ARUNACHAL PRADESH
STATE COUNCIL FOR TECHNICAL EDUCATION

UNDER THE DIRECTORATE OF HIGHER & TECHNICAL EDUCATION

GOVERNMENT OF ARUNACHAL PRADESH

ITANAGAR

Curiculum for

Herbal Technology

DEVELOPED BY

NATIONAL INSTITUTE OF TECHNICAL TEACHERS' TRAINING & RESEARCH

BLOCK-FC, SECTOR-III, SALT LAKE CITY, KOLKATA-700 106

Foreword

Government of Arunachal Pradesh has entrusted NITTTR, Kolkata for revising the existing course curricula in eight subject areas and for developing the new course curricula in the two areas.

Revised Course Curricula:

1. Herbal Technology
2. Garment and Fashion Technology
3. Hotel Management and Catering Technology
4. Travel and Tourism Management
5. Electrical and Electronics Engineering
6. Civil Engineering
7. Computer Science and Engineering
8. Automobile Engineering

New Course Curricula:

1. Electronics and Communication Engineering
2. Electrical Engineering
3. Mechanical Engineering

The Institute conducted a series of workshop involving experts in different subject areas for development of the course curricula. An effort has also been made to ensure that the revised course curricula do not deviate significantly from the existing course curricula and at the same time reflect the recent trends in a particular subject area.

The Institute welcomes any meaningful suggestions which can be incorporated in the final versions of the above said document.

Sd/-
(Prof. S. K. Bhattacharyya)
Director
NITTTR, Kolkata

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Scheme of Studies and Evaluation (MPECS) for Diploma in Herbal Technology

1. FOUNDATION COURSES:

Sl. No	Code	Course	Study Scheme				Evaluation Scheme						Total Marks	Credit
			Pre-requisite	Contact Hour/Week			Theory			Practical				
				L	T	P	End Exam	Progressive Assessment		End Exam	Progressive Assessment			
								Class Test	Assignment*		Sessional	Viva		
1	G101	Communication Skill-I		3	0	0	75	10	15	0	0	0	100	3
2	G102	Communication Skill-II	G101	2	1	2	50	0	0	25	25	0	100	4
3	HT101+	Mathematics		3	1	0	75	10	15	0	0	0	100	4
4	HT102	Anatomy& Physiology		3	0	2	75	10	15	25	25	0	150	4
5	HT103#	Physics		3	0	0	75	10	15	0	0	0	100	3
6	HT104	Biotechnology -I		3	1	4	75	10	15	50	50	0	200	6
7	G107	Chemistry - I		3	0	2	75	10	15	25	25	0	150	4
8	G108	Chemistry - II	G107	3	0	2	75	10	15	25	25	0	150	4
9	G109	NCC I/NSS I		0	0	2	0	0	0	25	25	0	50	1
10	G110	NCC II/NSS II		0	0	2	0	0	0	25	25	0	50	1
TOTAL				**23**	**3**	**16**	**575**	**70**	**105**	**200**	**200**	**0**	**1150**	**34**

***The marks for assignment (15) should include five (5) marks for attendance.**
+Study scheme and Evaluation scheme of HT101 will be same as that of G103.
#Evaluation scheme of HT103 for Theory will be same as that of G105.

2. HARD CORE COURSES:

Sl. No	Code	Course	Study Scheme				Evaluation Scheme						Total Marks	Credit
			Pre-requisite	Contact Hour/Week			Theory			Practical				
				L	T	P	End Exam	Progressive Assessment		End Exam	Progressive Assessment			
								Class Test	Assignment		Sessional	Viva		
11	HT201	Chemistry -III	G107,G108	3	0	2	75	10	15	25	25	0	150	4
12	HT202*	Environmental Education		3	0	0	75	10	15	0	0	0	100	3
13	HT203	Basic Soil Chemistry		3	1	2	75	10	15	25	25	0	150	5
14	HT204	Introduction to Herbal Technology		3	0	0	75	10	15	0	0	0	100	3
15	G206B	Introduction to Information Technology		2	1	2	50	0	0	25	25	0	100	4
16	HT205#	Entrepreneurship Development		3	0	0	75	10	15	0	0	0	100	3
TOTAL				**17**	**2**	**6**	**425**	**50**	**75**	**75**	**75**	**0**	**700**	**22**

***Study scheme and Evaluation scheme for HT202 will be same as that of G301.**
#Study scheme and Evaluation scheme for HT205 will be same as that of G302C.

3. SOFT CORE COURSES: (Two to be taken)

Sl. No	Code	Course	Study Scheme				Evaluation Scheme						Total Marks	Credit
			Pre-requisite	Contact Hour/Week			Theory			Practical				
				L	T	P	End Exam	Progressive Assessment		End Exam	Progressive Assessment			
								Class Test	Assignment		Sessional	Viva		
17	G302A	Engineering Economics & Accountancy		3	0	0	75	10	15	0	0	0	100	3
18	G302B	Principles of Management		3	0	0	75	10	15	0	0	0	100	3
19	G302D	Organizational Behaviour		3	0	0	75	10	15	0	0	0	100	3
20	HT301	Financial Management		3	0	0	75	10	15	0	0	0	100	3
21	HT302	Marketing Management		3	0	0	75	10	15	0	0	0	100	3
TOTAL				**6**	**0**	**0**	**150**	**20**	**30**	**0**	**0**	**0**	**200**	**6**

4. BASIC TECHNOLOGY COURSES:

Sl. No	Code	Course	Study Scheme				Evaluation Scheme						Total Marks	Credit
			Pre-requisite	Contact Hour/Week			Theory			Practical				
				L	T	P	End Exam	Progressive Assessment		End Exam	Progressive Assessment			
								Class Test	Assignment		Sessional	Viva		
22	HT401	Cultivation of Medicinal Plants		3	1	4	75	10	15	50	50	0	200	6
23	HT402	Analytical Chemistry		3	1	4	75	10	15	50	50	0	200	6
24	HT403	Phytochemistry		3	1	2	75	10	15	25	25	0	150	5
25	HT404	Drugs & Cosmetic Laws		3	0	0	75	10	15	0	0	0	100	3
26	HT405	Processing equipment & Machinery		3	1	2	75	10	15	25	25	0	150	5
27	HT406	Process Technology		3	1	4	75	10	15	50	50	0	200	6
28	HT407	Formulation Development		3	1	4	75	10	15	50	50	0	200	6
29	HT408	Biopharmaceutics		3	1	0	75	10	15	0	0	0	100	4
30	HT409	Fertilizer, Manures &Plant Protection Measures		3	1	0	75	10	15	0	0	0	100	4
31	HT410	Pharmacokinetics		3	1	0	75	10	15	0	0	0	100	4
TOTAL				**30**	**9**	**20**	**750**	**100**	**150**	**250**	**250**	**0**	**1500**	**49**

5. APPLIED TECHNOLOGY COURSES:

Sl. No	Code	Course	Study Scheme				Evaluation Scheme						Total Marks	Credit
			Pre-requisite	Contact Hour/Week			Theory			Practical				
				L	T	P	End Exam	Progressive Assessment		End Exam	Progressive Assessment			
								Class Test	Assignment		Sessional	Viva		
32	HT501	Clinical Assessment of herbal formulation		3	1	2	75	10	15	25	25	0	150	5
33	HT502	Pharmacognosy		3	1	4	75	10	15	50	50	0	200	6
34	HT503	Plant Toxicology		3	1	0	75	10	15	0	0	0	100	4
35	HT504	Pharmacology		3	1	0	75	10	15	0	0	0	100	4
36	HT505	Biotechnology II		3	1	4	75	10	15	50	50	0	200	6
37	HT506	Quality control of herbal formulation		3	1	2	75	10	15	25	25	0	150	5
38	HT507	Manufacturing of herbal formulation		3	1	0	75	10	15	0	0	0	100	4
39	HT508	Seminar		0	0	6	0	0	0	50	50	0	100	3
40	HT509	Project		0	0	8	0	0	0	100	50	0	150	4
41	HT510	Industrial Training(3 weeks OJT + 1 week orientation)		0	0	0	0	0	0	100	100	0	200	10
TOTAL				**21**	**7**	**26**	**525**	**70**	**105**	**400**	**350**	**0**	**1450**	**51**

6. ELECTIVE COURSES: (Any TWO to be taken)

Sl. No	Code	Course	Study Scheme				Evaluation Scheme						Total Marks	Credit
			Pre-requisite	Contact Hour/Week			Theory			Practical				
				L	T	P	End Exam	Progressive Assessment		End Exam	Progressive Assessment			
								Class Test	Assignment		Sessional	Viva		
42	HT601	Aroma Therapy		3	1	0	75	10	15	0	0	0	100	4
43	HT602	Herbs in health & diet		3	1	0	75	10	15	0	0	0	100	4
44	HT603	Quality Assurance of herbal Medicines		3	1	0	75	10	15	0	0	0	100	4
45	HT604	Cold chain Management		3	1	0	75	10	15	0	0	0	100	4
TOTAL				**6**	**2**	**0**	**150**	**20**	**30**	**0**	**0**	**0**	**200**	**8**

SAMPLE PATH : DIPLOMA IN HERBAL TECHNOLOGY

TERM -1

Sl. No.	Code	Course	Study Scheme				Evaluation Scheme						Total Marks	Credit
			Pre-requisite	Contact Hour/Week			Theory			Practical				
				L	T	P	End Exam.	Progressive Assessment		End Exam.	Progressive Assessment			
								Class Test	Assignment *		Sessional	Viva		
1	G101	Communication Skill -I		3	0	0	75	10	15	0	0	0	100	3
2	HT101	Mathematics		3	1	0	75	10	15	0	0	0	100	4
3	HT102	Anatomy & Physiology		3	0	2	75	10	15	25	25	0	150	4
4	HT103	Physics		3	0	0	75	10	15	0	0	0	100	3
5	G107	Chemistry-I		3	0	2	75	10	15	25	25	0	150	4
6	HT204	Introduction to Herbal Technology		3	0	0	75	10	15	0	0	0	100	3
7	G109	NCC I/NSS I		0	0	2	0	0	0	25	25	0	50	1
TOTAL				**18**	**1**	**6**	**450**	**60**	**90**	**75**	**75**	**0**	**750**	**22**

TERM - 2

Sl. No.	Code	Course	Study Scheme				Evaluation Scheme						Total Marks	Credit
			Pre-requisite	Contact Hour/Week			Theory			Practical				
				L	T	**P**	End Exam.	Progressive Assessment		End Exam.	Progressive Assessment			
								Class Test	Assignment		Sessional	Viva		
1	G102	Communication Skill-II	G101	2	1	2	50	0	0	25	25	0	100	4
2	HT104	Biotechnology – I		3	1	4	75	10	15	50	50	0	200	6
3	G108	Chemistry-II	G107	3	0	2	75	10	15	25	25	0	150	4
4	HT202	Environmental Education		3	0	0	75	10	15	0	0	0	100	3
5	HT203	Basic Soil Chemistry		3	1	2	75	10	15	25	25	0	150	5
6	G206B	Introduction to Information Technology		2	1	2	50	0	0	25	25	0	100	4
7	G110	NCC II/NSS II		0	0	2	0	0	0	25	25	0	50	1
TOTAL				**16**	**4**	**14**	**400**	**40**	**60**	**175**	**175**	**0**	**850**	**27**

TERM - 3

Sl. No.	Code	Course	Study Scheme				Evaluation Scheme						Total Marks	Credit
			Pre-requisite	Contact Hour/Week			Theory			Practical				
				L	T	P	End Exam.	Progressive Assessment		End Exam.	Progressive Assessment			
								Class Test	Assignment		Sessional	Viva		
1	HT201	Chemistry - III	G107, G108	3	0	2	75	10	15	25	25	0	150	4
2		Soft Core – 1		3	0	0	75	10	15	0	0	0	100	3
3		Soft Core - 2		3	0	0	75	10	15	0	0	0	100	3
4	HT401	Cultivation of Medicinal Plants		3	1	4	75	10	15	50	50	0	200	6
5	HT405	Processing Equipment & Machinery		3	1	2	75	10	15	25	25	0	150	5
6	HT406	Process Technology		3	1	4	75	10	15	50	50	0	200	6
TOTAL				**18**	**3**	**12**	**450**	**60**	**90**	**150**	**150**	**0**	**900**	**27**

TERM - 4

Sl. No.	Code	Course	Study Scheme				Evaluation Scheme						Total Marks	Credit
			Pre-requisite	Contact Hour/Week			Theory			Practical				
				L	T	P	End Exam.	Progressive Assessment		End Exam.	Progressive Assessment			
								Class Test	Assignment		Sessional	Viva		
1	HT402	Analytical Chemistry		3	1	4	75	10	15	50	50	0	200	6
2	HT403	Phytochemistry		3	1	2	75	10	15	25	25	0	150	5
3	HT408	Biopharmaceutics		3	1	0	75	10	15	0	0	0	100	4
4	HT409	Fertilizer, Manures & Plant Protection Measures		3	1	0	75	10	15	0	0	0	100	4
5	HT501	Clinical Assessment of herbal formulation		3	1	2	75	10	15	25	25	0	150	5
6	HT502	Pharmacognosy		3	1	4	75	10	15	50	50	0	200	6
TOTAL				**18**	**6**	**12**	**450**	**60**	**90**	**150**	**150**	**0**	**900**	**30**

TERM - 5

Sl. No.	Code	Course	Study Scheme				Evaluation Scheme						Total Marks	Credit
			Pre-requisite	Contact Hour/Week			Theory			Practical				
				L	T	**P**	End Exam.	Progressive Assessment		End Exam.	Progressive Assessment			
								Class Test	Assignment		Sessional	Viva		
1	HT404	Drugs & Cosmetic Laws		3	0	0	75	10	15	0	0	0	100	3
2	HT407	Formulation Development		3	1	4	75	10	15	50	50	0	200	6
3	HT503	Plant Toxicology		3	1	0	75	10	15	0	0	0	100	4
4	HT504	Pharmacology		3	1	0	75	10	15	0	0	0	100	4
5	HT506	Quality control of herbal formulation		3	1	2	75	10	15	25	25	0	150	5
6	HT507	Manufacturing of herbal formulation		3	1	0	75	10	15	0	0	0	100	4
TOTAL				**18**	**5**	**6**	**450**	**60**	**90**	**75**	**75**	**0**	**750**	**26**

TERM - 6

Sl. No.	Code	Course	Study Scheme				Evaluation Scheme						Total Marks	Credit
			Pre-requisite	Contact Hour/Week			Theory			Practical				
				L	T	**P**	End Exam.	Progressive Assessment		End Exam.	Progressive Assessment			
								Class Test	Assignment		Sessional	Viva		
1	HT205	Entrepreneurship Development		3	0	0	75	10	15	0	0	0	100	3
2	HT410	Pharmacokinetics		3	1	0	75	10	15	0	0	0	100	4
3	HT505	Biotechnology – II		3	1	4	75	10	15	50	50	0	200	6
4	HT601-604	Elective- I		3	1	0	75	10	15	0	0	0	100	4
5	HT601-604	Elective- I		3	1	0	75	10	15	0	0	0	100	4
6	HT508	Seminar		0	0	6	0	0	0	0	50	50	100	3
7	HT509	Project		0	0	8	0	0	0	0	100	50	150	4
TOTAL				**15**	**4**	**18**	**375**	**50**	**75**	**50**	**200**	**100**	**850**	**28**

Sl. No.	**Course Code**	Name of Course	1 Teaching Scheme					**Examination Scheme**				**Total Marks**
			Pre- requisite	**L**	**T**	**P**	**C**	**Theory**				
								End Exam	**PA**	**End Exam**	**PA**	
41	HT510	Industrial Training (3 weeks OJT + 1 week orientation)		-	-		10	-	-	100	100	200

Pre-requisite – Students must be either in 4th Term or higher.

