer in the environment

	7.2	Genetically engineered microbes (GEMs) in biotreatment of wastes.
VIII	8.0	Biohydrometallurgy And Biomining
	8.1	Bioleaching, Biosorbent microbial groups, macrophytes.
IX	9.0	Regulation, Patents And Society.
	9.1	Biotechnology And International Markets
	9.2	Regulation of biotechnology, Patents and biotechnology, University versus private enterprise. Copyrights of genetically engineered cells, Resource data bank, Culture collection
	9.3	International biotech scenario. Ethical and value judgements.
X	10.0	Project Report
	10.1	How to write a Project Report to evaluate techno-economic feasibility of project proposal.

References :

- 1) BIOTECHNOLOGY - AN INTRODUCTION, BY SUSAN R. BARNUM
WADSWORTH PUBLISHING COMPANY - 1998
- 2) BIOTECHNOLOGY, BY KESHAY TREHAN
NEW AGE INTERNATIONAL (P) LTD PUBLISHERS-2002
- 3) INTRODUCTION TO ENVIRONMENTAL BIOTECHNOLOGY
BY A.K.CHATTERJI, PRENTICE-HALL OF INDIA PVT LTD - 2002

List of experiments

1. Estimation of protein by Lowry's, Bradford's method, preparation of standard curve (spectrophotometric)
2. Isolation and purification of amylase using ammonium sulphate precipitation and gel filtration.
3. SDS PAGE – electrophoresis of proteins.
4. Culturing of E coli & preparation of cell free extract
5. Isolation of plasmid DNA & Chromosomal DNA
6. Spectrophotometric quantification of DNA content.
7. Agarose gel electrophoresis
8. Restriction enzyme digestion and data interpretation
9. Establishment of fungal culture (Mucor)
10. Plant tissue culture techniques : Media preparation, seed sterilisation, establishment of shoot cultures.
11. Isolation and identification of microflora from sewage water
12. Waste water treatment using enzymes.

Industrial Visits to :

Pharmaceutical, Chemical, Food and Food Processing, Marine Product industries and Research Institutions like BARC, BRIT, TIFR, TMH, ACTREC etc.

SYLLABUS OF CERTIFICATE COURSE IN RESEARCH METHODOLOGY

Paper I – Basics of Research Methodology

Unit No.	Topic No.	Topic
I	1.1	Meaning of Research
	1.2	Criteria of Good Research.
	1.3	Types of Research.
II	2.1	Interdisciplinary nature of modern research.
	2.2	Scientific method.
	2.3	Research Design-features of a good research,
	2.4	Design and planning of a research design.
III	3.0	Methodology of Research :-
	3.1	Identification of a research problem.
	3.2	Literature survey.
IV	4.0	Experimentation, data collection
	4.1	Methods of collecting primary and secondary data.
V	5.0	Analysis and treatment of data.
	5.1	Communication of findings.
VI	6.0	Treatment and Presentation of Data :
VII	7.1	Types of errors, precision and accuracy mean, median range, deviation, average deviation, standard deviation.
	7.2	Confidence limits, graphical representation of results, normal distribution and its importance.
VIII	8.0	Rejection of doubtful results by 'd', 's' and 'Q' tests.
	8.1	Significant figures.
	8.2	Method of averages and least squares.
IX	9.0	Sampling - representative sample, types of sampling.
	9.1	Sampling of gases, liquids, solutions and solids.
X	10.1	A survey of research activities in India, Research Institutions in India, National Laboratories of India,
	10.2	Thrust areas of research

Paper II – Techniques of Research Methodology

Unit No.	Topic No.	Topic
I	1.0	Searching the literature.
	1.1	Library reference work - abstracts, journals, indices, reviews and monographs.
	1.2	Impact factor of journals, Citation index.
II	2.0	Writing of synopsis and thesis. Defence of thesis.
III	3.0	Writing of a good research paper.
IV	4.0	Analysis of a research paper (At least two research papers to be discussed).
	4.1	Preparation of abstract of a research paper (At least 2 papers to be abstracted).
V	5.0	Writing of scientific articles for popular science magazines.
VI	6.0	Preparation and presentation of papers and posters at conferences, symposia and seminars.
VII	7.1	Use of computers in research work.
	7.2	Role of internet as provider of quick information.
VIII	8.1	Brief outline of Intellectual property laws and patent laws.
	8.2	How to apply for a patent.
IX	9.0	Budgeting for research proposal
X	10.1	How to write a research proposal to be submitted to funding agencies.
	10.2	Funding agencies in India.

REFERENCE BOOKS :

- 1) Research - How to plan, speak and write about it - ed. Clifford Hawkins and Marco Sorgi (1987), Narosa Publishing House, New Delhi.
- 2) A Handbook of Thesis Writing - A.S.Patel and B.P.Lulla (1968), Acharya Book Depot, Baroda.
- 3) How to write and publish a scientific paper, 4th ed. - Robert A, Day, Cambridge Low Price edition, Cambridge University Press.
- 4) Advice to a young scientist - P.B.Medawar (1979) – Basic Books (A division of Harper Collins Publishers).

PRACTICALS

- 1 Analysis of a research paper - introduction, Abstract key words, Materials and Methods, Results, Discussion, Acknowledgement, References & Bibliography. Presentation of the Analysis
(3 papers 6 hours each) - 40 Marks. (Total time : 18 Hours) (a)
- 2 Making an abstract of recent research paper (Not earlier than 5 years)
(3 papers, 3 hours each) - 20 Marks. (Total time : 09 Hours) (b)
(paper to be given to the students without a lecture)
- 3 Statistical Analysis of a given set of data
(3 sets of data, 3 hours each) - 20 Marks (Total time : 09 Hours) (c)
(03 different statistical tools to be applied)
(Total (a+b+c) Time : 36 Hours.

PROJECT (Non-experimental based) -

- 1) Literature survey with formulation of hypothesis,
- 2) Website scan, (10 websites to be scanned)
- 3) Preparation of a research proposal
- 4) Preparation of research paper on the basis of tailor - made data
(eg career aspiratious of Std XII students addiction)

INDUSTRIAL VISIT AND REPORT

Visits to research institutions such as TIFR, BARC, IIPS, TISS, ACTREC, NIRRH, serum Institute of India, R & D. Departments of Industries and NCL (Pune)

SYLLABUS OF CERTIFICATE COURSE IN DRUG DISCOVERY & DEVELOPMENT

Paper I : Drug Discovery

Unit No.	Topic No.	Topic
I	1.1	Brief history of the pharmaceutical industry. An overview of drug discovery and development stages/steps, research strategies, economics, financial risks, patents, first-in-class vs me-too products, regulatory aspects.
	1.2	
II	2.1	Challenges in new drug discovery. Examples of discovery of innovative drugs. Role of pharmacology in new drug discovery Introduction to GMP and GLP
	2.2	
	2.3	
III	3.0	Target identification and validation : The nature of drug targets. Strategies in target discovery: Traditional vs Molecular approach. Target identification: Technologies used in target identification: Genomics, proteomics, genetic linkages/association.
	3.1	
	3.2	
IV	4.0	Target validation approaches: Differential gene expression, Microarrays, antisense RNA technology, RNA interference, animal validation studies (transgenic and knock-out mice technology). Selection of target for drug discovery: Target selection criteria and strategies (corporate, medical, marketing and research).
	4.1	
	4.2	
V	5.0	Pharmacology and biochemistry. Principles of pharmacology. A brief understanding of pharmacodynamics and pharmacokinetics. Molecular basis of pharmacologic selectivity. Molecular basis of drug action. Fundamental biological concepts relevant to enzymes, receptors, ion channels and other drug targets. Receptors : Drug receptor theory, stimulus-response mechanism, receptor classification, agonists, antagonists, strategy in receptor-binding studies, receptor preparations, radiolig and binding experiments receptor-binding kinetics, receptor specificity and signal transduction.
	5.1	
	5.2	
	5.3	
VI	6.0	Enzymes : Classification of enzymes, Principles of enzyme assay and kinetic studies, buffers, determination to protein concentration, Different approaches for measuring enzyme activity (photometric, radiometric, fluorometric, luminescence, HPLC), Techniques for enzyme isolation and purification.
	6.1	
	6.2	
	6.3	
VII	7.0	A Identification and optimization of lead compounds : Screening approaches to drug discovery : Empirical and rational. Serendipity
	7.1	

	7.2	in drug discovery. Establishment of test models to identify active molecules. Biochemical and molecular biology-based approaches to screening, Mechanism-based screening. Methods employed for in vitro screening : Enzyme inhibition, receptor-bonding, ion transport, cell and tissue culture based assays and reporter gene assays.
	7.3	Concepts of potency and selectivity for selection of active molecules. Compound sources for screening : Natural products and synthetic compounds. Importance of medicinal chemistry in drug discovery : Identify and optimize new compounds that have activity against the target, Syntheses of structural analogs, stereochemistry in drug design, quantitative structure-activity relationship. Molecular modeling and drug design. Combinatorial chemistry and high throughput screening of compound libraries to identify active molecules.
VIII	8.0	Principles of in vivo pharmacology.
	8.1	Biostatistics and its application in animal experimentation data. Lead optimization.
	8.2	Criteria for selection of compounds for pre-clinical development.
IX	9.0	A Intellectual property rights :
	9.1	Protecting inventions : The patent system. What is a patent? Criteria for patentability. Patent laws.
	9.2	Format of patent application. Drafting and filing of patents.
X	10.0	Procedures for obtaining a patent.
	10.1	Filing the priority application and further patent application, patent examination process, rights conferred by a granted patent and duration of a patent.
	10.2	Role of patent attorneys in the patenting process. Biotechnology patents.

Paper 2 : Drug Development

Unit No.	Topic No.	Topic
I	1.0	Preclinical development
	1.1	Pharmacokinetics (PK) and drug metabolism : Objectives of PK analysis in drug discovery. Fundamental concepts in drug absorption, distribution, metabolism and elimination (ADME). Kinetics of drug following different modes of drug administration :
	1.2	Introduction to important pharmacokinetic parameters. Pharmacokinetics of oral administration and bioavailability.
	1.3	Metabolism and biotransformation of xenobiotics. Determination of dosage regime, drug interactions and adverse effects.
II	2.0	Preclinical toxicology and safety pharmacology :
	2.1	Introduction. ICH guidelines. In vitro toxicology. Mutagenicity (Ames test) and genotoxicity studies. Study design and requirements for in vivo toxicology : species and strain intake, body/organ weight, clinical and laboratory analyses, histopathology) and statistical considerations.
	2.2	Acute toxicity, dose-range-finding and chronic toxicity studies in rodent and non-rodent species. Recovery studies during chronic toxicity experiments. Toxicokinetics. Reproductive toxicity. Carcinogenicity studies.
	2.3	Safety pharmacology : Regulatory requirement. Study design and principles, Safety evaluation of drug candidate on cardiovascular system, central nervous system, respiratory system and secondary organ systems (renal, gastrointestinal, immune and endocrine systems).
III	3.0	A Process development/scale up :
	3.1	Design and develop a scheme to synthesize and drug candidate (new chemical entity) taking into consideration safety, environmental considerations and cost effectiveness.
	3.2	Synthesis of pilot batches. Streamline the process to maximize the yield and quality of the product.
	3.3	Bulk drug synthesis and preparation of bulk drug for development. Analytic process (assays to assure bulk purity). Long-term stability studies.
IV	4.0	Formulation Development :
	4.1	Drug product stability and the influence of formulation and environmental conditions. Preformulation issues. Dosage Forms. : Tablets, parenterals and ophthalmics,
	4.2	Dosage formulation and manufacture, concepts of sterile product formulation, clean room and quality assurance
V	5.0	A Investigational New Drug (IND) Application process :
	5.1	Documents/ information for filing INDs (animal pharmacology and toxicology studies, manufacturing information, clinical protocols and investigator information).
	5.2	Information for Clinical Investigators, laws, regulations, policies and procedures. IND forms and instructions. Targeted product information. IND review process. Permission to conduct human clinical trials.

VI	6.0	Introduction to fundamentals of clinical trials, including design, conduct, analysis and interpretation of trial results.
	6.1	A critical review of the trial concept : rationale of the trial, stages and milestones, clinical/public health importance.
	6.2	Clinical trial design : Type of design and rationale, protocol and case report form, use of control groups/active substances and placebo, inclusion and exclusion criteria, efficacy and choice of endpoints, safety outcomes.
VII	7.0	A Ethical issues :
	7.1	Values and principles in clinical investigations, international guidelines, patient care in clinical research, conflict of interest, ethical review, informed consent, vulnerable populations, biological samples, databases and confidentiality, fraud and misconduct.
VIII	8.0	Study organization :
	8.1	Clinical trial registration, selection of investigators, organization and delegation in the investigation team, flow chart, contracts and agreement, liability and insurance, logistics, data management, clinical trial committees.
	8.2	Study Conduct : Investigator's brochure, study monitoring, safety monitoring and end-of-trial issues.
IX	9.0	A Legal, regulatory and good practice framework :
	9.1	Regulatory and legal frameworks, Good Clinical Practice as per ICH directive, National regulations, application to regulatory agency, quality assurance systems, Standard Operating Procedures, Audits and inspections.
	9.2	Reporting clinical trials : Completeness of follow-up, statistical techniques for analyzing data, primary outcome analysis, clinical study report, communication and publication of study results.
X	10.0	New Drug Application (NDA) Process and drug approval :
	10.1	Introduction, NDA forms, Contents of NDA, Preparation and submission of documents,
	10.2	Guidance documents for NDAs, Laws, Regulations, policies and procedures, Advisory committees, Targeted product information, Drug Master Files, Review process. Product license, product registration. Post licensing/ marketing surveillance (Phase IV).