FOUNDATION COURSES

COMMUNICATION SKILL -I

L	T	P	Curri. Ref. No.: G101
3	0	0	

Total Contact hrs.:
Lecture: 45
Tutorial: 0
Practical: 0
Credit :3

Total marks: 100

Theory:
End Term Exam.:75
P.A: 25

RATIONALE

English is not our mother tongue, nor do most of us live in an atmosphere of English. In schools you read English as a *subject* and the main reason behind your reading, for many of you, was simply to pass the examinations.

Now, in the job-oriented education, learners need to learn English not as a subject but as a *service language*- serving as a vehicle for his/her educational as well as professional needs. These are needs for communication. They need to write reports, read instructions and manuals for setting up a machine perfectly and speak to clients for more orders.

So this subject will help to develop reading skills, listening skills, speaking skills and writing skills while using appropriate grammar in reading, writing and speaking. It will enable the learner to use them more confidently in their communicative activities. Learner s will be able to read by themselves text and reference books, articles, different government orders, various letters, non-text materials like charts, diagrams, brochures, technical reports and other writings which not only claim factual comprehension but demand higher levels of comprehension involving inference and evaluation etc. It will enable learners to listen, understand and respond appropriately.

DETAIL COURSE CONTENT

THEORY :

UNIT	TOPIC / SUB-TOPIC	Lecture Hrs.
1.0	**COMMUNICATION**	**4**

1.1 Communication and Communications
1.2 Features of Communication
1.3 Essential Components of Communication
1.4 Barriers of Communication
1.5 Types of Communication
1.6 Essential Elements of Effective Communication

2.0 READING AND REMEDIAL GRAMMAR USAGE 5

2.1 Developing Reading Skills
2.2 Skimming – Scanning – Reading for information structure
2.3 Remedial Grammar
- Time and Tense – Transformation of Sentences
- Relative Clauses
- Language Function: Reporting, Suggesting, Agreeing, Defining, Purpose, Instruction, Prohibition

3.0 PREPARATION FOR WRITING 3

3.1 Understanding the writing assignment: topic, purpose, reader, scope and constraints
3.2 Analyzing the content
3.3 Determining the scope of topic
3.4 Audience analysis for entry behavior
3.5 Collecting information for the assignment

4.0 WRITING PARAGRAPHS 6

4.1 Identifying Paragraphs
4.2 Essentials of effective coherent paragraphs
4.3 Use of appropriate linkers in paragraphs
4.4 Developing notes into a paragraph
4.5 Identifying and Writing Topic Sentences and Supporting Sentences
4.6 Recognising different types of paragraph organisation
4.7 Use of appropriate tenses, voices and linkers in paraqgraphs
4.8 Writing different types of paragraphs
- Process description
- Comprison and contrast
- Cause and Effect
- Problem Solution

5.0 COMPREHENSION OF TECHNICAL TEXTS MANUALS, INSTRUCTIONS ETC. 3

5.1 Recognising important information in written texts
5.2 Note – taking with the use of abbreviations, charts, diagrams and Symbols
5.3 Interpreting with visuals and illustrating with visuals like tables, charts and graphs

6.0 LISTENING 4

6.1 Importance of Active Listening
6.2 Functions of Active Listening
6.3 Techniques for ensuring Active Listening

7.0 PUBLIC SPEAKING **5**

7.1 Planning for the speech
7.2 Designing the speech
7.3 Deliver the speech
7.4 Evaluate the speech

8.0 Presentation **5**

8.1 Rationale of Presentation
8.2 Types of Presentation
8.3 Planning of Presentation
8.4 Guidelines for use of visual aids
8.5 Practice of Presentation on relevant topics

SUGGESTED LEARNING RESOURCES:

(a) Reference Books:

S. No.	Title	Author, Publisher, Edition & Year
1.	English for Specific Purposes: A learning – Centred approach	Hutchinson, Tom and Waters, A lan, CUP 1987
2.	The Second Language Curriculum	Robert Keith Johnson (Ed.), CUP 1989
3.	Designing Tasks for the Communicative Classroom	David Nunan, CUP 1989
4.	Writing English Language Tests	J. B. Heaton Longman Group, U K Limited 1988
5.	Writing Matters	Kristine Brown & Susan Hood, CUP 1989
6.	In at the deep end	Vicki & Hollett, OUP 1989
7.	Teaching the Spoken Language,	G. Brown and G. Yule CUP 1983
8.	ENGLISH SKILLS for Technical Students – TEACHERS'	HANDBOOK / West Bengal State Council of Technical Education in collaboration with THE BRITISH COUNCIL / Orient Longman

COMMUNICATION SKILL -II

L	T	P	**Curri. Ref. No.: G102**
2	1	2	

Total Contact hrs.:
Lecture: 30
Tutorial: 15
Practical: 30
Pre-requisite: Communication Skill - I
Credit :4

Total marks: 100

Theory:
End Term Exam.:50
Practical :
End Term Exam : 25
P.A: 25

RATIONALE

This subject will help to identify essentials of business correspondence. It will enable the learner to use them more confidently in their communicative activities. Learner s will be able to write letters asking for application forms, fill in the application forms.

They will be able to prepare a resume or a CV, write letters of application in response to advertisements, learn how to write technical reports, memos and they will be able to prepare themselves for job interview and group discussion..

DETAIL COURSE CONTENT

THEORY:

UNIT	TOPIC / SUB-TOPIC	Lecture Hrs.
1.0	**ESSENTIALS OF BUSINESS CORRESPONDENCE**	**3**

1.1 Introduction
1.2 Simplicity
1.3 Clarity
1.4 Brevity
1.5 Courteous
1.6 Persuasive
1.7 Sincerity
1.8 Tactful approach

2.0 BUSINESS LETTERS **7**

2.1 Introduction
2.2 Different types of Business Letters
- Letters of Enquiry
- Letters of Placing Orders
- Letters of Complaints

- Letters in response Letters of Enquiry, Placing Orders and Complaints
- Letters in response to Tender Notices

(samples of effective letters referred to above are to be shown to students)

3.0 JOB APPLICATION LETTERS **5**

3.1 Introduction
3.2 Job Application Letters in response to advertisements
3.3 Self-application letters for Jobs
3.4 Covering Letters

4.0 MEETING – AGENDA AND MINUTES **3**

4.1 Introduction
4.2 Technique
4.3 Key Language

5.0 MEMOS **5**

5.1 Introduction
5.2 Essential features
5.3 Format and Body

6.0 E-MAILS **5**

6.1 Introduction
6.2 Method
6.3 Use of attachments
6.4 Netiquettes related to e-mails

(Differences between Memos, Business Letters and E-mails to be explained to students)

7.0 TECHNICAL REPORT WRITING **7**

7.1 Introduction
7.2 Techniques of writing a report
7.3 Structure of technical reports
7.4 Language of technical reports
7.5 Types of Reports
- Accident Reports (related to industry)
- Laboratory Experiment Reports
- Workshop Reports
- Report of a Job done requiring technical expertise
- Investigative Report

8.0 JOB INTERVIEWS **5**

8.1 Importance
8.2 Prepare for an interview
8.3 Anticipating possible questions and framing appropriate answers to them
8.4 Responding politely and appropriately

8.5 Non-verbal communication – body language, postures, gestures, facial expressions, use of space, modulation, pitch, intonation etc.

9.0 GROUP DISCUSSIONS **5**

9.1 Importance and rationale
9.2 Required non-verbal behavior
9.3 Appropriate use of language in group interaction

- Entry / Taking the lead
- Asking for opinion / Creating turns for others to speak
- Expressing opinion (agreeing)
- Expressing opinion (disagreeing)
- Making suggestions
- Politely interrupting
- Stopping or blocking interruptions

(Note: Chapters 8 and 9 are to be dealt in the practical classes)

SUGGESTED LEARNING RESOURCES:

(a) Reference Books:

S. No.	Title	Author, Publisher, Edition & Year
1.	English for Specific Purposes: A learning – Centred approach	Hutchinson, Tom and Waters, A lan, CUP 1987
2.	The Second Language Curriculum	Robert Keith Johnson (Ed.), CUP 1989
3.	Designing Tasks for the Communicative Classroom	David Nunan, CUP 1989
4.	Writing English Language Tests	J. B. Heaton Longman Group, U K Limited 1988
5.	Testing for Language Teachers	Arthur Hughes, CUP 1989
6.	Writing Matters	Kristine Brown & Susan Hood, CUP 1989
7.	Communicate 2	Keith Morrow and Keith Johnson, CUP 1980
8.	In at the deep end	Vicki & Hollett, OUP 1989
9.	Teaching the Spoken Language	G. Brown and G. Yule CUP 1983
10.	Teaching Reading Skills in a Foreign Language	Christine Nuttall, Heinemann 1982
11.	Communication in English for Technical Students	Orient Longman 1984
12.	Teachers' Manual (for Communication in English for Technical Students, Orient Longman 1984)	Curriculum Development Centre Technical Teachers' Training Institute (Eastern Region) 1985

PRACTICALS:

Suggested activities:

- Organising and participating in Mock interviews by peers, teachers and also experts from the industry

- Students may be encouraged to look up books and websites to get an idea about frequently asked questions and finding out appropriate answers to these questions

- Mock group discussions are to be conducted for students in the presence of teachers and industry experts and these discussions are to be evaluated by peers, teachers and experts

- Students are to be given an exposure to sample Job Interviews and Group Discussions from videos, CDs, DVDs, websites etc.

MATHEMATICS

L	T	P	Curri. Ref. No.: HT101
3	1	0	

Total Contact hrs.:
Lecture:45
Tutorial:15
Practical: 0
Credit : 4

Total marks: 100

Theory:
End Term Exam.:75
P.A:25

RATIONALE

Mathematics is the backbone of all areas of technology and hence, technicians and engineers need study of relevant theories and principles of mathematics to enable them to understand and grasp the concept of advance courses of the curriculum. With the above view in mind, the necessary content details for the course of Mathematics-I are derived. It is presumed that this course content will provide a satisfactory foundation for technical applications, which technicians/ engineers supposed to come across in the field of studies.

D E T A I L C O U R S E C O N T E N T

THEORY :

UNIT	TOPIC / SUB-TOPIC	Lecture Hrs.
1.0	**ALGEBRA**	**15L+5T**

1.1 Arithmetic and Geometric Progressions (A.P. & G.P.)
1.2 Formula of the nth term of A.P.
1.3 Properties and concept of G.P., the nth term of G.P.
1.4 Complex Numbers

- Definition of a Complex number
- Polar form of a complex number, Problems
- Cube roots of unity, Fourth roots of unity, the nth roots of unity
- Permutation and combination in elementary level with formulae and simple examples.
- Factorials
- Quadratic Equation.
- Properties of quadratic Equation

1.5 **Binomial Theorem**

- Positive integral index
- Expansion of $(x+a)^n$, where n is a positive integer
- Rules for finding general term & middle term etc.

- Calculation of approximate value, when the number of terms, n is large.
- Properties of Binomial Coefficients

1.6 **Sets and Relation**

- Relational algebra
- Sets & subsets
- Operations on sets
- Product sets (Cartesian product)
- Concepts of relation, domain and Range
- Sets arising from relations

2.0 TRIGONOMETRY 10L+5T

2.1 Trigonometric functions
2.2 Trigonometric functions of allied angles
2.3 Trigonometric ratios
2.4 Half angle, double angle, triple angle – derivation & problems
2.5 Compound trigonometric functions
2.6 Properties of a Triangle
2.7 Solution of triangle using the properties
2.8 Trigonometric ratios with angles A±B and C±D
2.9 Definition of periodic function and the period of trigonometric function.
2.10 Interpret the graphs of: a sin (b θ + c), a cos (b θ +c)
2.11 Use multiple and sub-multiple angle formulae to simplify trigonometric expressions.

3.0 STATISTICS 10L+3T

3.1 Data frequency distribution, tabulations and representation.
3.2 Continuous and discontinuous variables
3.3 Frequency- relative and commutative relative
3.4 Graphical representation of frequency.
3.5 Bar chart, Histogram and frequency polygon
3.6 Mean, median, mode and relationship.
3.7 Harmonic mean
3.8 Range, Deviation, Mean deviation, Standard Deviation
3.9 Probability
3.10 Event and different mathematical formulae
3.11 Probability for independent and dependent events
3.12 Problems based on probability
3.13 Introduction : Numerical Methods
3.14 Concept of difference tables.
3.15 Newton's Interpolation methods (Forward and backward)
3.16 Lagrange's interpolation method.

3.17 Concept of extrapolation.

4.0 MATRICES 10L+2T

4.1 Matrix- definition, notations
4.2 Element of matrix
4.3 Type of matrices
4.4 Special Matrices
- Square, diagonal, row, column, scalar Unit, zero or null, upper and lower triangles, Symmetric, skew.

4.5 Introduction to determinants
4.6 Addition and subtraction of matrices
4.7 Product of two matrices
4.8 Adjoint of a matrix
4.9 Inverse matrix
4.10 Solution of a system of linear equations using matrix method.

SUGGESTED LEARNING RESOURCES:

(a) Reference Books:

S. No.	Title	Author, Publisher, Edition & Year
1.	College Algebra	A.R. Majumder & P.L. Ganguli
2.	Plane Trigonometry Part I	S.L. Loney
3.	Statistics	N.G. Das
4.	Trigonometry	Das & Mukherjee
5.	Engineering Mathematics Part I	Shanti Narayan
6.	Polytechnic Mathematics Vol. I	Dutta & Bera

ANATOMY & PHYSIOLOGY

L	T	P	*Curri. Ref. No.:* HT102
3	0	2	

Total Contact hrs.:	*Total marks: 150*	**Theory:**
Lecture:45		End Term Exam.:75
Tutorial:0		P.A: 25
Practical: 30		**Practical:**
Credit : 4		End Term Exam: 25
		P.A: 25

RATIONALE

This course is aimed at developing understanding of structure and functions of human body. The course provides knowledge of different systems of human body, organs constituting them and their functions.

D E T A I L C O U R S E C O N T E N T

THEORY:

UNIT	TOPIC / SUB-TOPIC	Lecture Hrs.
1.0	**THE HUMAN BODY**	**10**

1.1 An introduction to human physiology with different physiological systems specially with reference to the following.

- Integumentary system
- Respiratory system
- Endocrine system
- Excretory system
- Reproductive system
- Nervous system
- Skeletal system

2.0 CELL AND TISSUES 5

2.1 Cell – definition, Structure
2.2 Definition of tissue, Classification of different tissue system
2.3 Structure of Prokaryotic & Eukaryotic cell, Difference between Prokaryotic & Eukaryotic cells
2.4 Structure of Plant and Animal cell, Difference between Plant and Animal cells
2.5 Functions of different components of cells.

3.0 THE MAINTENANCE OF HUMAN BODY-I 5

3.1 The Cardiovascular System-A: Blood and lymph

- Composition and Functions
- Blood Groups
- Coagulation of Blood, clotting time
- Disorders of blood
- Haemoglobin Value
- Lymph
- Blood pressure, Pulse rate

4.0 MAINTENANCE OF HUMAN BODY –II 4

4.1 The Cardiovascular System-B: Heart and Blood Vessels.

- Overview of the circulation
- Structure and working of Heart.
- The Blood vessels – structure and working.
- Functions of Heart and Blood Vessels.