PRACTICALS

- 1) Enzyme Kinetics of GOT/Phosphatase/Protein Kinase
- 2) Measurement of Enzyme activity by Photometric Luminiscent / Flourimetric / HPLC technique
- 3) Methods for invitro secrecing of drugs
 - a) Enzyme inhibition
 - b) cell tissue culture based assays
 - c) potency & selectivity for selection of active molecules
- 4) Identification and optimisation of active compound from any medicinal plant
- 5) Molecular modeling and drug design
- 6) Evaluation of efficacy in animal model.
- 7) Kinetics of drugs following different modes of drug administration (streptomycin/Tetracyclin/Cyclosporin) by intravenous, intramuscular, intradermal and intraperitoneal routes.
- 8) Histopathology – clinical and lab Analysis for toxicity determination.
- 9) Carcinogenecity and Mutergenecity (AMES) test
- 10)
 - a) Lab scale preparation of acetyl salicylic acid.
 - b) Extraction of thymol / menthol from plant source.
- 11) Statistical analysis
- 12) Maintenance of Lab animal.

Projects

- 1) Survey of medicinal plants in India.
- 2) Comparison among Allopathy, Homeopathy, Ayurveda and other Alternative methods of medicine.
- 3) QC, GMP and GLP in Pharmaceutical industry.
- 4) Packaging in Pharmaceutical industry
- 5) Traditional Medicines.

Industrial Visits to :

- a) Manufacturing units of pharmaceutical industry producing various forms of allopathy / ayurvedic / homeopathic / unani medicines
- b) Pharmacology Dept. of Medical Colleges.
- c) Botanical gardens / Herbaria for medicinal plants.

**SYLLABUS OF CERTIFICATE COURSE IN
INDUSTRIAL BIOCHEMISTRY**
Paper I - Principles of Industrial Biochemistry

Unit No.	Topic No.	Topic
I	1.0	General properties of A Acids, proteins and enzymes
	1.1	Classification & properties of amino acids
	1.2	classification of proteins on the basis of their structure & function
	1.3	classification and properties of enzymes, factors affecting enzyme catalyzed reaction
II	2.0	Michaelis - Menten Equation & Lineweaver - Burke Plot, Active site, theories of enzyme catalysis, Enzyme specificity
	2.1	Protein engineering
	2.2	Immobilisation of enzymes, proteins and cells
III	3.0	Biosensors
	3.1	General properties of carbohydrates
	3.2	Types & classification of carbohydrates
IV	4.0	Mono, di and polysaccharides of industrial importance and originals.
	4.1	General properties of lipids
	4.2	Types and classification of lipids
V	5.0	Oils/ fats, fatty acids, phospho lipids with special reference to lecithin and sterols of industrial importance.
	5.1	Isolation & purification techniques
	5.2	Solvent extraction
	5.3	Centrifugation
	5.4	Column chromatography – ion exchange, affinity
VI	6.0	GLC, HPLC
	6.1	Techniques involved in identification and characterization
	6.2	Spectrophotometric analysis
	6.3	Electrophoresis, isotachopheresis, iso electric focussing
VII	7.0	Radio immunoassay, ELISA
	7.1	Upstream and downstream regulation processes
	7.2	Selection and improvement of microbial strain for optimum productivity
	7.3	Separation of biomass, drying, cell lysis
VIII	8.0	Group separation techniques, High resolution techniques
	8.1	Fermentation technology
	8.2	Principle, design and types of fermenters.
IX	9.0	Fermentation process, factors required and metabolic regulation during fermentation
	9.1	Recombinant DNA technology
	9.2	Isolation of genes, restriction enzymes
	9.3	Vectors for cloning & gene cloning techniques
	9.4	CDNA synthesis
	9.5	PCR analysis
X	10.0	Southern & northern blotting techniques.
	10.1	Hybridoma technology
	10.2	General principle, technique and requirements for hybridoma cell preparation
		Methods of isolation of monoclonal antibodies from hybridoma cells.

Paper II Commercial Production of Industrial Biochemicals

Unit No.	Topic No.	Topic
I	1.0	Pharmaceutical products
	1.1	Interferons
	1.2	Hormones (insulin)
	1.3	Enzymes - sptptokinase
II	2.0	Nutraceuticals
	2.1	Vitamins (ascorbic acid and tocopherol)
	2.2	Beta carotene, lycopene, spirullina
III	3.1	Enzymes and isoenzymes in diagnosis kits
	3.2	Diagnostic kits
	3.3	Glucose oxidase - liquid reagent
IV	4.0	Brewery products
		Wine & beer
V	5.0	Amino acids, and proteins
	5.1	Amino acids & its derivatives – lysine, monosodium glutamate
	5.2	Proteins – albumin, soya protein
VI	6.0	Organic acids
	6.1	Citric acid, lactic acid, Acetic acid (vinegar)
VII	7.0	Carbohydrates
	7.1	Starches
	7.2	Cellulose
	7.3	Sea-weed polysaccharides
VIII	8.0	Lipids & essential oils
	8.1	Lecithin, soyalecithin
	8.2.1	Citronella oil
	8.2.2	Menthol
IX	9.1	Bio pesticides
	9.2	Bio-fertilizers
	9.3	Plant growth modulators
X	10.1	Synthetic flavouring agents
	10.2	Synthetic aromatic agents (perfumes)
	10.3	Mushrooms.

Practicals

1. Gel filtration - determination of void volume separation of starch & glucose
2. Ion exchange chromatography for amino acids
3. Agar gel electrophoresis of proteins
4. Amylase - Km, Optimum pH, optimum temperature
5. Colorimetric estimation - proteins by Bradford method - Vit C by DNPH method

Bench scale preparation of the following industrially important biochemicals

6. Lecithin from egg yolk
7. Essential oil from orange peels
8. Proteins from soya beans
9. Starch from potato / sweet potato
10. Carotene from carrots
11. Pappain from papaya
12. Lycopene from tomatoes.

Industrial visits to :

- 1) Breweries
- 2) Tissue culture lab
- 3) Food industry
- 4) Food/ Pharma/Perfume/Neutraceuticals

Recommended Spots for examination

- 1) Chit containing question about principle of Ion exchange chromatography
- 2) Use of Blue dextran
- 3) Use of Sephadex
- 4) Slide of gel electrophoresis for identification
- 5) Colorimeter or its accessories
- 6) Column for ion exchange chromat/gel filtration
- 7) Diagram of anaerobic fermentor
- 8) Diagram of aerobic fermentor
- 9) Principle of hybridoma technique
- 10) Michaelis Menten plot for identification
- 11) Lineweaver Burke plot for identification
- 12) Stains used in gel electrophoresis
- 13) Principles of RIA / ELISA
- 14) Principles of affinity chromatography
- 15) Tissue culture specimen.