5.0 MAINTENANCE OF THE HUMAN BODY-III 3

5.1 Digestive System
5.2 Metabolism
5.3 Enzyme & Vitamin, Definition

6.0 HEALTH CARE AND HYGIENE 6

6.1 Health, disease, prevention of diseases.
6.2 Temperature and Heat balance of human body.
6.3 Body water and fluid balance.
6.4 Cleanliness and good health.
6.5 First Aid

SUGGESTED LEARNING RESOURCES:

(a) Reference Books:

S. No.	Title	Author, Publisher, Edition & Year
1	The living body	Best and Taylor
2	Human Physiology and Anatomy	Kimber and Gray
3	Introduction to Human Anatomy	Francis
4	Principles of Anatomy and Physiology	Tortora and Grabowski, Harper Collins College Publisher- 1996
5	Human Physiology	C. C. Chatterjee, Medical Allied Agency, Kolkata

(b) Others:

- OHP transparencies.
- Computer Aided Instructional packages
- Video/Audio Cassettes.
- Microscope.
- Blood pressure instrument.
- Haemocytometer
- Haemoglobinometer
- Thermometer
- First Aid Box
- Prepared stained slides of mammalian ovary &testis
- Prepared stained slides of mammalian liver in V.S.
- Prepared stained slide of human skin in V.S.
- Prepared stained slide of human lung & kidney tissue

PRACTICAL:

Suggested list of experiments:

- Microscopic examination of typical cells and elementary tissues (skin, muscles, blood film etc.)
- Study of plant and human cells
- Study of Prokaryotic & Eukaryotic cell
- Study of following systems and organs with the help of charts and models -
  - Digestive system
  - Respiratory system
  - Cardiovascular system
  - Excretory system
  - Reproductive system
  - Nervous system
  - Sense organs
  - Skeleton system
- Determination of haemoglobin value, clotting time, bleeding time, RBC, ESR
- Recording of pulse rate, blood pressure, body temperature and heart beat.
- Study of structure of animal cell from human cheek cells.
- Microscopic examination and study of the structure of mammalian liver from prepared stained slide.
- Microscopic examination and study of the structure of pancreas from prepared stained slides.
- Study of detailed structure of human skin under microscope in V.S. from prepared stained slides.
- Microscopic examination and study of the structure of lung and kidney tissue from prepared stained slides.

PHYSICS

L	T	P	Curri. Ref. No.: HT103
3	0	0	

Total Contact hrs.:
Theory: 45
Tutorial :0
Practical: 0
Credit: 3

Total marks: 100

Theory:
End Term Exam: 75
P.A.: 25

RATIONALE:

Physics form a foundation for all technician courses. The study of engineering concepts of physics will help the students in understanding engineering subjects where the emphasis will be on the application of these concepts. A good foundation in physics will also help students for self-development in future, to cope up with the continuous flow of new innovation and discoveries in technology. The topics in Applied Physics for the foundation course were identified on the following basis:

- The attainment level of students in Physics at entry level to polytechnics.
- Reference to engineering subjects.
- Continuity of sequence necessary for logical development of the subject

DETAILED COURSE CONTENTS

THEORY

UNIT	TOPIC / SUB-TOPIC	Lecture Hrs.
1.0	**UNITS, DIMENSION AND MEASUREMENTS**	**2**

1.1 **Units, Dimension**

- Concept of unit of physical parameters
- Fundamental and derived units
- SI system of units of different physical parameters
- Dimension with examples of different physical parameters.

1.2 **Measurements**

- Measuring devices e.g., slide callipers, screw gauge, spherometer with concept of vernier constant, least count and zero error.
- Physical Balance

2.0 MECHANICS 4

2.1 Motion along a straight line and Force

- Concept of scalar and vector quantities
- Speed, velocity and linear acceleration
- Equations of motion with constant acceleration (derivation not required)
- Equations of motion of falling body under gravity
- Simple problems on linear motion
- Newton's laws of motion, Action and reaction, tension
- Force, inertia, momentum, impulse and impulsive force with practical examples
- Conservation of linear momentum.

3.0 GRAVITATION 3

- Newton's laws of gravitation
- Newton's gravitational constant G and its SI unit
- Acceleration due to gravity (g) and its relation with "G".
- Variation of g with altitude and latitude (deduction not required)
- Difference between mass and weight
- Simple problems

4.0 WORK, POWER AND ENERGY 3

- Work, power and energy with their units and mathematical expressions
- Relation between Horse power and Watt
- Different forms of mechanical energy : PE, KE and their expressions
- Conservation of energy and transformation of energy with examples
- Simple problems

5.0 PROPERTIES OF MATTER 6

5.1 Properties of solid

- Plasticity and elasticity in solids
- Deformation of bodies by the action of external forces change in size and change in shape
- Unit of stress – tensile stress, compressive stress and Shear stress with examples
- Unit of strain – tensile strain., volumemetric strain and shear strain & Hooke's law
- Modulus of elasticity – Young's modulus, Bulk modulus and Modulus of rigidity, Poison's ratio and their units [Definition & basic concepts only, no deduction]
- Stress – Strain curve

5.2 **Properties of Fluid**

- Thrust and pressure
- Law of fluid pressure, Pascal's law and working principles of hydraulic press
- Archimedes Principle and its applications
- Specific gravity and relative density
- Hydrometers and their uses
- Properties of gas : Toricelli's Expt. & Simple Barometer
- Simple problems

6.0 **HEAT** 9

6.1 **Heat and temperature (Review)**

- Heat and temperature
- Fixed points and different scales of temperature - Fahrenheit, Celsius and Kelvin and their relationships
- Simple problems

6.2 **Measurement of heat**

- Quantity of heat, units of heat:Joule and Calorie
- Specific heat of solid, heat capacity ,water equivalent
- Principle of calorimeter, Measurement of specific heat
- Change of state : Latent heat, evaporation & boiling, effect of pressure
- Boyle's law and Charles law, Universal gas law and universal gas constant.
- Idea of two specific heat capacities of gas: C_p and C_v and their relationships (deduction not required)

6.3 **Thermal expansion & Transmission of heat**

- Expansion of solid – linear, superficial and cubical co-efficient of expansion & their units
- Interrelationship between different co-efficient of expansion with examples
- Different methods of transmission of heat : conduction, convection and radiation
- Co-efficient of thermal expansion & its unit
- Good conductors and bad conductors of heat
- Simple problems

7.0 SOUND **8**

7.1 **Simple Harmonic Motion**

- Simple harmonic motion and its characteristics
- Time period, frequency & amplitude of vibration
- Mathematical expression of SHM

- Examples of SHM: Simple Pendulum
- Idea on Longitudinal & Transverse wave
- Simple problems

7.2 **Production and propagation of Sound**

- Natural vibration, forced vibration with examples
- Resonance of sound with examples
- Principle of resonance to find out velocity of sound in air.
- Velocity of sound, Newton's formula and Laplace correction (Idea only, no deduction)

7.3 **Reflection of sound**

- Echo, reverberation
- Simple problems

7.4 **Musical sound, noise**

- Characteristics of musical sound and noise with examples
- Factors affecting sound

(Note: 10 L Hrs. can be used for assessment and evaluation of students on each module.)

SUGGESTED LEARNING RESOURCES:

(a) Reference Books:

S. No.	Title	Author, Publisher, Edition & Year
1.	Principle of Physics	Subrahmanyan & Brizal
2.	Intermediate Physics	S.C.Roy Chaudhury & D.B.Sinha
3.	Fundamentals Of Physics	David Halliday, Robert Resnick & Jeal Walka
4.	University Physics	Francis W. Sears, Mark W. Zemans Key & Hugh D. Young
5.	University Physics	Hugh D. Young & Roger H. Freedman
6.	A text book of Physics (Part I)	C. R. Dasgupta
7.	Elements of Higher Secondary Physics (Part I)	D. Dutta, B. Pal & B. Chaudhuri
8.	Physics (Volume I)	Ajoy Chakraborty
9.	Applied Physics (Vol. 1)	Saxena H.C. & Singh Prabhakar
10.	Physics for 10+2 students (Part I)	Das, S.K, Sisodia M.L, Neher P.K., Kachhawa C.M.

BIOTECHNOLOGY -I

L	T	P	Curri. Ref. No.: HT-104
3	1	4	

Total Contact hrs.:	**Total marks: 200**	**Theory:**
Lecture:45		End Term Exam.:75
Tutorial:15		P.A: 25
Practical: 60		**Practical:**
Credit : 6		End Term Exam: 50
		P.A: 50

RATIONALE

Biotechnology is highly multidisciplinary science. It has its foundations in many fields including biology, microbiology, biochemistry, molecular biology, genetics, chemistry and chemical and process engineering. The processes of biotechnology now encompass a wide range of new products including antibiotics, vaccines, monoclonal antibodies, diagnostic kits along with molecular innovations allowing unprecedented changes to be made to living systems. Transgenic plants and animals are heralding a new age in agriculture and gene therapy.

Biotechnology can be especially helpful in conserving, multiplying and making sustainable management of valuable endangered medicinal and economically useful plants.

This indicates a clear need for those involved in the cultivation and processing of medicinal plants to become informed about growing scope and usefulness of this revolutionary science. This will also make the students aware about the ethical issues surrounding its role in todays society, allowing them to develop informed opinion about biotechnology and its use in the service of mankind.

D E T A I L C O U R S E C O N T E N T

THEORY

UNIT	TOPIC / SUB-TOPIC	Lecture Hrs.
1.0	**BIOTECHNOLOY – BASIC CONCEPTS**	**3**
1.1	Principles and Scope,	
1.2	Traditional biotechnology	
1.3	Modern biotechnology	
1.4	Biotechnology in India	
1.5	Biotechnology and Biosafety	

2.0 IMPACT OF BIOTECHNOLOGY IN VARIOUS FIELDS OF AGRICULTURE 3

2.1 Agriculture
2.2 Horticulture
2.3 Forestry
2.4 Environment
2.5 Industry
2.6 Healthcare and Immunology
2.7 Food and Beverage technology.
2.8 Biodiversity and Conservation

3.0 MOLECULAR GENETICS, DNA & GENES 8

3.1 DNA as genetic material
3.2 Structure of DNA
3.3 Replication of DNA
3.4 Structure and types of RNA
3.5 Transcription
3.6 Translation – Protein synthesis

4.0 GENE-NATURE, CONCEPT AND REGULATION 4

4.1 The gene concept
4.2 Gene structure in Prokaryotes
4.3 Gene structure in Eukaryotes
4.4 Gene Library
4.5 Polymerase chain reaction (PCR)
4.6 DNA finger printing

5.0 RECOMBINANT DNA TECHNOLOGY 6

5.1 An outline of recombinant DNA technique
5.2 Isolation of DNA
5.3 Tools of recombinant DNA technology
- Enzymes – restriction edonucleases, DNA modifying enzymes, DNA Ligases.
- Cloning vehicles – plasmids and bacteriophages cosmids, phagemids and viruses
- Competent cells
- Purified DNA – purification of DNA from bacterial, plant and animal cell.

5.4 Cloning

6.0 **MICROBIOLOGY 4**

6.1 An outline Bacteria, fungi, virus and their classification
6.2 Isolation and culturing of bacteria, fungi

6.3 Fermentation
6.4 SCP
6.5 Production of vaccines, antibiotics etc.

7.0 BIOINFORMATICS 4

7.1 What is Bioinformatics?
7.2 Data acquisition and data bases
7.3 Retrieval of biological data from data bases.
7.4 The role of computers in bioinformatics
7.5 Internet and use of world wide web
7.6 Uses and limitations of bioinformatics

8.0 BIOCHEMISTRY 3

8.1 Carbohydrates, proteins, fats
8.2 Classifications of carbohydrates, protein, fats
8.3 Vitamin, Enzymes, Amino Acids

SUGGESTED LEARNING RESOURCES:

(a) Reference Books:

S. No.	Title	Author, Publisher, Edition & Year
1	Biotechnology and Plant Genetic Resources: Conservation & Use	Gallow, J.A.; Ford-Lloyd, B.V. and Newbury, H.J. CAB International, Oxon, U.K., 1997
2	Plant, Genes and Agriculture	Chrispeels, M.J. and Sadava, D.E. Jones &b Bartlett Publishers Boston, U.S.A., 1994
3	Biotechnology, Biosafety and Biodiversity	Shantharam, S. and Montgomery, J.F. Oxford Publishing Co. Pvt. Ltd., New Delhi, 1999
4	Understanding Biotechnology	Borem; A. Santos, F.R. and Bowen, E.D., Pearson Education (Singapore) Pvt. Ltd. Patparganj, Delhi, 2004
5	An Introduction to Genetic Engineering	Nicholl, D.S. Cambridge University Press, U.K. 2nd Ed., 2002
6	Biotechnology	Smith, J.E., Low price edition, Cambridge University Press, New York U.S.A. 1996
7	Biotechnology	Singh B.D. Kalayani Publisher, New Delhi, 1999

S. No.	Title	Author, Publisher, Edition & Year
8	A Text Book of Biotechnology	Dubey, R.C., S. Chand and Company Ltd., New Delhi, 2006
9	Plant Tissue Culture: Theory and Practice (a revised edition)	Bhojwani, S.S. and Razdan, M.K., Elsevier Science Publisher, New York, USA, 1996
10	Plant Tissue Culture: Applications and Limitations	Bhojwani S.S. Elsevier Science Publisher, New York, USA, 1990
11	Plant Tissue Culture	Collins, H.A. & Edwards, Bios Scientific Publishers, Oxford, U.K., 1998
12.	Practical Applications of Plant Molecular Biology	Henry, R.J. , Chapman & Hall, London U.K, 1997
13.	Cryopreservation of Plant Cell & Organs	Kartha, K.K. CRC Press, Boca Raton, Florida, USA, 1985
14.	Bioinformatics	Westhead. D.R.; Parish, J.H. and R.M. Twyman, Viva books Pvt. Ltd. New Delhi, 2003
15.	Protecomics in Functional Genomics	Jolles, O. and Nornvall, H. eds. Birkhauser Verlag, Basel, Switzerland, 2000

(b) Others:

- OHP transparencies
- Computer with internet facility.
- Computer Aided Instructional packages showing simulated biotechnology processes.
- Microscope
- Spectrophotometer
- Auto clave
- Sensitive electronic balance
- Laminar air flow system
- Membrane filters
- Chemicals used in various experiments
- Special glassware for tissue culture
- Shaker system
- Green House facility for hardening of tissue cultured plantlets.

PRACTICAL:

Suggested list of experiments:

- Preparation of solid and liquid culture media
- Demonstration of *in vitro* culture technique using appropriate explant by callus and suspension culture method.

- Subculture of cell line from callus and suspension culture in tissue culture bottle/ test tubes.
- Demonstration of organogenesis and somatic embryogenesis by using appropriate explant and culture media.
- Study of somaclonal variations in tissue cultured plantlets.
- Preparation of artificial seeds
- Isolation of genomic DNA from plant tissue using CTAB (Cetyltrimethylammonium bromide) method.
- Quantitative estimation of DNA/ RNA by spectrophotometric method.
- Acquiring basic knowledge of handling of computers.
- Use of internet and world wide web in biological data search.
- Preparation of layout of a tissue culture lab and culture room

CHEMISTRY - I

L	T	P		Curri. Ref. No.:G107
3	0	2		
Total Contact hrs.:			**Total marks: 150**	**Theory:**
Theory: 45				End Term Exam: 75
Tutorial : 0				P.A.: 25
Practical: 30				**Practical:**
Credit: 4				End Term Exam: 25
				P.A : 25

RATIONALE

Chemistry is an important subject in technician education, because of the fact that fundamental knowledge and skills in respect of chemical characteristics of matters related to solid, liquid and gas are essential elements on which various aspects of application in technology depend upon.