References :

1. Protein engineering in industrial biotechnology
Edited by Lilia Alberghina, Harwood Academic Publisher, 2000
2. Protein engineering - approaches to the manipulation of protein folding
Edited by Sara A. Narang, Butterworths, 1990
3. Immobilized cells and enzymes - a practical approach
Edited by J. Woodworth, IRL Press, 1985
4. Industrial microbiology, L. E. Casida, Wiley Estem Ltd. 1986
5. Industrial Microbiology, A. H. Patel, MacMillan India Ltd.
6. Industrial chemistry of fats & waxes, J. P. Hilditch
7. Essential Oils, Earnst Ghenthuer Vol I.
8. Molecular Biology and Biotechnology, Ed. J. M. Walker & E. B. Gingold
Panima Educational Book Agency, New Delhi
9. Principles of Biotechnology, By Alan Weisman, John Wiley Publication
10. Genetic Engineering, Willaimson Robert, Academic Press
11. Genetic Engineering : Principles & Practice ,
Mitra Sandhya, Macmillan India Pvt. Ltd.
12. Nutraceuticals, By Lisa Rapport
13. Nutraceuticals : The complete encyclopedia of supplements, herbs, vitamins & healing
foods, By Authur J. Roberts
14. Methods of Analysis for functional foods & Nutraceuticals
By W. Jeffrey Hurst
15. An introduction to practical biochemistry, David T. Plummer
Tata Mc Graw Hill Publishing Co.

Projects :

1. Isolation of plant pigments from different sources and their TLC separation.
2. Separation of sugars from various fruit juices by paper chromatography
- 3) $(\text{NH}_4)_2\text{SO}_4$ precipitation of different proteins
4. Extraction and assay of analyse/protease/lipase (crude extract) from various stages in
germination of seeds.

SYLLABUS OF CERTIFICATE COURSE IN INSTRUMENTAL ANALYTICAL TECHNIQUES

Paper I – General Laboratory

Unit No.	Topic No.	Topic
I	1.1 1.2	General Laboratory work, safety in the laboratory, Experimental write-up :- Introduction, experimental data collection, results & discussions, glassware cleaning.
II	2.1	Modes of expression of concentration of a solution-molar, molal, normal, Percent -w/v or w/w, of v/v, ppm, ppb. Expression of enzyme activity IU Katal.
III	3.1 3.2	Buffers : Concept of acids & bases; dissociation of water, K_w , pH, & pK, Henderson - Hesselbalch (H-H) equation, Buffer system eg. phesphate or acetate, Numerical problems based on H-H equation.
IV	4.1 4.2	Measurement of pH, pH meter Electrodes : Glass electrode, calomel, reference electrode, combination electrode, ion selective electrodes, oxygen electrodes.
V	5.0	Chromatography : Principles, techniques and applications of Partition and Absorption Chromatography.
VI	6.1	Chromatography : Principles, techniques and applications of Gel filtration, GLC, HPLC
VII	7.0 7.1 7.2 7.3	Spectroscopy : Nature of electromagnetic radiation, Lambert's & Beer's Law, molar absorbance coefficient; Instrumentation & applications of colorimeter and spectrophotometer.
VIII	8.0	Principles, techniques and applications of NMR, ESR and Mass Spectroscopy.
IX	9.0	Conductometry : Principles, techniques & applications.
X	10.0	Priciples, techniques & applications of Polarimetry & Polarography.

Paper II – Advanced Instrumentation

Unit No.	Topic No.	Topic
I	1.0 1.1	Spectroscopy : UV, IR, FTIR : Principle & applications,
II	2.1 2.2	Flourescence spectrophotometry. Atomic Absorption Spectroscopy
III	3.0	Flame photometry
IV	4.0	MALDI-TOF
V	5.0	Advanced chromatographic methods : GSC, GCMS
VI	6.0	HPTLC, FPLC
VII	7.0	Electrophoresis : Cellulor acetate paper electrophore Polyacrylamide gel electrophoresis, agarose gel electrophoresis,
VIII	8.0	Iscelectric focusing & two dimensional electrophoresis. Pulse field get electrophoresis
IX	9.0 9.1 9.2	Centrifugation : RCF & RPM, Low speed, high speed & ultra centrifuge, differential centrifugation.
X	10.0 10.1	Scope of Instrumentation in : Pharmaceutical & Chemical Industry : Quality control and R & D, Environmental pollution control lab, Pathological labs, Research institutions.

REFERENCES :

- 1) William & Willson - Practical Biochemistry.
- 2) Quantitative Analysis - R.A.Day Jr. and A.L. Underwood
3rd Edition, Prentice Hall of India Pvt. Ltd., New Delhi.
- 3) Modern Experimental Biochemistry - Rodney Boyer,
3rd ed. (Low priced edition) Pearson Education.
- 4) Principles of Instrumental Analysis -
D.A. Skoog F.J. Holler and T.A.Nieman, 5th Edition,
Saunders College Publishing.
- 5) Instrumental Methods of Analysis - H.H.Willard,
L.L. Merrit John A. Dean and Frank Seattle, 6th ed.
(First Indian edition 1988 CBS Publishers and Distributors, Delhi)
- 6) Fundamentals of Analytical Chemistry -D.A. Skoog,
D.M.West and F.J.Holler, 7th ed. Saunders College publishing.

Short experiments :

1. Preparation of standard solutions
0.1 N Oxalic acid, 0.1 N NaOH, 0.1 N HCL, 0.1 N acetic acid, 100 ppm & 100 ppb
CuSO₄, standarisation of 0.1 N HCL and 0.1 N acetic acid by titration
2. Preparation of 0.1 M acetate and phosphate buffers and determination pH & pKa
3. To determine the conductivity of 0.1 M & 0.2 M NaCl
4. Identify the sugars present in the yeast extract by paper chromatography
5. To analyse the invertase activity of yeast extract by using a polarimeter.

Major experiments

- 6
 - a) Preparation of 10% bakers yeast extract by homogenisation and centrifugation
 - b) Estimation of glucose content of the above extract by glucose oxidase method
 - c) Preparation of standards graph with different concentrations of glucose
7.
 - a) Preparation of 10% bakers yeast extract
 - b) Determination of protein content of extract by Lowry's method / Bradford's method
 - c) Determination of 260/280 ratio of the extract.
8.
 - a) Preparation of TLC plates
 - b) Extraction of plant pigments from spinach and separation of plant pigments by TLC
9. Determination of concentration of plant pigments (chlorophyll A and B) at different wavelengths (662 nm and 645 nm)
10. Separation of proteins by electrophoresis.
11. Gel filtration : Separation of starch and glucose.
12. Calibration of laboratory Glasswares.

References : (for Practicals)

1. Modern Experimental Biochemistry, 3rd Edition, Rodney Boyer, low priced edition, Pearson Education
2. Introduction to Practical Biochemistry - S. K. Saawhney & Randhir Singh, Narosa Publication, Delhi.
3. Practical Biochemistry - Plummer, Tata McGraw Hill Publication, New Delhi

Project :

1. Quantitative separation and analysis of natural products or commercially important materials using instrumental methods
2. Soil analysis with respect to acidity, pH, presence of metal including toxic elements
3. Use of electrophoresis for biochemical analysis

Industrial Visit and Report

Visits to research institutions, such as TIFR, BARC, ACTREC, NIRRH, Serum Institute of India, R&D, Departments of Industries and NCL (Pune)

SYLLABUS FOR CERTIFICATE COURSE IN CLINICAL BIOCHEMISTRY AND BASICS OF MEDICAL LABORATORY TECHNOLOGY (CBBMLT)

Paper I – Clinical Biochemistry and Instrumentation

Unit No.	Topic No.	Topic
I	1.0	Orientation to Clinical Biochemistry
	1.1.1	Introduction and importance of Clinical Biochemistry: Microbiology, Hematology, Histopathology, Clinical Pathology, Microbiology and Instrumentation
	1.1.2	Health and Diseases : Overview
	1.1.3	Types of Diseases
	1.2	Setting up and maintenance of a clinical laboratory : 1) Types of Laboratory 2) Basic requirement of each type 3) Use of computers and LAN
	1.3	Laboratory Management and Ethical aspects (in brief)
	1.3.1	Biological and chemical hazards,
	1.3.2	Safety precautions
	1.3.3	Inventory
	1.3.4	Collection, labelling and transport of samples
	1.3.5	Waste disposal, segregation and types of containers.
	1.3.6	Ethical aspects in a medical laboratory
II	2.0	Preparation of standard solutions & calibration
	2.1.1	Normality, Molarity
	2.1.2	Acids, bases, Buffers
	2.1.3	Reagent Quality
	2.1.4	Units in Biochemistry
		Calibration of Laboratory Glassware and Autofilters
	2.2.1	Beer and Lambert's Law
	2.2.2	Colorimetry and spectrometry and flurimetry :- Principles, technique and applications,
	2.2.3	Significance of standard curve importance.
III	3.1.1	Structure and function of proteins
	3.1.2	Methods of protein separation
	3.2.1	Enzymes in clinical biochemistry
IV	4.1	Blood glucose Level in health and disease
	4.2	Factors affecting blood glucose level
	4.3	Glucose estimation by chemical methods and enzymatic method
	4.4	Glucosylation of proteins with special reference to glycosylated hemoglobin.
V	5.1.1	Lipid Metabolism

	5.1.2 5.1.3 5.1.4 5.1.5 5.1.6 5.2.1 5.2.2 5.2.3	Classification and functions of lipids Dietary Lipids, Metabolism of Lipoproteins Obesity and Atherosclerosis Significance of Lipid Profile Liver function tests Renal function tests Thyroid function tests
VI	6.0	Chromatography - principles and techniques and applications of paper chromatography, TLC, GC
VII	7.0	Steric exclusion chromatography, HPLC
VIII	8.1 8.1.1 8.1.2 8.1.3 8.1.4 8.1.5 8.1.6 8.1.7 8.2	Radioactivity, its measurement - Precautions and hazards Definitions of atomic no., mass no., isotopes, atomic binding energy, Radiation - particulate & electromagnetic Radioactive decay - alpha decay & beta - decay Half-life Detection & Measurement - auto radiography, scintillation detectors- liquid & crystal Hazards & risk Applications ELISA and RIA
IX	9.0	Automation in Clinical Biochemistry and instrumentation and application of semi and fully automated analysers
X	10.1 10.2	Advances in clinical biochemistry such as - cardiac markers, troponins as Tumor markers, Micro albuminuria, prenatal and postnatal diagnosis of inborn error of metabolism in brief using chorion villias & amniotic fluid stem-cell technology, CT scan, PET, MRI, Laser technology (Lithotripsy), Ultrasound Technique - RFLP, Southern blotting, Western blotting

Paper II – Medical Laboratory Technology

Unit No.	Topic No.	Topic
I	1.0	Microbiology
	1.1	Microscopy : Stains and staining methods for microbes
II	2.0	Sterilisations, sterility test, aseptic techniques
	2.1	Reagents, media, biochemical media
III	3.0	Morphology, colony characteristics, biochemical tests, pathogenicity and diagnostic tests - bacilli, cocci, mycobacteria and spirochetes
IV	4.0	Serology : WIDAL, VDRL, RA, antibody titre,
V	5.1	Introduction to histopathology : general technology, i.e. microtomy and tissue processing.
	5.2	Microscopes : staining use of various reagents for tissue processing, differential analysis.
	5.3	Special techniques : Staining & impregnation, Decalcification, cryostat
	5.4	Museum methodology
VI	6.1	Clinical pathology
	6.2	Blood collection, Separation of sera and plasma, Use of anticoagulants, Precautions in blood collection
VII	7.0	Introduction to :
	7.1	Urine analysis
	7.1.1	Methods of urine collection and preservation
	7.1.2	Urine reports using uristix for proteinuria, glycosuria, ketonuria
	7.1.3	Urine microscopy : pus cells, cast cells, epithelial cells and crystals
	7.2	Fecal examination
	7.2.1	Methods of preparing wet smears
	7.2.2	Physical examination
	7.2.3	Chemical examination for occult blood
	7.2.4	Microscopy for detecting ova, blood, amoeba
VIII	8.0	Introduction to :
	8.1	Analysis of CSF and exudates, transudates in health & diseases,
	8.2	Exudates and transudates : differentiation by protein estimation, semen analysis
IX	9.1	Anemia : hypochromic, microcytic, macrocytic norm chromic, aplastic leukopenia, leukocytosis, sickle cell, pernicious, megaloblastic,
	9.2	Mechanism of blood clotting and related disorders : inherited and acquired (in brief) drug induced
	9.3	Blood banking. storage & preservation, ABO & Rh blood grouping, plasma fractionation, cross matching, HIV, Australian antigen tests.
X	10.1	Defining of project parameters in brief. Project work : some topics are suggested herewith
	10.1.1	Quality control
	10.1.2	Functioning of clinical biochemistry laboratory
	10.1.3	Comparative study of small and tertiary level laboratory
	10.1.4	Emergency laboratory
	10.1.5	Waste disposal in clinical laboratory
	10.1.6	Autoanalyser

Practicals

- 1) Estimation of blood glucose by glucose oxidase,
- 2) Estimation of serum uric acid by Caraway's method
(Normal range and interpretation with special reference to Gout.)
- 3) Estimation of total and HDL cholesterol by using enzymatic method (using commercially available kit)
- 4) RBC/WBC count. Differential count peripheral blood smear. With normal range & interpretation (demonstration)

Practical (Long experiments)

- 5) Estimation of total proteins by Biuret and albumin by BCG. Determination of AG ratio with interpretation of the result and normal values.
- 6) Estimation of alanine amino transferase & aspartate amino transferase by DNPH method with interpretation stating normal range.
- 7) estimation of creatinine from serum and urine & determination of clearance.

Instrumentation

- 8) Separation of amino acids by ascending / circular paper chromatography (Long expt)
- 9) electrophoresis : separation of proteins.