Chemistry-I will enable the students to develop fundamental knowledge and skills related to chemical properties of matters in general, such as solid liquid and gas, and their appropriate applications in engineering disciplines which include general chemistry, chemistry of water Electro-chemistry, physical chemistry, organic chemistry and refractories.

DETAIL COURSE CONTENT

THEORY:

UNIT TOPIC / SUB-TOPIC	Lecture Hrs.
1.0 GENERAL CHEMISTRY	**12**

1.1 Concept of symbol, valency, formula, atomic mass, molecular mass, elementary idea of atomic structure (Review).

1.2 **Solution**

- 1.2.1 Classify and explain solution according to concentration
- 1.2.2 Distinguish among suspension, colloids and true solution.
- 1.2.3 Define and explain solubility, effect of temperature on solubility
- 1.2.4 Mention practical applications of colloids in different situations
  - 1.2.4.1 Colloidal impurities in drinking and sewage water.
  - 1.2.4.2 Finely divided colloidal particles in air causes Air-Pollution.

Assignment and Class test

1.3 Acid, Base and Salt

1.3.1 Define and classify acid, base and salt (Review)
1.3.2 Define and explain normal solution, molar solution, titration and indicator
1.3.3 Define pH of a solution and pH Scale
1.3.4 Calculate pH from H^+ ion concentration
1.3.5 Mention application of pH in industry such as
1.3.5.1 pH of a boiler feed water
1.3.5.2 Role of pH in sewage treatment
1.3.5.3 pH in Sugar, Paper industry
1.3.5.4 Buffer Solution, types and application.

Assignment and Class test

1.4 Chemical Bonding

1.4.1 Covalent Bond, Ionic Bond, Hydrogen Bond and Metallic Bond

Assignment and Class test

2.0 CHEMISTRY OF WATER **10**

2.1 State the different types of impurities present in natural water and name impurities under each of them types.

2.2 Explain how natural water gets contaminated with the impurities.

2.3 Explain the action of soap on water

2.4 Define and explain soft and hard water with illustrations

2.5 Classify and explain hardness of water with illustration

2.6 State different ways of expressing concentration of impurities in water including hardness.

2.7 Name the bad effects caused by natural water when used in domestic as well as industrial purpose.

2.8 State and Explain the remedial measures of the following bad effects of natural water in boiler.

- Scales and sludges
- Caustic Embrittlement
- Priming and foaming
- Corrosion

2.9 Define boiler feed water

2.10 Describe with help of diagram of the following water treatment Process.
2.10.1 Lime soda process

2.10.2 Permuit or Zeoilite process

2.11 Describe with the help of block diagram, the treatments done on a sample of raw water to produce drinking water and boiler feed water. Solve problems on a) bad effects on natural water b) water treatment process.

Assignment and Class test

3.0 PHYSICAL CHEMISTRY 7

3.1 Catalyst, types, characteristics and application of Catalyst in Industries

3.2 Radioactivity-Introduction, Characteristics of alphas, beta and gamma rays, half-life period, artificial fission, atomic fusion, application in different fields.

4.0 ORGANIC CHEMISTRY 10

4.1 Organic chemistry and its scope in various industries.

4.2 Tetravelancy of Carbon atom

4.3 Functional groups

4.4 Distinguish between organic and inorganic compounds.

4.5 Homologous series-alkane, alkene, alkyne, alcohol, aldehyde, ketone, ether, carboxylic acid.(general formula)

4.6 Preparation method of Methane, ethane Ethene and ethylene

4.7 Benzene and its preparation and discuss its derivatives.

5.0 Refractories 6

5.1 Define refractories

5.2 Classification

5.3 Properties

- 5.3.1 Refractoriness,
- 5.3.2 Strength
- 5.3.3 Thermal expansion,
- 5.3.4 Porosity

5.4 Portland Cement

- 5.4.1 Composition
- 5.4.2 Properties
- 5.4.3 Types.

SUGGESTED LEARNING RESOURCES:

Reference Books:

S. No.	Title	Author, Publisher, Edition & Year
1.	Modern Intermediate Chemistry Part I and Part II	R.N. Nanda, A.K. Das , Y.R Sharma
2.	Engineering Chemistry	Jain & Jain
3.	A Text Book of Polytechnic Chemistry	J.P. Mehta & Jain and Jain
4.	Industrial Chemistry	B.K. Sarma
5.	Intermediate Chemistry	R.K. Samal

PRACTICAL:

Suggested list of experiments:

- To titrate using standard acid solution to know the strength of a base using indicator or vice-versa.
- To determine alkalinity of a water sample by titration method.
- To observe action of soap on hard water(only demonstration).
- To determine the total hardness of water sample by complexometric method using EDTA
- To determine the pH of different sample by using pH meter.
- To detect qualitatively the presence of Arsenic/Iron in drinking water by using Arsenic/Iron Kit

CHEMISTRY - II

L	T	P		
3	0	2		**Curri. Ref. No.: G108**

Total Contact hrs.:
Theory: 45
Practical: 30
Prerequisite: G107
Credit: 4

Total marks: 150

Theory:
End Term Exam:75
P.A.: 25
Practical:
End Term Exam: 25
P.A : 25

RATIONALE:

Chemistry is an important subject in technician education, because of the fact that fundamental knowledge and skills in respect of chemical characteristics of matters related to solid, liquid and gas are essential elements on which various aspects of application in technology depend upon.

Chemistry-II will enable the students to develop fundamental knowledge and skills related to chemical properties of matters in general, such as solid liquid and gas, and their appropriate applications in technical disciplines which include electro-chemistry, fuel, lubricants, corrosion, protective coatings, plastic and polymer, metallurgy and alloys.

DETAIL COURSE CONTENT

THEORY:

UNIT TOPIC / SUB-TOPIC	Lecture Hrs.
1.0 ELECTROCHEMISTRY	**8**

1.1 Define conductor, insulator, semi-conductor, electrolyte and non-electrolyte with examples.
1.2 State postulates of Arrhenuou's and electrolytic theory of dissociation
1.3 Demonstrate the phenomenon of electrolysis.
1.4 State and explain Faraday's 1st and 2nd laws of electrolysis
1.5 Define and explain conductance, specific conductance, molar conductance, electrochemical cell

Solve problems on electrolysis
Solve problems, Assignment and Class test.

2.0 FUEL **12**

2.1 Explain importance of fuels in industries.
2.2 Define 'fuel' and 'combustion of fuel' with examples.
2.3 State the classification of fuels into two different ways, namely

2.3.1 Classification based upon occurrence with examples.
2.3.2 Classification based upon state of aggregation with examples.

2.4 Define calorific value and mention its units.

2.5 Distinguish between gross (or higher) and net (or lower) calorific value.

2.6 State the relative merits and demerits of solid, liquid and gaseous fuel

2.7 State the availability of different fuels in India.

2.8 Define coal.

2.9 State and explain origin of coal.

2.10 Classify coal by rank.

2.11 Define pulverized coal

2.12 State the advantage and disadvantage of pulverized coal.

2.13 Explain proximate and ultimate analysis of coal.
2.14 Define 'Petroleum' or 'Crude oil'
2.15 Describe the fractional distillation of crude petroleum

2.16 Name the main products obtained from crude petroleum and mention their respective boiling ranges and uses.

2.17 State and explain important properties of liquid fuels namely, viscosity, flash and fire point, smoke point, aniline point, knocking, octane number, cetane number, anti-knocking properties.

2.18 State composition, preparation and industrial application of coal gas, water gas, producer gas, LPG, natural gas and gobar gas.

Solve problems, Assignments and class tests

3.0 LUBRICANTS **3**

3.1 Define 'lubricant' and 'lubrication'.
3.2 Mention the major functions of a lubricant.
3.3 Different types of lubricants with examples
3.4 Applications.

Solve problems, Assignments and class tests

4.0 CORROSION **4**

4.1 Define corrosion.
4.2 Describe the causes of corrosion.
4.3 State the different types of corrosion of metal.
4.4 Explain chemical corrosion of metals and mention the names of the corrosion products.
4.5 Explain rusting of iron
4.6 Name the various methods of corrosion control.

Solve problems, Assignments and class tests

5.0 PROTECTIVE COATING **4**

5.1 State the necessity of protective coating.
5.2 State the main types of protective coatings.
5.3 Recall the different kinds of organic and inorganic (or metallic) protective coating.

5.4 Explain the term " Paint "
5.5 State the functions of component-drying oil, pigment, driers and thinners with examples.

5.6 Varnish, types and application.
Solve problems, Assignments and class tests

6.0 POLYMER AND PLASTICS **6**

6.1 Define polymer.
6.2 The types of polymerization.
6.3 Classify polymers
6.4 Properties of thermoplastics and thermosetting polymers.
6.5 Define plastics
6.6 Name important plastic materials with their properties and uses (in tabular form).

Namely : Polythene, Polypropylene, polystyrene, PVC, Nylon, Terelene,

Neoprene, Bakelite, Urea-formaldehyde and PET.

6.7 Mention examples of plastics used in different situations :

i) Electrical insulation
ii) Lubrication
iii) Ropes and beams
iv) Optical lens
v) Adhesives
vi) Pipes and housing
vii) Fibre glass
viii) Carrybag

Solve problems, Assignments and class tests

8.0 METALLURGY AND ALLOYS 8

8.1 Types of metals & properties
8.2 General Metallurgical process
8.3 Metallurgy of iron by blast furnace (principle only)
8.4 Classification of Steel based on its carbon content and its application
8.5 Properties of cast iron, wrought iron and steel
8.6 Effects of adding alloying elements on the properties of steel
8.7 Definition of alloy and purpose of alloying
8.8 Method of preparation of alloy (brief outline only)
8.9 Composition, properties and engineering uses of following alloys : Duralumin, Magnalium, Brass, Bronze, Monel metal, Babbits metal, Gun metal and Alnico.

Solve problems, Assignments and class tests

SUGGESTED LEARNING RESOURCES:

(a) Reference Books:

S. No.	Title	Author, Publisher, Edition & Year
1.	Modern Intermediate Chemistry Part I and Part II	R.N. Nanda, A.K. Das , Y.R Sharma
2.	Engineering Chemistry	Jain & Jain
3.	A Text Book of Polytechnic Chemistry	J.P. Mehta & Jain and Jain
4.	Industrial Chemistry	B.K. Sarma
5.	Intermediate Chemistry	R.K. Samal

(b) Others:

- Pensky-Martein instrument
- Red-wood Viscometer
- Smoke meter
- Bomb Calorimeter
- Conductivity-TDS meter
- Aniline point meter
- Muffle Furnace
- Hot air oven
- Electronics balance
- Different sieve trays
- Glassware, Porcelin ware, and reagent

PRACTICAL:

Suggested list of experiments:

- To determine calorific value of solid fuel using Bomb Colorimeter.
- To find the proximate analysis (% moisture, %Ash, %volatile matter) of a given sample of coal
- To determine the viscosity of petroleum oil by using Red-wood Viscometer
- To determine smoke point of petroleum (Kerosene) products by using Smoke meter
- To determine flash point of petroleum products (Petrol) by using Pensky-Martein instrument
- To determine the aniline point of petroleum products by using Aniline point
- Instrument
- To determine the conductivity & TDS of water by Conductivity meter.

HARD CORE COURSES

CHEMISTRY – III

L	T	P	Curri. Ref. No.:HT201
3	0	2	

Total Contact hrs.: **Total marks: 150** **Theory:**
Theory: 45 End Term Exam: 75
Tutorial :0 P.A.: 25
Practical: 30 **Practical:**
Pre-requisite : G107,G108 End Term Exam: 25
Credit: 4 P.A : 25

RATIONALE

The aim of teaching Chemistry - III is to develop attitudes in the students, namely, the habits of scientific enquiry, ability to investigate the cause and effect relationships, ability to predict the results under given conditions of activities and given convincing reasons for his prediction. A student of chemistry is able to make generalisation.

The knowledge of Chemistry -III is essential for a technician and engineers because chemistry is concerned with the changes in the structures and properties of matter and all engineering activities and processes are involved to bring out these changes.

DETAILED COURSE CONTENT

THEORY

UNIT TOPIC / SUB-TOPIC	Lecture Hrs.

1.0 INTRODUCTION TO ORGANIC CHEMISTRY 6

1.1 Classification of organic compounds
1.2 Nomenclature of organic compounds
1.3 IUPAC system
1.4 Important properties of organic compound, Isomerism
1.5 Saturated and unsaturated hydrocarbons
1.6 Hybridisation.

2.0 SATURATED, UNSATURATED AND AROMATIC HYDROCARBONS 5

2.1 General methods of preparation, properties and uses of –
- Alkanes (Methane)
- Alkenes (Ethene) (ethylene)
- Alkynes (Acetylene)
- Aromatic Compound (Benzene)

3.0 BONDING IN ORGANIC COMPOUNDS **4**

3.1 Tetravalency of Carbon
3.2 Electrovalent bond
3.3 Covalent bond

4.0 HALOGEN DERIVATIVES OF PARAFFINS **4**

4.1 General methods of preparation, properties and uses of –
- Chloroform
- Carbon tetrachloride

5.0 ETHERS AND ALCOHOLS **4**

5.1 Definition, Nomenclature, preparation, properties and uses of diethyl ether, ethyl alcohol
5.2 Anaesthetic ether

6.0 ALDEHYDE AND KETONES **4**

6.1 Definition, Nomenclature, Preparation, properties and uses of acetaldehyde, acetone
6.2 Polymerisation of aldehyde and ketone .

7.0 CARBOXYLIC ACID **4**

7.1 Definition, nomenclature, classification, preparation, properties and uses of formic acid, acetic acid.

8.0 AMINES **4**

8.1 Definition, classification, preparation, properties and uses of ethyl amine.

SUGGESTED LEARNING RESOURCES

(a) Reference Books:

S. No.	Title	Author, Publisher, Edition & Year
1	Organic Chemistry	B.S.Bahl
2	Physical Chemistry	B.S.Bahl
3	Text-book of Organic Chemistry	Morrison and Boyd
4	Elements of Physical Chemistry	Glasstone
5	Text-book of Organic Chemistry	Chatwal

(b) Others:

- Lab manuals available
- CAI Packages
- OHP transparencies
- Models

PRACTICALS:
Suggested list of experiments:

- Determination of boiling point.
- Determination of melting point.
- Systematic organic analysis of unknown organic compound i.e. preliminary tests, detection of elements and groups, determination of physical constant and specific tests.
- pH and conductivity determination in herbal extracts.
- Organic preparation based on nitrates.
- Organic preparation based on condensation.

ENVIRONMENTAL EDUCATION

L	T	P		Curri. Ref. No. HT202
3	0	0		
Total Contact hrs.:			**Total marks: 100**	**Theory:**
Theory: 45				End Term Exam: 75
Tutorial : 0				P.A.: 25
Practical : 0				
Credit: 3				

RATIONALE

Management of Environmental Degradation as also its control using innovative technologies is of prime importance in the times we are living in. Since the days of the famed Rio Summit (1992) awareness about degradation of environment we live in an its management through participation of one and all has literally blossomed into a full fledged movement of universal importance. Technically qualified people, such as the Diploma Engineers, should not only be aware about new technologies to combat environmental degradation at their disposal but also various aspects of environment, ecology, bio-diversity, management, and legislation so that they can perform their jobs with a wider perspective and informed citizens. This course can be taken by all diploma students irrespective of their specializations.

DETAILED COURSE CONTENT

THEORY:

UNIT TOPIC / SUB-TOPIC	Lecture Hrs.
1.0 INTRODUCTION	**2**
1.1 Introduction 1.2 Environment and its components 1.3 Environment in India 1.4 Public Awareness	
2.0 ECOLOGICAL ASPECTS OF ENVIRONMENT	**8**
2.1 Ecology • Eco-system • Factors affecting Eco-system	
2.2 Bio-geochemical cycles • Hydrological cycle • Carbon cycle • Oxygen cycle • Nitrogen cycle	

- Phosphorous cycle
- Sulphur cycle

2.3 Bio-diversity
2.4 Bio-diversity Index

3.0 NATURAL RESOURCES 5

3.1 Definition of Natural Resources
3.2 Types of Natural Resources
3.3 Quality of life
3.4 Population & Environment
3.5 Water Resources
- Sources of Water

3.6 Water Demand
3.7 Forest as Natural Resource
- Forest and Environment
- Deforestation
- Afforestation
- Forest Conservation, its methods

3.8 Land
- Uses and abuses of waste and wet land

4.0 GLOBAL ENVIRONMENTAL ISSUES 9

4.1 Introduction
4.2 Major Global Environmental Problems
4.3 Acid Rain
- Effects of Acid Rain

4.4 Depletion of Ozone Layer
- Effects of Ozone Layer Depletion

4.5 Measures against Global Warming
4.6 Green House Effect

5.0 ENVIRONMENTAL POLLUTION 9

5.1 Introduction
5.2 Water Pollution
- Characteristics of domestic waste water
- Principles of water treatment
- Water treatment plant (for few industries only- unit operations & unit processes - names only)

5.3 Air Pollution
- Types of air pollutants
- Sources of Air Pollution
- Effects of Air Pollutants

5.4 Noise Pollution

- Places of noise pollution
- Effect of noise pollution

6.0 CLEAN TECHNOLOGY 6

6.1 Introduction to Clean Technologies
6.2 Types of Energy Sources
- Conventional Energy sources
- Non-conventional sources of Energy

6.3 Types of Pesticides
6.4 Integrated Pest Management

7.0 ENVIRONMENTAL LEGISLATION 3

7.1 Introduction to Environmental Legislation
7.2 Introduction to Environmental Laws

8.0 ENVIRONMENTAL IMPACT ASSESSMENT 3

8.1 Introduction to Environmental Impact Assessment
8.2 Environmental Management (elements of ISO 14001)
8.3 Environmental ethics

SUGGESTED IMPLEMENTATION STRATEGIES

The teachers are expected to teach the students as per the prescribed subject content. This subject does not have any practical but will have only demonstration and field visit as stated. The students will have to prepare report of the site visit.

SUGGESTED LEARNING RESOURCES:

(a) Reference Books:

S. No.	Title	Author, Publisher, Edition & Year
1.	Environmental Engineering	Pandya & Carny, Tata McGraw Hill, New Delhi
2.	Introduction to Environmental Engineering and Science	Gilbert M. Masters Tata McGraw Hill, New Delhi
3.	Waste Water Engineering – Treatment, Disposal & Reuse	Metcalf & Eddy Tata McGraw Hill, New Delhi
4.	Environmental Engineering	Peavy, TMH International New York
5.	Study / training materials, references, reports etc. developed by Central Pollution	Central Pollution Control Board Postal Address: Parivesh Bhawan, CBD-cum-Office Complex East Arjun Nagar,

S. No.	Title	Author, Publisher, Edition & Year
	Control Board, New Delhi as also State Pollution Control Boards	DELHI - 110 032, INDIA Tel.: 91-11-22307233 Fax: 91-11-22304948 e-mail: ccb.cpcb@nic.in
6.	Environmental Science	Aluwalia & Malhotra, Ane Books Pvt. Ltd, New Delhi
7.	Text Book of Environment & Ecology	Sing, Sing & Malaviya, Acme Learning, New Delhi
8.	Environmental Science & Ethics	Sing, Malaviya &Sing , Acme Learning, New Delhi
9.	Environmental Chemistry	Samir K. Banerji, Prentice Hall of India, New Delhi

(b) Others:

1. Text book mentioned in the references
2. Lab Manuals
3. OHP Transparencies
4. Video film on Environment

SUGGESTED LIST OF DEMONSTRATIONS/FIELD VISIT

- pH value of water sample.
- Hardness of water
- Calcium hardness
- Total Hardness
- Residual Chlorine to a given sample of water
- Turbidity
- B.O.D.
- C.O.D.

Visits: Following visits shall be arranged by the teachers during the semester:

- Water Treatment Plant
- Sewage Treatment Plant
- Maintenance work of water supply mains and sewage system

BASIC SOIL CHEMISTRY

L	T	P	Curri. Ref. No.: HT-203
3	1	2	

Total Contact hrs.:	**Total marks: 150**	**Theory:**
Lecture:45		End Term Exam: 75
Tutorial:15		P.A.: 25
Practical: 30		**Practical:**
Credit : 5		End Term Exam: 25
		P.A.: 25

RATIONALE

Soil forms the base in which the plants grow. It is not only the physical support medium for anchorage of the plants but also a source of supply of various micro and macronutrients essential for plant growth. Plants absorb their water from soil solution. Different areas have different soil types. It is therefore essential to have basic knowledge about the nature of soil and soil chemistry. This knowledge will enable the student to understand the soil type of their region, its assets and shortcomings. So that they could plant and execute their medicinal plant cultivation programme accordingly.

DETAILED COURSE CONTENT

THEORY:

UNIT	TOPIC / SUB-TOPIC	Lecture Hrs.
1.0	**THE NATURE OF SOIL**	**8**
1.1	What is soil?	
1.2	The Soil Profile and its horizons	
1.3	Top-soil and Sub-soil	
1.4	Processes of soil formation	
1.5	Classification of soil	
2.0	**PHYSICAL PROPERTIES OF SOIL**	**10**
2.1	The Particle Size & Soil Texture	
2.2	Soil Air and Soil Temperature	
2.3	Soil Porosity	
2.4	Soil Density	
2.5	Soil Water	
3.0	**CHEMICAL PROPERTIES OF SOIL**	**9**
3.1	The Particle Size & Soil Texture Soil Solution	
3.2	Soil Colloids	

3.3 Acidity & Alkalinity of Soils
3.4 Soil Salinity and Sodicity
3.5 Ion Exchange

4.0 ORGANIC COMPONENT OF SOIL 6

4.1 Sources of Soil Organic Matter
4.2 Nature of Soil Organic Matter
4.3 Humus-Nature and Formation
4.4 Soil Microorganisms (General)
4.5 Soil Plant Relations

SUGGESTED LEARNING RESOURCES

(a) Reference Books:

S. No.	Title	Author, Publisher, Edition & Year
1	The Nature and Properties of Soils	Nyle C Brandy, Prentice-Hall of India Pvt. Ltd., New Delhi, Tenth Edition-2001
2	Soil Physics	T.J. Marshall, J.W. Holmes and C.W. Rose, Cambridge University Press, Third Edition-1996
3.	Soils and Agriculture	Edited by P.B. Tinker, Society of Chemical Industry Black-Well Scientific Publication, Oxford, London
4.	Ecology and Environment	P.D. Sharma Rastogi Publications
5.	A Text Book of Plant Ecology	R.S. Ambasht & N.K. Ambasht CBS Publishers & Distributors
6.	Ecology Work-Book	R. Mishra Oxford & IBH, Calcutta, 1969
7.	Soil Plant Analysis	P.C. Piper N.Y. Inter Science, 1994
8.	Practical Ecology	K.S.Rao Anmol Publications, New Delhi, India, 1993
9.	Soil Science Simplified	Harpstead M.I., F.D. Hole & W.F. Bennet Ames, IA, Iowa State University Press, 1998

(b) Others:

- OHP transparencies
- Video-Audio cassettes
- Computer Aided Instructional package
- Charts (Soil Profile)

PRACTICALS:

Suggested list of experiments:

- To determine soil colour and soil temperature.
- To determine soil texture of the given soil sample.
- To determine soil density of the given soil sample.
- To determine soil porosity of the given soil sample.
- To determine pH of the given soil sample.
- To determine total soluble salt (or soil conductivity) by conductivity meter.
- To determine moisture percentage of the given soil sample.
- To determine carbonate content of the given soil sample.
- To determine nitrate content of the soil using colorimeter.
- To study soil profile and its horizons in field conditions).

INTRODUCTION TO HERBAL TECHNOLOGY

L	T	P	**Curri. Ref. No.: HT-204**
3	0	0	

Total Contact hrs.:
Lecture:45
Tutorial:0
Practical: 0
Credit: :3

Total marks: 100

Theory:
End Term Exam: 75
P.A.: 25

RATIONALE

This paper is designed to provide introductory idea related to Herbal Technology. It will provide knowledge about the identification, authentication and collection of plant and plant products, their various uses with a special consideration of standardisation of those products using analytical techniques. Finally, this paper aims at providing the idea about herbal pharmacopoeia and standardisation of herbal product as per the guidelines of WHO.

DETAILED COURSE CONTENT

THEORY:

UNIT TOPIC / SUB-TOPIC	Lecture Hrs.

1.0 INTRODUCTION **10**

1.1 Definition of herbs & their medicinal values
1.2 Identification & authentication of herbs
1.3 Source of herbal raw materials
1.4 Seasonal & geographical variations
1.5 Collection, natural & artificial drying methods, storage.
1.6 A brief outline of extraction methodologies
1.7 Packaging & labeling of herbal drugs
1.8 Standardization of medicinal plant products as per WHO guidelines
1.9 Different herbal pharmacopoeias.

2.0 STANDARDIZATIONS **7**

2.1 Determination of physical and chemical constants such as extractive values, moisture content, volatile oil content, ash values, bitterness value and foreign matters applicable to the various herbal drugs.

3.0 TECHNIQUES INVOLVED **10**

3.1 Extraction, Separation, Mixing, Analysis.

3.2 Outline of some analytical techniques such as chromatography including HPTLC, NMR, IR.

4.0 USAGES **6**

4.1 Use of plant products in various commercially available formulations and other plant products

SUGGESTED LEARNING RESOURCES

(a) Reference Books:

S. No.	Title	Author, Publisher, Edition & Year
1	Herbal Technology Concepts & Approaches	M Daniel
2	Herbal Drug Technology	S S Agrawal & M Paridhavi , 2nd edition, Orient blackswan
3.	Pharmacognosy	Dr. C. K. Kokate, A. P. Purohit, S. B. Gokhale
4.	Trease and Evans pharmacognosy	William C Evans, 16th edition

INTRODUCTION TO INFORMATION TECHNOLOGY

L	T	P	**Curri. Ref. No. G206B**
2	1	2	

Total Contact hrs.:
Theory: 30
Tutorial: 15
Practical: 30
Credit: 4

Total marks: 100

Theory:
End Term Exam: 50
Practical:
End Term Exam: 25
P.A : 25

RATIONALE

Information Technology is an in-evitable part now-a-days. The discipline of Engineering is also being highly influenced by the recent development in the field of IT. This course emphasizes of the various components of Information Technology. The course deals with Hardware, Software and Communication technologies in brief those are the foundation of IT. It therefore becomes important for the students to understand the concept and develop necessary skills in different aspects of information technology.

DETAIL COURSE CONTENT

THEORY:

UNIT	TOPIC/SUB-TOPIC	Lecture Hrs.
1.0	Introduction to IT - its components computer, communication & management	03
2.0	Introduction to Number System, Bits, Bytes, Word, Logical Gates, Truth Table, ASCII, BCD, Floating point and Fixed Point number represeantation.	06
3.0	Introductory ideas about the components of computer - Hardware - Central Processing Unit, Input Unit, Output Unit, Memory Unit, Auxiliary Unit, Peripherals - Monitor, Keyboard, Mouse, Printer, Hard disk, CD / DVD, USB storage devices, Micro SD Cards, etc. Software and firmware building blocks of a computer, its function and its use. Role of operating system.	08
4.0	Classification of software - System Software, Application Software Translator - Compiler, Interpreter, Preprocessor Operating System - Single User, Multiple User Windows XP/Vista / 7 / 8 - Definition of Windows, Windows element, Concept of Graphical user Interface, Concept of Icon, Working with File Management, Concept of GUI based software; concept of client & server, concept of www, Internet services, use of standard browsers,	06

basics of HTML and searching.

5.0	Computer communication interface, introductory concepts of networking, Transmission media – Wired and Wireless, use of Modem Concept of LAN, WAN, Internet, Intranet, Email.	07

PRACTICAL:

Suggested demonstration / tasks :

1.	Introduction to MS Office Basic features of Ms Office, Overview of Different Office Tools	01
2.	Introduction to MS Word Creating and Editing document, Formatting Documents, Working with Tables, Spell checking, Mail Merging, Importing Graphics into word Document	08
3.	Introduction to MS Excel Creating a New Work Book, Entering Labels, Values and Formulas, Formatting the layout, Working with Functions, Creating the Chart from data, Writing macros	09
4.	Introduction to Power Point Creating a Presentation, Adding/Editing Text, Working with objects, Formatting the Presentation, Placing the chart in slide, Slide Show and Printing	07
5.	Internet Browsing and Emailing Internet surfing and browsing, searching content from the Internet using search engines, Email – account opening, composition of e-mails, searching mails, forward and reply of mails	05

ENTREPRENEURSHIP DEVELOPMENT

L	T	P	Curri. Ref. No.: HT205
3	0	0	

Total Contact hrs.:
Theory: 45
Tutorial :0
Practical: 0
Credit: 3

Total marks: 100

Theory:
End Term Exam: 75
P.A.: 25

RATIONALE

The course intends to provide the fundamental aspects of entrepreneurship as a means for self employment and culminating in economic development of the country. It deals with basic issues like entrepreneurial characteristics and quality, governmental policy support and overall scenario along with opportunities and the facilities available for entrepreneurship development.

DETAIL COURSE CONTENT

THEORY:

UNIT	TOPIC / SUB-TOPIC	Lecture Hrs.
1.0	**INTRODUCTION**	**10**
1.1	Definition and functions of Entrepreneur, entrepreneurship quality, entrepreneurial spirit, need for entrepreneurship.	
1.2	Individual and social aspects of business – achievement motivation theory	
1.3	Social responsibilities of Entrepreneurs	
2.0	**FORMS OF BUSINESS ORGANISATION**	**4**
2.1	Types of company	
2.2	Merits and demerits of different types	
2.2	Registration of small scale industries	
2.4	Conglomeration.	
3.0	**SMALL SCALE AND ANCILLARY INDUSTRIES**	**8**
3.1	Definition – scope with special reference to self employment.	
3.2	Procedure to start small scale and Ancillary industries	
3.3	Pattern on which the Scheme/Project may be prepared	
3.4	Sources of finance - Bank, govt., and other financial institutions.	
3.5	Selection of site for factory	
3.6	Factors of selection	
3.7	N.O.C. from different authorities, e.g., Pollution Control Board, Factories Directorate etc.	

3.8 Trade License.

4.0 SYSTEM OF DISTRIBUTION **1**

4.1 Wholesale Trade
4.2 Retail trade

5.0 SALES ORGANISATION **3**

5.1 Market survey, marketing trends, knowledge of competitors, product selection & its basis .
5.2 Sales promotion
5.3 Advertisement
5.4 Public relations and selling skills

6.0 PRICING THE PRODUCT **1**

6.1 Basic guidelines

7.0 INTRODUCTION TO IMPORT AND EXPORT **6**

7.1 Procedures for export
7.2 Procedures for import
7.3 Technical collaboration – international trade
7.4 Business insurance
7.5 Rail and road transport
7.6 Forwarding formalities, FOR, FOB, CIF, etc.

8.0 BUSINESS ENQUIRIES **4**

8.1 Enquiries: From SISI, DIC, SFC Dept. of Industrial Development Banks.
8.2 Offers and Quotations
8.3 Orders

9.0 PROJECT REPORT **6**

9.1 Project Report on feasibility studies for small scale industries, proposal for finances from bank and other financial institutions for establishing new industries and its extension, obtaining License enlistment as suppliers, different vetting organizations for Techno Economic feasibility report.
Breakeven analysis, Breakeven point.