Microbiology practicals

- 10) a) Staining methods : monochrome staining, negative staining, gram staining, acid fast staining
b) Reagents media, biochemical media
c) Preparation of plates & slants
d) Sterilisation - dry heat, moist heat sterilisation & antimicrobial sensitivity test
e) Bacterial serology WIDAL, VDRL, RA

Clinical Pathology

- 11) Urine analysis
 - a) physical examination
 - b) chemical test by use of Uristix
 - c) microscopy
- 12) CSF analysis (long expt)
 - a) estimation of proteins - SSA method
 - b) estimation of chlorides - schales & schales method

List of spots

1) Folin wu tube, 2) Centrifuge tube, 3) Volumetric flask, 4) Conical flask, 5) Measuring cylinder, 6) Auto pipette, 7) Cuvette, 8) filter, 9) Urinometer, 10) Neubaur chamber, 11) WBC pipette, 12) RBC pipette, 13) Sahli's comparimeter, 14) ESR tube/stand westergreen, 15) Wintrobe tube, 16) Chromatogram, 17) TLC tank, 18) EP tank & power supply, 19) PH Meter, 20) Electrode, 21) EP patterns protein / LP / Hb, 22) Flame photometer, 23) Fouschet's test, 24) Benedict's qualitative reagent, 25) Benzidine, 26) Sulphur flower, 27) Alpha Naphthol, 28) Na nitroprusside, 29) Eosin, 30) Hematoxylin, 31) Use of microtome

References :

1. U. Satyanarayan, Text book of Biochemistry, Books and allied publications
2. Debjyoti Das, Biochemistry, Academic publishers
3. Siegel, Biochemical Calculations,
4. Gradwahl's Clinical Laboratory Methods and Diagnosis Vol I, II, III, IV
Editors : A.C.Sonnerwirth & L. Jarett, The C.V. Mosby 1980 8th Ed. (latest)
5. K.L.Mukherjee , Medical Laboratory Technology Vol. I, II, III, IV Mc. Graw hill
Publishing Co. Ltd
6. Khandpur, Instrumentation Analysis, Tata Mc graw Hill
7. Ananth Narayan, Text book of Medical Microbiology
8. Tiet : Textbooks of Clinical Chemistry, Qurtis C.A. Ashwood E.R.
9. A Concise Note on Medical laboratory Technology
C.R.Maiti, New Central Book Agency Pvt. Ltd. Kolkatta (1995)
10. Histopathology, Ogilvie Rebertson, Churchill Livingstone publishing Co.

Visits to various industrial institutes / laboratories

1. Clinical Biochemistry Laboratory, LTMM college sion at Dept. of Biochemistry
2. C.C.B.L. Set GSM college & KEM Hospital parel at GSMC
3. Bicochemistry Laboratory, Tata Memorial Hospital Parel
4. Dr. Phadke's Laboratory L.J. Road, Mahim
5. Laboratories of Hinduja Hospital L.J.Road, Mahim.
6. Thyrocare, Thane

SYLLABUS FOR CERTIFICATE COURSE IN NUTRITION & DIETETICS

Paper I - Human Nutrition

Unit No.	Topic No.	Topic
I	1.0	Energy units of energy energy from biological oxidation of foodstuff - calorific value of foodstuff and numerical problems based on it.
II	2.0	Measurement of energy expenditure : direct and indirect calorimetry, physiological energy values, basal and resting metabolism, energy expenditure in man
III	3.0 3.1 3.2	Carbohydrates classification and functions Digestion, absorption and assimilation, Role of carbohydrates in health and Disease, Dietary sources RDA for different age groups, dietary fibres and their importance
IV	4.0 4.1 4.2	Proteins - classification & functions Digestion, absorption and assimilation of proteins, amino acids imbalance Nutritional supplementation for essential amino acids
V	5.0 5.1	Indices of Protein quality - PER Protein requirements and deficiency, Dietary sources, RDA for different age groups
VI	6.0 6.1	Fats & lipids - classification & functions, digestion, absorption & transport, essential fatty acids and their deficiency disorders, Fat storage - adipose, tissue metabolism and obesity
VII	7.0 7.1	Dietary significance of phospholipids, cholesterol MUFA, PUFA, SFA, n6:n3 ratio phospholipids, cholesterol Dietary sources and RDA for different age groups.
VIII	8.0 8.1	Micronutrients : Vitamins A, D, E, K, C, B-complex Dietary sources, RDA for different age groups, biochemical, nutritional functions, deficiency disorders
IX	9.0 9.1	Minerals : Macro : Ca, Na, K, Cl, Mg, P, S, Micro : Zn, Cu, Mn, Cr, Cd, Mo, Se, Co, Ni, Si, Va, Fe, I Dietary sources, bioavailability, biochemical role, deficiency manifestations and toxicity (hypervitaminosis)
X	10.1	Water : Water balance, intoxication, dehydration role of ADH in water balance

Paper II - Dietetics

Unit No.	Topic No.	Topic
I	1.0	Introduction to Dietetics Formalisation of diets in balanced diet
II	2.0	Diet planning in special clinical conditions : Undernutrition, Obesity, Cardiovascular diseases, diabetes
III	3.0 3.1 3.2	Diet planning for Acute and chronic renal failure and stones hepatitis, diseases of liver, cirrhosis, gastrointestinal hyperacidity, irritable bowel syndrome, AIDS, Cancer, (Lactose intolerance)
IV	4.0 4.1	Dietary recommendations in AIDS & Cancer Inborn - errors of metabolism - lactose imbalance
V	5.0	Nutritional requirements for high altitude, space, burns, post surgery, parenteral nutrition, extreme climatic conditions
VI	6.0 6.1	Nutraceuticals - Phytochemicals - sources, mode of action Dietary supplements - vitamins, multivitamins, fish oils, a acid, herbal teas
VII	7.0 7.1	Sports nutrition - Role of specific nutrients in exercises, ergogenic aids and sports, health drinks Health drinks : creatine, carnitines, amphetamines, anabolic steroids
VIII	8.0 8.1 8.2 8.3	Nutrient - drug interaction Effect of drugs on nutrient status Drug food and drug nutrient incompatibility Drugs as antimetabolites
IX	9.1 9.2 9.3	Nutrition and Brain Nutrition and immunity Influence of foods on behaviour
X	10.1	Project report : Food product development, Labelling, packing, Costing & marketing trial, Planning a diet for given clinical conditions, Diet Surveys

Practicals

1. Estimation of Carbohydrates from flour, reducing sugars, anthrone method
2. Estimation of protein - Kjedahl method from milk powder
3. Estimation of lipid contents (acid value, peroxide value) (any edible oil)
4. Estimation of vitamin C (lemons) - Dye method
5. Estimation of Calcium - Titrimetric method (EDTA)
6. Sensory evaluation (food score) of food product with different brand names
7. Assessment of nutritional status : a) Height, b) weight, c) BMI, d) head circumference e) chest, f) Mid arm circumference, g) Waist Hip ratio
8. Dietary assessment - dietary recall - 3 days / week
9. Menu planning for specific conditions, design of functional foods
10. Visit to ICDS centre, Dietetics department of hospitals, industrial canteens
11. Market survey of health foods.
12. Qualitative Tests for adulterants in milk.

Paper I - References

- 1) Anderson, L. Dibble, M and Mitchell N (1982)
Nutrition in health and disease (17th Ed) Philadelphia, J. B. Lippencott Co.
- 2) Bamji M, Pralhad Rao, N. and Reddy V (Ed) 1996, Textbook of Human Nutrition,
Oxford and IBH Publishing Co. Pvt. Ltd.
- 3) Davidson S, Passmore R. (1986), Human Nutrition and Dietetics (8th Ed) ELBS
Edinburgh, Guthrie, H, (1986) Introductory Nutrition (6th Ed),
Times Mirror/Mosby College Publication.