10.0 ENVIRONMENT LEGISLATION **2**

10.1 Air Pollution Act
10.2 Water Pollution Act
10.3 Smoke Nuisance Control Act
10.4 ISO: 14000, OSHA

SUGGESTED LEARNING RESOURCES

(a) Reference Books:

S. No.	Title	Author, Publisher, Edition & Year
1.	Entrepreneurship Development	CTSC Manila Publishers by Tata Mc Graw Hill Publishing Co. Ltd.
2.	Small Enterprise Management	ISTE, Mysore
3.	Motivation Published	ISTE, Mysore
4.	S.S.M. in Environmental Engineering	ISTE, Mysore
5.	Entrepreneurship New Venture Creations	Holt, Prentice Hall, India
6.	Essence of TQM	John Bank
7.	A Handbook of Entrepreneurship	Rathore, B.S. and J.S. Saini(ed), Panchkula : Aapga, 1997
8.	Entrepreneurship Development	Jose Pauletal, : Himalaya Publishing House, Mumbai 1996
9.	Entrepreneurship Development	Khanka, S.S., S. Chand and Co., 2001, New Delhi
10.	TQM New Delhi	Nagarazan, R.S. and A.A. Arivalagar, New Age International Publishers, 2005
11.	Marketing Communication and Advertising	Bhatia, R.C. Galgotia Publishing Co., 2003 New Delhi
12.	A Textbook of Commerce	Sinha, J.C., and V.N. Mugali New Delhi : R. Chand and Co., 1994

SOFT CORE COURSES

ENGINEERING ECONOMICS AND ACCOUNTANCY

L	T	P	Curri. Ref. No.: G302A
3	0	0	

Total Contact hrs.:
Theory: 45
Tutorial: 0
Practical: 0
Credit: 3

Total marks: 100

Theory:
End Term Exam: 75
P.A.: 25

RATIONALE

The knowledge of Engineering Economics and Accountancy is needed by personnel dealing with the cost of products of any kind related to quality and standards of production including its financial control. Engineers / Technicians, in general, need to know the cost of the final products for marketing purposes. The knowledge of Economics as well as Accountancy is required by all people dealing in any business or enterprise.

This particular subjects deals in basic concepts of economics, production of commodities, different types of industries, market forms, objective of economic planning, concept of value of money, causes of unemployment, industrial policy, business transaction and accountancy, maintenance of cash and balances, receipt and expenditures and final accounts.

DETAIL COURSE CONTENT

THEORY:

UNIT	TOPIC / SUB-TOPIC	Lecture Hrs.
1.0	**INTRODUCTION**	**1**
1.1	Introduction to Economics and its Utility of study	
1.2	Importance of the study of Economics	
2.0	**BASIC CONCEPTS OF ECONOMICS**	**3**
2.1	Definition of Utility, Consumption, Want, Value, Price, Goods, National Income.	
2.2	Classification of goods, characteristics and classification of wealth.	
2.3	Basic Laws of demand and supply.	
2.4	Concept and Measurement of Elasticity of demand	
3.0	**PRODUCTION**	**3**
3.1	Meaning and factors of production.	

3.2 Land, Labour, Capital and Organisation
3.3 Formation of Capital, Break even chart-its uses.

4.0 SCALE OF INDUSTRIES 2

4.1 Definition, advantages and disadvantages of small, medium and large scale production
4.2 Internal and External Economies

5.0 MARKET FORMS 3

5.1 Definition and types of Markets in respect of present trends.
5.2 Features of Perfect, Imperfect and monopoly markets.
5.3 Price determination under perfect competition and monopoly

6.0 ECONOMIC PLANNING 3

6.1 Features of Under-developed and Developing Countries.
6.2 Meaning, objectives and needs of planning.
6.3 Introduction to industrial development in India during the five year plans.

7.0 MONEY 3

7.1 Meaning and functions of Money
7.2 Introduction to the concept of the value of money
7.3 Meaning of Inflation, Deflation, Stagnation.

8.0 UNEMPLOYMENT 2

8.1 Meaning, types and causes of Unemployment
8.2 Unemployment problems in India

9.0 INDUSTRIAL POLICY 3

9.1 Current Industrial Policy
9.2 Industrial licensing Policy, De-licensing
9.3 Monopolistic and Restricted Trade practices (MRTP) Foreign Exchange Regulation Act (FERA).

10. 0 BUSINESS TRANSACTIONS AND ACCOUNTANCY 5

10.1 Transactions and classifications, need and objectives of proper records including double entry system.

10.2 Classification of Accounts and its description (in respect of real accounts, personal accounts and nominal accounts)

10.3 Debit and credit concept; golden rules of debit and credit.

10.4 Objectives and principles of double entry book-keeping.

11.0 BOOKS OF ACCOUNTS **2**

11.1 Journal and Ledger, their sub-divisions; posting from journals to ledger.

11.2 Balancing of Accounts

12.0 CASH BOOK **2**

12.1 Objective of Cash Book (in respect of all kinds of Cash transactions)

12.2 Single column, double column and triple column cash book

12.3 Imprest system of Petty Cash Book.

13.0 TRIAL BALANCE **2**

13.1 Objective, Preparation, errors and rectification (in respect of balance of accounts for the total period).

14.0 FINAL ACCOUNTS **5**

14.1 Steps of preparing accounts; Trading Account; Profit and Loss Account

14.2 Revenue and Depreciation adjustment

14.2 Introduction to balance sheet

15.0 CAPITAL AND REVENUE EXPENDITURE DISTRIBUTION **3**

15.1 Receipts and payments

15.2 Income and Expenditure differences

16.0 MEANING AND PURPOSE OF COSTING 2

16.1 Elements of Cost-Analysis and classification of expenditure for cost accounts.
16.2 Cost Control – Prime cost, Overhead cost, and Indirect materials and tools.

17.0 ELECTRONICS COMMERCE – MEANING – SCOPE 1

17.1 Accounting Software – Tally latest version

SUGGESTED LEARNING RESOURCES

(a) Reference Books:

S. No.	Title	Author, Publisher, Edition & Year
1.	Indian Economy	Agrawal, A.N., New Delhi ; wish Prahashan, 2005
2.	Managerial Economics	Wali, B.M., and A.B. Kalkundrikar New Delhi : R.Chand and Co., 1983

PRINCIPLES OF MANAGEMENT

L	T	P		Curri. Ref. No. G302B
3	0	0		
Total Contact hrs.:			**Total marks: 100**	**Theory:**
Theory: 45				End Term Exam: 75
Tutorial :0				P.A.: 25
Practical : 0				
Credit: 3				

RATIONALE

Management is the integrated component of all areas of technological courses as recognized across the world. Technicians or supervisors coming out of the system hence need to study the basics components of the management relevant to them. Principals of management will enable them to apply basic knowledge of management in their field of work. Keeping with this in mind necessary content details of the course on Principles of Management has been developed. Further, it will develop some management foundation for the diploma students.

DETAIL COURSE CONTENT

THEORY:

UNIT TOPIC / SUB-TOPIC	Lecture Hrs.
1.0 FRAMEWORK OF MANAGEMENT	**8**
1.1 Nature of management	
1.2 Development of management thoughts	
1.3 Management and process skills	
2.0 PLANNING	**9**
2.1 Fundamentals of planning	
2.2 Planning premises and forecasting	
2.3 Decision making	
2.4 Mission and objective	
3.0 ORGANIZING	**10**
3.1 Fundamentals of organizing	
3.2 Design of organization structure	
3.3 Forms of organization structure	
3.4 Power and authority	
3.5 Authority relationship	

4.0 STAFFING **8**

4.1 Fundamentals of staffing
4.2 HR planning
4.3 Recruitment and selection
4.4 Training and development
4.5 Performance appraisal

5.0 DIRECTING **6**

5.1 Fundamentals of directing
5.2 Operational control techniques
5.3 Overall control technique

6.0 TOTAL QUALITY MANAGEMENT 4

6.1 Concepts and definitions
6.2 Sages of quality gurus and their contributions
6.3 Basic tools of TQM

SUGGESTED LEARNING RESOURCES

(a) Reference Books:

S. No.	Title	Author, Publisher, Edition & Year
1.	Principles of Management	T.Ramasamy (Himalya publishing house)
2.	Management	S. P. Robins
3.	Management Principles	Anil Bhat and Arya Kumar
4.	Principles and Practice of Management	LM Prasad
5.	Principles of Management	LM Prasad
6.	Essentials of Management	Joseph L. Massie Prentice-Hall of India

ORGANIZATIONAL BEHAVIOUR

L	T	P	Curri. Ref. No.:G302D
3	0	0	

Total Contact hrs.: **Total marks: 100** **Theory:**
Theory: 45 End Term Exam: 75
Tutorial :0 P.A.: 25
Practical: 0
Credit: 3

RATIONALE

Knowledge in behavioural principles in an organization is an important requirement because concepts such as work motivation, behavioural patterns of individuals as also those of group of individuals etc are intimately related to it. Organizational Behavioural principles, its scopes, applicability etc. are therefore important to know by the students irrespective of the branch of specialization. Based of the above facts following content details of the subject on Organizational Behaviour has been suggested.

DETAIL COURSE CONTENT

THEORY:

UNIT TOPIC / SUB-TOPIC	Lecture Hrs.
1.0 ORGANIZATION	**8**
1.1 Concept and Definition	
1.2 Structures (line, staff, functional divisional, matrix)	
2.0 MOTIVATION	**10**
2.1 Principles of Motivation	
2.2 Aspects of Motivation	
2.3 Job motivation	
2.4 Theories of motivation (Maslow, Herzberg, Theory of X&Y of Mc. Gregar)	
3.0 DEVELOPING GOOD WORK HABITS	**10**
3.1 Principles of habit formation	
3.2 Attitude and values	
3.3 Personality-	
- Concepts	
- Theories	
- Personality and Behaviour	

4.0 ORGANIZATIONAL CULTURE **8**

4.1 Concepts and its importance
4.2 Determinants of organizational culture
4.3 Rules & regulations

5.0 TEAM BUILDING **9**

5.1 Concepts
5.2 Team and Group
5.3 Formation of Team building

SUGGESTED LEARNING RESOURCES

(a) Reference Books:

S. No.	Title	Author, Publisher, Edition & Year
1.	Organisational Behaviour — An introductory Text	Huezynski A. & Bucheman C. (Prentice Hall of India)
2.	Image of Organisation	Morgan G. (Sage)
3.	Understanding Management	Linstoand S. (Sage)
4.	Organizational Behaviour	Robbins (Prentice Hall of India)
5.	Understanding and Managing – Organizational Behavior	George & Jones
6.	Organisational Behaviour	L.M. PRASAD, New Delhi, Sultan Chand & Sons
7.	Essentials of Management	Koontz (Tata McGraw Hill)

FINANCIAL MANAGEMENT

L	T	P	Curri. Ref. No.:HT301
3	0	0	

Total Contact hrs.:
Theory: 45
Tutorial :0
Practical: 0
Credit: 3

Total marks: 100

Theory:
End Term Exam: 75
P.A.: 25

RATIONALE

The importance of financial management in business and engineering industries is undeniable. As such it is very essential that this subject and its basic concepts are required to be clearly understood by all those who are or will be operating in business/ industries. This subject inculcates the values of money and management of money as well as it gives a direction and ideas for money drives. A good businessman without knowledge of finance is worth nothing. Financial management explains the features of money and financial policies to lead the business towards the great success. Financial management provides the information to the business, which are required for managers and developing the business.

DETAIL COURSE CONTENT

THEORY:

UNIT	TOPIC / SUB-TOPIC	Lecture Hrs.
1.0	**INTRODUCTION TO FINANCE**	**8**
	1.1 Need & source of finance	
2.0.	**FINANCIAL STATEMENT ANALYSIS**	**10**
	2.1 Comparative financial statement	
	2.2 Common size financial statement	
	2.3 Ratio analysis	
3.0	**WORKING CAPITAL MANAGEMENT**	**10**
	3.1 Components of working capital	
	3.2 Factors influencing working capital	
	3.3 Management of cash, including cash budget preparation	
	3.4 Management of inventory	
	3.5 Overtrading and under-trading	

4.0 ASSESSMENT OF CAPITAL PROJECT 8

4.1 Payback method
4.2 Return on investment method
4.3 Discounted cash flow method
4.4 Net present value method
4.5 Internal rate of return method (practical problems, simple)

5.0 PREPARATION OF FUNDS FLOW STATEMENT 8

Simple practical problems

Students may be assigned problems and exercises related to financial statement analysis, Assessment of capital projects and preparation of fund flow statements.

SUGGESTED LEARNING RESOURCES

(a) Reference Books:

S. No.	Title	Author, Publisher, Edition & Year
1.	Fundamentals of financial management	R.P.Rustogi, Galgotia Publishing Co., New Delhi. 1999
2.	Financial management	I.M. Pandey, Vikas Publishing House, New Delhi, 8th Edition, 1999
3.	Financial accounting	Jawahar Lal, Wheeler Publishing, 1996
4.	Understanding financial statement	A.A.Gopala Krishnan, Abhinav Publishing, 1992

MARKETING MANAGEMENT

L	T	P	Curri. Ref. No.:HT302
3	0	0	

Total Contact hrs.: **Total marks: 100** **Theory:**
Theory: 45 End Term Exam: 75
Tutorial :0 P.A.: 25
Practical: 0
Credit: 3

RATIONALE

Marketing Management is a discipline which is focused on the practical application of marketing techniques and the management of an organization's marketing resources and activities. Pass out from some diploma courses are sometimes given the responsibility as marketing manager. Some basic concepts of marketing management in this regard are very essential. Keeping this in view following content has been suggested incorporating latest development of the subject.

DETAIL COURSE CONTENT

THEORY:

UNIT	TOPIC / SUB-TOPIC	Lecture Hrs.
1.0	**MARKETING MANAGEMENT** 1.1 Meaning, definition, scope and importance of marketing 1.2 Meaning of market, types of market	**2**
2.0	**MARKET SEGMENT** Meaning & process of market segmentation	**2**
3.0	**MARKETING FUNCTIONS** 3.1 Buying, selling, grading, branding, assembling functions	**3**
4.0	**PRICING** 4.1 Meaning, importance of pricing, factors affecting price change 4.2 Price determination process 4.3 Pricing policies- skimming price, penetration price, cost plus price, psychological price, charging what the public will bear	**8**
5.0	**DISTRIBUTION** 5.1 Meaning, importance of channels of distributions 5.2 Functions of channels of distributions 5.3 Functions & types of mercantile agents	**8**

6.0 SALES FORECASTING **5**

6.1 Meaning, objectives, methods of sales forecasting

7.0 SALES PROMOTION **4**

7.1 Meaning, objectives

7.2 Kinds of sales promotion- consumer's sales promotion and dealer's sales promotion

8.0 SALES MANAGEMENT **6**

8.1 Meaning, definition & scope of sales management

8.2 Process of selling

8.3 Selection, compensation, training, motivating sales staff

9.0 ADVERTISING **7**

9.1 Meaning, definition, role of advertising

9.2 Advertising media, media planning, types of media

9.3 Effectiveness of advertising

9.10 Social, economic impacts of advertising

SUGGESTED LEARNING RESOURCES

(a) Reference Books:

S. No.	Title	Author, Publisher, Edition & Year
1.	Marketing Management	S.A. Sherlekar, Himalaya Publishing House
2.	Marketing Management	Rajan Nair
3.	Principles of Marketing	P. Kotler & Armstrong, Prentice Hall, New Delhi
4.	Marketing	J.C. Gandhi - Tata Mc. Graw. Hill, New Delhi
5.	Marketing Management	C.N. Santokki, Kalyani Publishers
6.	Marketing Communication & Advertising	Bhatia, R.C., New Delhi: Gargotia Publishing Co., 2003
7.	Consumer Behaviour in Indian Context	Srivastava, K. K. & Sujatha, K., New Delhi: Galgotia Publishing Co., 2003

BASIC TECHNOLOGY COURSES

CULTIVATION OF MEDICINAL PLANTS

L	T	P	Curri. Ref. No.: HT-401
3	1	4	

Total Contact hrs.: Lecture:45
Tutorial:15
Practical: 60
Credit: 6

Total marks: 200

Theory:
End Term Exam: 75
P.A: 25
Practical:
End Term Exam: 50
P.A: 50

RATIONALE

Arunachal Pradesh is a treasure of medicinal and aromatic plants. There are many plants species which are being depleted because of lack of knowledge about their plantation and cultivation. This course is introduced with a view to educate the people of Arunachal Pradesh about plantation and cultivation of these species. Moreover, knowledge about cultivation will increase the production of species which are extensively used for medicinal and cosmetic purpose. This course shall enable the students to select appropriate medicinal plants based on the soil type and climatic condition making judicious use of fertilizers, manures, pesticides, harvesting, processing and storage techniques thus ensuring better quality control and production.
Cultivation of medicinal plants ensure abundance and availability, authenticity of raw material, easy management and harvest, economic sustainability and annual returns, better land use and better health of people.