Paper II - References

- 1) Antia F. P., (1997) Clinical Nutrition and Dietetics (4th Ed)
New Delhi, Oxford University Press
- 2) Bennion, Marion (1997), Clinical Nutrition (7th Ed)
New York, Harper and Row Publishers
- 3) Davidson & Passmore, Human Nutrition and Dietetics (18th Ed)
New Delhi, Tata McGraw Hill
- 4) Krause and Mahar (2000), Foods, Nutrition & Diet Therapy (10th Ed)
Philadelphia, W. B. Saunders
- 5) Robinsson (1989), Normal and Therapeutic Nutrition (7th Ed)
New York, McMillan Pub. Company
- 6) Srilakshmi B. Dietetics (4th Ed.) 2000
New Age International (P) Ltd. Publishers.

Practicals - References

- 1) Gopaldas, T. Seshadri, S. (1987) Nutrition Monitoring and Assessment
Delhi Oxford University Press
- 2) Jelliffe, D. (1966), The assessment of nutritional status of the community
WHO (Geneva)
- 3) Pearson; D (1970), Chemical Analysis of Foods (6th Ed)
London J. A. Churchill
- 4) Ranganna S (1995) Handbook of analysis and quality control for fruit and vegetable
products, Tata McGraw Hill Publishing, New Delhi.

SYLLABUS FOR CERTIFICATE COURSE IN FOOD PROCESSING AND PRESERVATION

Paper I - Food Processing

Unit No.	Topic No.	Topic
I	1.0	Principles in food processing : Thermal processing, Refrigeration, freezing, dehydration, irradiation
II	2.0	Processing technology of cereals and pulses : bakery products - bread, biscuits, instant legume powder, soya products
III	3.1 3.2 3.3	Processing technology of oil seeds : Oil extraction, Hydrogenation Frying oils Coconut products
IV	4.0 4.1 4.2 4.3 4.4	Processing technology of vegetables, fruits and beverages frozen vegetables and fruits Jams, Jellies and marmalade Tea, coffee carbonated beverages
V	5.0 5.1 5.2 5.3	Processing technology of Dairy products Dehydrated milk powder, Sweetened condensates milk Ice cream, cottage cheese, butter Cocoa powder & chocolate manufacture
VI	6.0 6.1 6.2 6.3	Processing technology of meat, fish & poultry Dried fish Bacon, Ham, Sausages Egg products
VII	7.0 7.1 7.2 7.3	Fermentation Technology : Beer Wine Vinegar
VIII	8.0	Food Additives : Antioxidants, Emulsifiers, Leavening Agents, Preservatives
IX	9.1	Newer methods of food processing : Microwave, High pressure, Ohmic heating
X	10.0	National and International Legislation and Agencies governing food and its quality.

Paper II - Food Peservation

Unit No.	Topic No.	Topic
I	1.0	Causes of food spoilage and its control
II	2.0	Fod preservation
	2.1	Principles of food preservation
	2.2	Use of high and low temperature temperature
III	3.0	Preservation methods
	3.1	Drying and concentration
	3.2	Food additives
	3.3	Ionising radiations,
IV	4.0	Preservation techniques for cereals and pulses
	4.1	Cereals, - white rice, wheat
	4.2	Pulses, legumes, nuts, oil seeds
V	5.0	Preservation techniques for
	5.1	Meat, fish, poultry
	5.2	Dairy products
	5.3	Fats and oils
VI	6.0	Preservation techniques for
	6.1	Sugars
	6.2	Fruits - jams, jellies, marmalade
	6.3	Vegetables - frozen, canned
	6.4	Pickles, sauces, dehydrated
VII	7.0	Fermented products : Idlis, Dosas, Dhokla
VIII	8.0	Effect of preservation techniques on quality of foods
IX	9.0	Packaging of foods
	9.1	Functions of food packaging
	9.2	Requirements for effective packaging
	9.3	Types of containers & food packaging materials
X	10.1	Convenience foods & extruded food products

Practicals course in food processing & preservation

1. Estimation of crude gluten from wheat - gravimetric method
2. Saponification value of refined oil
3. Different processing techniques in preparation of pickles (minimum 2 methods)
4. Preparation of moulded chocolates
5. Isolation of cholesterol from sheep brain / egg yolk
6. Optimization of curd making in terms of raw materials, fermentation conditions
7. Evaluation of stored pickles with and without preservatives
8. Effect of low temperature on milk - MBRT
9. Effect of dehydration on storage stability of fresh coconut
10. Analysis of Ice cream, aerated / bottled beverages w.r.t.
 - a) overrun
 - b) sugar (Lactose by Cole's method)
 - c) acid i.e. lactose - cole's method
11. Report writing on convenience foods
12. Estimation of fibre content of green leafy vegetables.

References :

- 1) Fellons, P & Hanpton A (1992), Small Scale Food Processing, London Intermediate Tech. Publications
- 2) McWilliams, M. (1984) Experimental Foods Laboratory Manual, New Delhi, Subject Publications
- 3) Swaminathan, M. (1995), Food Science Chemistry and Experimental Food – The Bangalore Printing & Publishing Co. Ltd.
- 4) P. Fellows, Food processing Technology Principles and practice, 2nd Ed., Woodhead Publishing Ltd., Cambridge, England & CRC Press, Washington D. C. N. America

References - Paper I - Food Processing

- 1) Kulshreshta, S. K. (1994), Food Preservation, New Delhi, Vikas Publishing House
- 2) Subbulakshmi G and Udipi S. A. (2001), Food Processing and Preservation, New Delhi, New Age International Ltd. Publishers

References - Paper II - Food Preservation

- 1) Desrosier, N & Desrosier J (1987) The technology of food preservation, CBS Publishers
- 2) Mahadeviah M. and Gowramma, R. V. (1996) Food packaging materials, New Delhi, Tata McGraw Hill
- 3) Subhulakshmi G & Shoobha A. Udysi (2001) Food Processing & Preservation, New Delhi
- 4) Siva Kumar, Food preservation & Processing, New Age International (P) Ltd, Publishers,

Industrial Visits

1. Parle Products Ltd.,
Vile Parle (E), Mumbai - 400 057.
2. Foods & Inns Ltd.
Punjabwadi, Sion Trombay Road,
Deonar, Mumbai - 400 088.
3. Worli Dairy
Mumbai - 400 018.
4. Mafco Ltd.
Mistry Bhavan, 6th Floor,
Dinshaw Vachha Road, Mumbai - 400 020.
5. Vista Processed Foods Pvt. Ltd.
M75, MIDC, Taloja, P.O.Box 49,
Panvel 410 208.
6. Britannia Industries Ltd.
Reay Road (E), Mazgaon, Mumbai - 400 010.
7. Frolic Foods
117/118, Daulat Udyog Bhavan, Wadhavli Village Road,
Chembur, Mumbai - 400 074.
8. Hindustan Lever Ltd.
Plot # 7 & 7A, MIDC Industrial Area, Thane Belapur Road, Airoli, Navi Mumbai - 708.
9. Hindustan Coco Cola Beverages Pvt. Ltd.
Shubh House, 177, Vidya Nagri Marg, Kalina Santacruz (E), Mumbai - 400 098.
10. Cadbury India Ltd.
1, Pokaran Road, Off Eastern Express Highway, Thane 400 606.
11. Food Technology Division
BARC, Trombay, Mumbai - 400 085.
12. M/s K. T. Kubal & Co.
40, R. S. Nimkar Road, Mumbai - 400 008.
13. V. P. Bedekar & Sons
Tatya Gharpure Path, Girgaon, Mumbai - 400 004.