DETAIL COURSE CONTENT

THEORY:

UNIT TOPIC / SUB-TOPIC	Lecture Hrs.
1.0 METHODS OF CULTIVATION	**15**

1.1 Propagating Material-Seeds.
1.2 Vegetative propagation-

- Apomictic seedlings
- Propagation by specialized vegetative structures-cloning:
- Bulbs
- Tubers and Tuberous roots
- Rhizomes
- Corms
- Suckers
- Runners
- Offsets

1.3 Propagation by cuttings

- Root cuttings
- Stem cuttings
- Leaf cuttings
- Leaf bud cuttings
- Time and method of planting of cuttings
- Use of hormones in stem cuttings

1.4 Propagation by Layering
- Simple layering
- Tip layering
- Trench Layering
- Compound serpentine Layering
- Stool Layering
- Air Layering or Gootee

1.5 Propagation by Grafting or Transplantation methods of grafting
- Splice or whip grafting
- Tongue grafting
- Saddle grafting
- Cleft grafting
- Slide grafting
- Veneer grafting
- Bark grafting
- Approach grafting
- Root grafting

1.6 Propagation by Budding
- 'T' budding
- Patch budding
- Flute or Tube budding
- Chip budding
- Ring budding
- 'I' budding
- Forkert budding

2.0 FACTOR AFFECTING CULTIVATION/ DISTRIBUTION OF PLANT SPECIES 12

2.1 Suitable habitat for cultivation
2.2 Altitude, temperature and humidity
2.3 Soil and Soil fertility
2.4 Rain fall or irrigation
2.5 Fertilizers / Manures
2.6 Pest and Pest control
- Types of pests

- Fungi, bacteria and viruses
- Weeds
- Insects
- Non-insects pests

2.7 Methods of Pests Control
- Mechanical methods
- Agricultural methods
- Biological methods
- Chemical methods

2.8 Shifting cultivation
2.9 Forest fire
2.10 Unscientifc exploitation of plant resources
2.11 Unsystematic developmental activities
2.12 Degradation of natural habitat.

3.0 CULTIVATION OF MEDICINAL PLANTS: 8

3.1 Gol Mirch (*Piper nigrum*)
3.2 Ashwagandha (*Withania somnifera*)
3.3 Brahmi (*Baccopa monnerii*)
3.4 Kalmegh (Andrographis paniculata)

SUGGESTED LEARNING RESOURCES

(a) Reference Books:

S. No.	Title	Author, Publisher, Edition & Year
1	The useful Plants of India	PID Staff, CSIR New Delhi
2	Wealth of India	PID Staff, CSIR New Delhi, 1986
3	Botany, Part-II	Dr. P.C. Jain, Dr. Amarjeet Bajaj Madhya Pradesh, Hindi Granth Academy, 2002
4	Hand Book of Medicinal Plants,.	Kurup, P.N.V., Rama Das, V.N.K., Joshi, Prajapati Singh, P.B. and Aswal, B.S., CCRAS, New – Delhi 1979
5	Glossary of Indian Medicinal Plants,	Chopra, R.N. Nayar, S.L. Chopra, I.C., C.S.I.R.,(P.I.D) New Delhi 1956
6.	Indian Medicinal Plants.	Kritikar, K.R. and Basu, B.D., L.M. Basu Road, Allahabad 1918
7	Supplemant to glossary of Indian Medicinal Plants	Chopra, R.N., Chopra I.C., and Verma, B.S., CSIR (P.I.D.), New Delhi, 1969
8	Cultivation of Some Pharmaceutically Important Medicinal Plants in Itanagar (Arunachal Pradesh),	Rawat, M.S., Singh, V.K. and Rama Shankar, *Bull. Medico-Ethno Bot. Res.*. Vol. XVII (1-2); 37-51, 1996

S. No.	Title	Author, Publisher, Edition & Year
9	*Taxus baccata* in Arunachal Pradesh, Arunachal Forest News,.	Shukla, G.P., Rama Kishor and Haridasan, K. 12 (1): 1-71994
10	Cultivation and Utilisation of Medicinal Plants,	Atal, C.K. and Kapur, B.M. RRL (CSIR) Jammu Tawi., 1982
11	Medicinal plants from Dibang Valley (A.P.)-Social forestry & afforestation,	Rama Shankar, Singh, V.K., and Rawat, M.S. B.M.E.B.R. Vol. XIV (3-4); 144-149, 1993
12	Some Medicinal Plants from District Siang and Subansiri of Arunachal Pradesh	Tiwari, K.C., Majumdar, R. and Bhattacherjee, S. *B.M.E.B.R* Vol. V No. 1-2 p.p 1.-14, 1984
13	Medicinal plants of Madhya Pradesh, Distribution, Cultivation and Trade	K.P. Tiwari, J.L. Shrivastava, M.C. Sharma SFRI Jabalpur, Bulletin No-31, 1998
14	Rare and endangered plants of Gujarat state forest	Joshi, M.C. *B.M.E.B.R.* Vol. IX : 31-39, 1987
15	Some Threatened medicinal plants from north-eastern region of India	Majumdar, R. *B.M.E.B.R.* Vol. XII (1-2): 12-16, 1991
16	Threatened and rare medicinal plants of Sikkim	Mudaiya, R.K., Sharma, B.N. and Singh, D.N *B.M.E.B.R.* Vol. VIII (3-4): 155-159., 1987
17	Cultivation of Medicinal Plants in Social Forestry Programme in Arunachal Pradesh	Rawat, M.S. *B.M.E.B.R.* Vol. XVII (3-4): 169-174., 1997
18	Pharmaceutical Important Medicinal Plants of Gujarat Forest	Joshi, M.C. *Bull. Medico-Ethno Bot. Res.* Vol. VII (1-2):1-25, 1986
19	Medicinal plants of Himachal Pradesh used in Indian Pharmaceutical Industry	Singh, P.B. and Aswal B.S. *Bull. Medico-Ethno. Bot. Res.* Vol. XIII, No. 3-4. pp. 172-208., 1992
20	Conservation and Cultivation of some Rare and Threatened Medicinal Plants in Arunachal Pradesh	Rawat, M.S.; Shankar, R, and Singh V.K.
21	Observation of Medico-Ethno Botany of IDU-MISHMIS in Dibang Valley District of Arunachal Pradesh	Rawat, M.S.; Singh , V.K. and Rama Shankar *B.M.E.B.R.* Vol. XVII No. (1-2):pp. 18-23., 1996
22	Some Folklore Medicines from District Subansiri of Arunachal Pradesh	Rawat, M.S.; Singh , V.K. and Rama Shankar *B.M.E.B.R.* Vol. IV No. (3-4):pp. 95-101.,
23	Medico-Ethno Botanical Aspects of Some Plants of Arunachal Pradesh	Rawat, M.S.; Singh , V.K. and Rama Shankar *B.M.E.B.R.* Vol. XVI No. (3-4):pp. 83-89., 1995

(b) Others:

- OHP transparencies
- Computer Aided Instructional package
- Models of different driers, equipments, tools and implements.
- Samples of different planting materials like seed, cutting, sapling etc.

PRACTICAL & TUTORIALS

Suggested list of experiments / tasks :

- Preparation of appropriate bed for cultivation using relevant fertilizer / manure.
- Study of method of sowing of seed / sapling for growing plants of different species.
- Identification of insect pests and use of appropriate insecticides.
- Cultivation of different plant species suggested in the text (annexure 1 and 2).
- Identification of drying methods of crude plants for specific species.
- Identification of different harvesting methods of crude plant species.
- Identification of different storage methods of dried plants.
- Study of prapagules used in vegetative propagation of available medicinal plants.
- Vegetative propagation of medicinal plants by Cutting (with and without using hormones).
- Demonstration of vegetative propagation by layering.
- Propagation by gootee or air layering
- Propagation of medicinal plants by grafting.
- Vegetative propagation by budding.
- Micro propagation by tissue and organ culture.

Annexure – 1

List of medicinal plants that have high demand for cultivation in N-E states in India

Common Name/Vernacular Name	**Botanical Name**
Catechu	*Acacia catechu.*
Ultihot, Apamarga	*Achyranthus aspera*
Boch	*Acorus calamus*
Bel	*Aegle marmelos*
Ghrit kumari	*Aloe vera*
Kalmegh	*Andrographis paniculata*
Satavani	*Asparagus racemosus*
Brahmi	*Baccapa monneri*
Phul jelong	*Baliospermum montana*
Punarnava	*Boerhaavia diffusa*
Karanju	*Caesalpinia bonducella*
Brahmi	*Centella asiatica*
Kachura	*Curcuma zedorea*
Motha	*Cyprus rotundus*
Dioscorea	*Dioscorea floribunda*
Bhringraj	*Eclipta prostrata*
Aowla	*Emblica officinalis*
Anantamul	*Hemidesmus indicus*
Dhudhi	*Holarrhaena antidysentrica*
Dudhkalni	*Ipomoea turpethum*
Losan	*Mallotus phillipensis*
Nagkesar	*Mesua ferrea*
Tulsi	*Ocimum sanctum*
Batghila	*Oroxylum indicum*
Bhumi amla	*Phyllanthus niruri*
Pipli	*Piper longum*
Black pepper	*Piper nigrum*
Kutki	*Picrorrhiza kurrooa*
Agechhit	*Plumbago zeylanica*
Sural	*Pueraria tuberosa*
Amar	*Punica granatum*
Manista/ Tamen	*Rubia cordifolia*
Ashok	*Saraca asoka*
Lalberela	*Sida rhomboides*
Gulkumari	*Solanum nigrum*
Chiraita	*Swertia chirata*
Bohera	*Terminalia belerica*
Arjun	*Terminalia arjuna*
Amarlata	*Tinospora cordifolia*
Hilika	*Terminalia chebula*
Dheira	*Vetiveria zizanioides*
Virina	*Woodfordia fruiticosa*
Ashwagandha	*Withania somnifera*
Ginger	*Zingiber officnalis*

Annexure – 2

List of medicinal plants that are commonly use in Arunachal Pradesh

	Common Name/ Vernacular Name	**Botanical Name**
1.	Boch.	***Acorus calamus***
2.	Chiraita teeta, Kalmegh	***Andrographis paniculata.***
3.	Agar, Shashi	***Aquilaria agallocha***
4.	Satmul, Satavari	***Asperagus racemosus***
5.		***Dioscorea floribunda***
6.	Bhatghila	***Oroxylum indicum***
7.	Pipli (Piper brachystachyum/ P. mullesua) Pipli round	***Piper longum***
8.	Sarpagandha	***Rauvolfia serpentina***
9.	Amrit lata	***Tinospora cordifolia***
10.	Ashwagandha	***Withania somnifera***

Annexure – 3

List of Selected Medicinal plants which can be cultivated in low and high altitude.

Low altitude (Tropical and Subtropical areas) below 1000m.

Trees:	*Aquilaria agallocha*
	Emblica officinalis
	Gmelina arborea
	Oroxylum indicum
	Terminalia arjuna
	Teminalia bellirica
	Teminalia chebula
	Bixa orellana
Herbs:	*Acorus calamus*
	Andrographis paniculata
	Catharanthus roseus
	Costus speciosus
	Cymbopogon citratus
	Piper mullesua
	Piper peepuloides
	Rauvolfia serpentina
	Withania somnifera
Climbers:	*Dioscorea floribunda*
	Gloriosa superba
	Piper longum
	Piper nigrum
	Tinospora cordifolia

High altitude (temperature and Alpine areas) Above 1000m. Altitude

Trees:	*Taxus baccata*
	Illicium griffithii
Herbs:	*Aconitum ferox*
	Aconitum heterophyllum
	Coptis teeta
	Gymnadaenia orchidis
	Panax sikkimensis
	Panax pseudoginseng
	Panax bipinnatifida
	Picrorrhiza kurroa
	Podophyllum hexandrum
	Valeriana jatamansi
Climbers:	*Rubia cordifolia*

ANALYTICAL CHEMISTRY

L	T	P	Curri. Ref. No.: **HT-402**
3	1	4	

Total Contact hrs.:	**Total marks: 200**	**Theory:**
Lecture:45		End Term Exam.:75
Tutorial:15		P.A: 25
Practical: 60		**Practical:**
Credit :6		End Term Exam: 50
		P.A: 50

RATIONALE

Analytical Chemistry may be defined as the science and art of determining the composition of materials in terms of the elements or compounds contained. The basic aim of teaching analytical chemistry is to develop the analytical skills of student to find out what a substance is composed of and exactly how much.
Analytical chemistry gives information about the qualitative and quantitative composition of a sample of matter through analysis the knowledge of which is essential for a technician and engineers involved in new emerging inter disciplinary areas such as herbal technology.

DETAIL COURSE CONTENT

THEORY:

UNIT TOPIC / SUB-TOPIC	Lecture Hrs.
1.0 INTRODUCTION TO ANALYTICAL CHEMISTRY	**3**
1.1 Theoretical aspects of Quantitative Analysis	
1.2 Analytical balance	
1.3 Rules for handling the analytical balance	
1.4 Calibration of weights	
1.5 Weighing	
2.0 PRECISION, ERROR AND ACCURACY	**3**
2.1 Theoretical aspects of Reproducibility	
2.2 Determinate and Intermediate error	
2.3 Normal law of error	
2.4 Standard and average deviations	
3.0 VOLUMETRIC ANALYSIS	**8**
3.1 Principle of the volumetric analysis	
3.2 Classification	

3.3 Volume measurement
3.4 Calibration of measuring vessel
3.5 Calculation of the results of volumetric analysis
3.6 Calculation in preparing and dilution of solutions.
3.7 Precipitation titration.
3.8 Precipitation and complex forming reaction
3.9 Argentometric titrations
3.10 Complexometric titrations
3.11 Oxidation, Reduction titrations.
3.12 Non aqueous titrations – media, titration of weak acid and weak bases – indicator used.

4.0 ACID VALUE 4

4.1 Principle of the Determination and significance of acid value
4.2 Saponification value
4.3 Iodine value
4.4 Ester values.

5.0 GRAVIMETIC ANALYSIS 3

5.1 Gravimetric analysis, quantitative separation, solubility product.
5.2 Fraction precipitation, Co & Post precipitation.