Project

- 1) Literature survey on a new food product/method of processing / preservation
- 2) Report on market survey / feasibility of development of new product.

SYLLABUS OF CERTIFICATE COURSE IN QUALITY CONTROL (QC), GOOD MANUFACTURING PRACTICES (GMP) AND GOOD LABORATORY PRACTICES (GLP)

Paper I – Concepts, Definitions and Description of QC, GMP and GLP

Unit No.	Topic No.	Topic
I	1.0	Definitions and description in brief
	1.1	Quality
	1.2	Quality cost prevention cost appraisal cost, cost of internal and external failure
	1.3	Quality management, Quality control, Quality assurance, Quality system, Quality improvement
II	2.0	Definitions and brief description as applicable to Analytical laboratories
	2.1	Analytical specification report
	2.2	Analytical methods
	2.3	Calibration of equipment
	2.4	Equipment validation
	2.5	National Standard Accreditation
	2.6	Quality reference standard for raw material
	2.7	Test Validation & Verification
	2.8	Working standard or reference standard for product.
III	3.0	Concept of GMP & GLP & QA
IV	4.1	GMP: General requirement with respect to premises.
	4.1.1	Location, buildings, water supply, quality air of waste disposal, storage area, working space, Maintenance etc.
	4.1.2	Responsibility - manager, supervisors operators (personnel)
	4.1.3	Safety, Sanitation & Health care & hygiene
	4.1.4	Pest control
V	5.1	GMP - Equipment for manufacturing of drugs
	5.1.1	Specification
	5.1.2	Criteria for selection with example
	5.2	Raw material :
	5.2.1	Specifications
	5.2.2	Criteria for selection
	5.2.3	Care while receiving material & handling
	5.2.4	Storage
	5.2.5	Sampling
	5.2.6	Packaging
	5.2.7	Labeling
	5.2.8	Storage of Finished goods.

	5.2.9	Recall of material from market, Standard Operating Procedure (SOP) for the above
VI	6.1	Documentation – SOP, Protocol, Quality manual
VII	7.0 7.1	Assessment and Certification Audit 1) Preassessment audit 2) Documentation audit 3) Implementation compliance audit 4) Non conformities
VIII	8.1	Various national & international regulatory bodies 1) US guidelines 2) European guidelines 3) WHO 4) ISI
IX	9.0 9.1 9.1.1 9.1.2 9.1.3 9.2	ISO Definitions Quality Documentation procedure Record. 9000 family of standards:- Background, Benefits, Guidelines.
X	10.0 10.1 10.2	Certifying Authorities - National & International. FDA - Functioning & Scope. Drug controller - Functioning & Scope

Paper II - Quality Control in Clinical Laboratory

Unit No.	Topic No.	Topic
I	1.0	Functioning of clinical laboratory : basic requirement as per type of laboratory and staff needed.
II	2.0	Preamlytical, Analytical & Post analytical procedures and possible errors Rectification of the errors.
III	3.0	Blood, Plasma, Serum and anticoagulants used. Blood collection procedures. Sample preparation, sample preservation and transport of samples precautions in handling of the samples.
IV	4.0	Various types of routine investigations and their description in brief in various disciplines
	4.1	Biochemistry
	4.2	Clinical pathology
	4.3	Histopathology
	4.4	Microbiology
	4.5	Hematology
V	5.0	Common techniques, their principles & application
	5.1	Centrifugation
	5.2	Chromatography
	5.3	Electrophoresis
	5.4	Colorimetry, Spectrophotometry
	5.5	Fluorimetry
	5.6	Micortomy
	5.7	Microscopy
	5.8	Radio immunoassay
	5.9	ELISA
VI	6.0	Sterilization, sterility test, Aseptic techniques, Waste disposal
VII	7.0	Internal & external quality control in Clinical Laboratory use of control charts eg. Levey Jennings chart.
VIII	8.0	Use of autoanalysers, computers & Local Area Network in clinical laboratory
IX	9.0	Statistical methods applicable to clinical laboratories & medical research Mean, SD, Students 't' test
X	10.1	Defining of project parameters (in brief) for setting up a Clinical Laboratory.

Suggested topics for Project

1. Staff pattern & work Pattern in any pharmaceutical unit
2. Quality Assurance & Quality control in any manufacturing unit w.f.t. preparation of document & procedure followed.
3. Preparing levey Jennings charts from data of any laboratory.
4. Preparation of weekly report from given information about any manufacturing unit.
5. Preparing a report about location of a unit w.r.i. manufacturing storage & other functions.
6. Waste disposal in a laboratory.
7. Preparing SOP for analytical part of clinical laboratory w.r.t different parameters.
8. Preparing SOP for pre analytical procedures in clinical laboratory for different parameters.
9. Preparing SOP for post analytical procedures in clinical laboratory
10. Preparing SOP for waste disposal procedures in clinical laboratory

Institutes for visits :

- 1) UMICT, Matunga
- 2) Haffkine Biopharmaceuticals, Parel
- 3) Themis Pharmaceuticals, Vapi
- 4) Lpea Lab, Silvasa
- 5) Accurex, Boisar
- 6) Sigma Lab, Nashik
- 7) Serum Instt. Pune
- 8) Gharda Chemical, Dombivli
- 9) Jai Chemicals, Baroda

PRACTICAL SYLLABUS

- 1) Weights & Measures :- Know your balance and validate, To find out percentage accuracy of
 - a) Weights
 - b) Balance :- by using standard weights provided to students.
- 2) To find out percentage deviation of Thermometer. Use standard material for testing MP, BP.
- 3) To calibrate a pH meter by using standard pH solutions find out percentage deviation.
- 4)
 - a) To calibrate glass pipettes against class A pipette and find out percentage accuracy for 0.5 ml, 1.0 ml, 2.0 ml, 5.0 ml pipettes.
 - b) Calibration of burette by using standard pipette and standard solution
- 5)
 - a) Calibration of volumetric flask using calibrated pipettes
 - b) Calibration of measuring cylinders using calibrated volumetric flasks.
 - c) Calibration of autopipettes by using following method as guideline
 - 1) Set Volume
 - 2) Weight water
 - 3) Find out volume of water & correlate 1 with 3
- 6)
 - a) Preparation of normal/molar solutions using organic acid as control.
 - i) 1N NaOH
 - ii) 1N HCL
 - iii) 1N H₂SO₄
 - b) Preparation of standard solution by using calibrated glass ware. Standard/molar concentration of Glucose, Ures, Cuso₄