6.0 CHROMATOGRAPHY 5

6.1 Introduction
6.2 Classification in chromatography
6.3 Paper chromatography principle/ technique
6.4 Application: Separation of amino acids by paper chromatography
6.5 Thin layer chromatography principle technique

7.0 VISIBLE SPECTROSOPY 5

7.1 Photometric Analytical methods
7.2 The principle of the method
7.3 Laws of Absorption of light by solution
7.4 Application of Lambert's Beer's law
7.5 Method of colour comparison
7.6 Instrumentation.

8.0 INFRA RED SPECTROSCOPY 5

8.1 Photometric 1Introduction
8.2 Origin of Infra Red Spectra/ Instrumentation
8.3 Interpretation of Spectra
8.4 Normal alkanes
8.5 Branched chain alkanes/ Alkynes
8.6 Aromatic hydrocarbons
8.7 Alcohols and phenols
8.8 Aldehydes and Ketones
8.9 Amines and amides.

8.10 Application

SUGGESTED LEARNING RESOURCES

(a) Reference Books:

S. No.	Title	Author, Publisher, Edition & Year
1	Text Book of Quantitative Chemical Analysis	Vogel's Quantitative Analysis Peerson 2000
2	Analytical Chemistry	B.S. BAHL
3	Instrumental Methods of Chemical Analysis	B.K. Sharma, Goel Publishing House, Meerut
4	Quantitative Analysis	V. Alexeyev Mir Publishers, Moscow
5	A text book of quantitative analysis	A.I. Vgel ELBS and Longman Green Co. Ltd.
6	Photometric Analysis	A.K. Babko and A.T. Pilipenko Mir Publisher, Moscow

(b) Others:

- Lab manuals available
- CAI packages
- OHP transparencies
- Models

PRACTICAL:

Suggested list of experiments:

- Determination of Saponification number
- Determination of NaOH and Na_2CO_3 in the same solution
- Determination of percentage (%) of Fe in Ferrous Ammonia Sulphate (FAS)
- Determination of hardness of water by EDTA
- Determination of zinc by precipitation with potassium ferrocynade
- Retension Factor (R_f) value of Amino acid by paper chromatography.
- Determination Cu in Copper Sulphate Solution
- Determination of H^+ ion concentration
- Study of UV – visible absorption spectra of various chromophores.
- Photometric determination of boron with salicyclic acid and crystal violet.

PHYTOCHEMISTRY

L	T	P	Curri. Ref. No.: **HT-403**
3	1	2	

Total Contact hrs.:	**Total marks: 150**	**Theory:**
Lecture:45		End Term Exam.:75
Tutorial:15		P.A: 25
Practical: 30		**Practical:**
Credit : 5		End Term Exam: 25
		P.A: 25

RATIONALE

This subject is aimed at providing knowledge of the Chemistry of herbal constituents and isolation from the plant origin for pharmacological screening.

DETAIL COURSE CONTENT

THEORY:

UNIT	TOPIC / SUB-TOPIC	Lecture Hrs.
1.0	**PHYSICAL PROPERTIES OF LIQUIDS AND MOLECULES**	**2**
1.1	Surface tension	
1.2	Viscosity.	
1.3	Intermolecular forces and its impact on states of matter, various physical properties of matter.	
2.0	**EXTRACTION**	**7**
2.1	Methods of isolation,(including industrial methods) purification and characterization of following natural products:	
2.2	Starch, Citric acid, Pectin, Digoxin, Sennosides, Lawsone, Phyllanthin, Bacosides, Lycopene, Hesperidin, Diosgenin, Curcumin, Lemon grass oil, Sandal wood oil, Quinine, Morphine, Atropine, Vincristine, Emitine and Caffeine.	
3.0	**CARBOHYDRATES & VITAMINS**	**5**
3.1	Carbohydrates: Introduction, Definition, Classification , Nomenclature, Source, importance, Structure , chemistry of Glucose & Sucrose .	
3.2	Glycosides: Introduction, Definition, Classification , Nomenclature, Source, importance, Structure , chemistry of cardiac glycosides - digoxin, Anthracene glycosides - Sennosides.	
3.3	Vitamins: Introduction, Definition, Classification , Nomenclature, Source, importance, Structure , chemistry of Ascorbic acid.	

4.0 STEROIDS & PLAN HORMONES 3

4.1 Steroids: Introduction, Definition, Classification, Nomenclature, Source, importance, Structure, chemistry of cholesterol.

4.2 Plant Hormones: Introduction, Definition, Classification, Nomenclature, Source, importance, Structure, chemistry of Auxins.

5.0 TERPENOIDS & ANTIBIOTICS 3

5.1 Terpenoids: Introduction, Definition, Classification, Nomenclature, Source, importance, Structure, chemistry of Citral, Menthol and Zingiberene. Isoprene and Special Isoprene rule.

5.2 Antibiotics: Introduction, Definition, Classification, Nomenclature, Source, importance, Structure, chemistry of Penicillin.

6.0 NATURAL PIGMENTS 4

6.1 Natural Pigments: Introduction, Definition, Classification, Nomenclature, Source, importance, Structure, chemistry of Carotene, Lycopene, Bixin, Chlorophyll, Quercetine and Indigotine.

7.0 ALKALOIDS & PURINES 3

7.1 Alkaloids: Introduction, Definition, Classification, Nomenclature, Source, importance, Structure, chemistry of quinine, morphine and atropine.

7.2 Purines: Introduction, Definition, Classification, Nomenclature, Source, importance, Structure, chemistry of Caffeine.

8.0 CROMATOGRAPHY & SPECTROSOCPY 5

8.1 Natural products as markers for new drug discovery:

- The Role of natural products as potential new drug discovery.
- The Role of natural products chemistry in drug discovery.
- Selection and optimization of lead compounds for further development with suitable examples.

8.2 Chromatography: Introduction, definition, classifications, general principles of different chromatographic techniques, and applications of: TLC, HPTLC, Column, Paper, HPLC, GC in the isolation, separation and purification of natural products.

8.3 Spectroscopy*:* General principles & applications of UV, IR, HNMR, C13 NMR, Mass Spectroscopy of natural products.

8.4 Stereoisomerism: Introduction, Definition, types, concept of Stereoisomerism taking examples of natural products.

SUGGESTED LEARNING RESOURCES

(a) Reference Books:

S. No.	Title	Author, Publisher, Edition & Year
1.	Natural Products Chemistry	Nakanishi Golo
2.	Natural products	A Laboratory guide by Raphel Ikhan
3.	Organic Chemistry	I.L. Finar vol.ii
4.	Chemistry of Natural Products	K.W. Bentley
5.	Pharmacognosy by Trease and Evans	ELBS.
6.	Practical Evaluation of Phytopharmaceuticals	K.R. Brain, T.D. Turner
7.	The Chemistry of Natural Products	Edited by R.H. Thomson, Springer International Edn. 1994
8.	Phytochemical methods of chemical analysis	Harbone
9.	Natural Products from Plants	1st edition, by Peter B. Kaufman, CRC Press, NewYork, 1998
10.	Natural products: A lab guide	Raphael Ikan , 2nd Edition, Academic Press 1991
11.	The review of Natural products	Ara Dermarderosia
12.	Modern methods of plant analysis –High performance Liquid chromatography in plant science	H.F.Linskens and J.F.Jacksons

(b) Others:

- Lab manuals available
- CAI Packages
- OHP transparencies
- Models

PRACTICALS:

Suggested list of experiments :

- Study of surface tension of liquids using a stalagmometer
- Study of viscosity of liquids using Ostwald's viscometer
- Determination of volatile oils from plant materials
- Extraction of plant products by percolation
- Extraction of plant products by Soxhlet apparatus
- Chemical tests of tannins, resins, alkaloids, glycosides from the extracted products

DRUGS AND COSMETIC LAWS

L	T	P	Curri. Ref. No.: HT-404
3	0	0	

Total Contact hrs.
Lecture:45
Tutorial: 0
Practical: 0
Credit :3

Total marks: 100

Theory:
End Term Exam.:75
P.A: 25

RATIONALE

This subject provides the knowledge of the essential acts and laws related to drugs and plant product formulations. It further develops a morally responsible behaviour among the students.

DETAIL COURSE CONTENT

THEORY:

UNIT TOPIC / SUB-TOPIC	Lecture Hrs.
• Ayurvedic laws	2
• Drugs and Cosmetics Act, 1940	7
• Good manufacturing practices, Guidelines to practice	1
• Herbs related patents	1
- Patent Act, 1970	2
- Patent laws	
- Laws to protect herbs	
• Case Studies/Case Laws on Herbs	2
• Copy Right Law	2
- Intellectual Property Right (IPR)	
• Drugs and Magic Remedies Act. Objectionable Advertisements.	1
• Prevention of Cruelty to Animals Act.	1
• The medicinal and Toilet preparations (Excise duties) acts & Rules.	1
• Drug Price Control order.	1
• Code of Pharmaceutical Ethics	10
• Pharmacy Act	1
• Factory Act	2
• Contract Act	1
• Shop & Establishment Act	1
• Sales Promotion Employees Act	1

SUGGESTED LEARNING RESOURCES

(a) Reference Books:

S. No.	Title	Author, Publisher, Edition & year
1	Drugs and Cosmetic Acts and Rules	Govt. of India Publication
2	Text-book of Forensic Pharmacy	M.Mittal

(b) Others:

- Journals , Text books
- Hand Books, Reference books

PROCESSING EQUIPMENT & MACHINERY

L	T	P	Curri. Ref. No.: **HT-405**
3	1	2	

Total Contact hrs.:	**Total marks: 150**	**Theory:**
Lecture:45		End Term Exam.:75
Tutorial:15		P.A: 25
Practical: 30		**Practical:**
Credit : 5		End Term Exam: 25
		P.A: 25

RATIONALE

The basic aim of introducing this course is to develop awareness in the students about the different herbal processing equipment used for different purposes. They will be gaining hands on experience on operation of different types of equipments.
This course will also help in generating confidence in handling of various equipments so that they can start their own enterprise after passing diploma programme.

DETAIL COURSE CONTENT

THEORY:

UNIT TOPIC / SUB-TOPIC	**Lecture Hrs.**

1.0 BASIC PRINCIPLES, OPERATIONS AND USAGES OF DEVICES FOR SIZE REDUCTION AND DRYING **3**

1. Siever -Fine and micro fine mesh
2. Mechanical Chopper - Cut and Powdering raw drug
3. Pulveriser - Powder the drug/ plant product

2.0 BASIC PRINCIPLES, OPERATIONS AND USAGES OF GRINDERS **5**

1. Mechanical Grinder - Grind and mix the drug
2. Khalwa Yantra - Grind and mix the drug
   (made of stone, metal, porcelain)

3. Ulukhal Yantra(manual)-Pounding (Churha)
4. Wet Grinder - Grinding wet drugs to prepare kalka extract (Swarasa)
5. Mixter Grinder - Powder and mixing dry drugs / plant product

3.0 BASIC PRINCIPLES, OPERATION AND USAGES OF EXTRACTION DEVICES 3

1. Juice Extractor - Extract Juice (Swarasa)
2. Soxhlet Extractor - Extract the juice.
3. Distillation unit - Distill the extract from herbs.

4. Clevanger distillation

4.0 BASIC PRINCIPLES, OPERATION AND USAGES OF VESSELS 1

1. Vessel Containing water and plant product - Prepare decoction

2. Vessel with steam Jacket - (a) Prepare water extracts decoction of drug
   (b) Prepare oil and leha

5.0 BASIC PRINCIPLES, OPERATION AND USAGES OF TABLETING EQUIPMENT 7

1. Granulator - Convert powder into granules for tablets
2. Tablet making machine - Tablet (Pills)
3. Hot air oven - Dry the drugs tablets
4. Mechanical strainer - Strain, Juice, Oil Ghee etc.
5. Filling machine - Fill oil, Ghee syrup
6. Manual Filling machine - Fill oil, ghee syrup
7. Packing machine - Packing

6.0 BASIC PRINCIPLES, OPERATION AND USAGES OF OTHER EQUIPMENT 12

1.Steam Cooker - Extract Juice by steam Cooking

2. Vortex Shaker - For mixing of two dissimilar liquids (i.e. organic and water)

3. Water bath - Prepare Ghan Satva (Extract) of drug
4. Heating devices - Fry, cook and boil the drugs
5. pH meter - To measure the pH of extract for medicinal preparation.
6. Spectrophotometer-Qualitative and Quantitative estimation of bio-chemicals.

7. Electronic balance - Weighing with precision.
8. Magnetic stirrer - Stirring with high speed.

SUGGESTED LEARNING RESOURCES:

(a) Reference Books:

S. No.	Title	Author, Publisher, Edition & Year
1	Instrumental methods of analysis	Willard , Merrit, Dean, settle CBS Publication, 6th edition, 1986
2	Principles of Instrumental analysis	Douglas A. Skoog 3rd edition, 1985
3.	Text book of Quantitative chemical analysis	Vogel's Pearson Education Ltd., Delhi 6th edition

(b) Others:

- Equipments/Tools required.
- Video programmes.
- CAI packages

PRACTICALS:
Suggested list of experiment:

- Handling and operation of equipments listed in detailed content.
- General maintenance equipments listed.
- Safety precautions required to be followed in handling and operation of equipment.

PROCESS TECHNOLGY

L	T	P	Curri. Ref. No.: **HT-406**
3	1	4	

Total Contact hrs.:	**Total marks: 200**	**Theory:**
Lecture:45		End Term Exam.:75
Tutorial:15		P.A: 25
Practical: 60		**Practical:**
Credit : 6		End Term Exam: 50
		P.A: 50

RATIONALE

The purpose of this course is to understand the series of scientific process/ operations performed in making or treatment of product. It also helps to know the changes in material properties, matter composition and type of matter.

The basic aim of introducing this course is to develop awareness in the students about the different processes and mechanism employed for different purposes. They will be acquainted and gaining experience on use of different processes for beneficiation of various herbs. Further, this course will help in generating confidence in Identification and implementation of various processes which can be employed for the best use of different herbs, also helpful in the entrepreneurial skills of the students after completion of the course.

DETAIL COURSE CONTENT

THEORY:

UNIT TOPIC / SUB-TOPIC	**Lecture Hrs.**
1.0 PROCESSES AND THEIR APPLICATIONS	**20**

1.1 Distillation
1.2 Fractional distillation
1.3 Distillation under reduced pressure
1.4 Steam distillation
1.5 Sublimation
1.6 Crystallization
1.7 Extraction
1.8 Filtration
1.9 Decantation
1.10 Condensation
1.11 Addition

1.12 Adsorption
1.13 Osmosis & dialysis – Membrane process
1.14 Complexation
1.15 Binary mixtures
1.16 Colloids & Colloidal dispersion in liquids.
1.17 Test of purity
1.18 Melting point and boiling point
1.19 Coagulation

2.0 FLUID FLOW **8**

2.1 Fluid statics
2.2 Manometers.
2.3 Types of flow
2.4 Reynold's number and its significance
2.5 Bernoulli's theorem and its applications
2.6 Measurement of flow of liquids, Values.

3.0 HEAT TRANSFER **6**

3.1 Thermochemical equation
3.2 Exothermic and endothermic reaction, Enthalpy
3.3 Heat transfer by Conduction, Convection, Radiation

SUGGESTED LEARNING RESOURCES

(a) Reference Books:

S. No.	Title	Author, Publisher, Edition & Year
1	Unit Operations of Chemical Engg.	P. Chattopadhyay Vol. I
2	Unit Operations of Chemical Engg.	P. Chattopadhyay Vol. II
3.	Fundamentals of Heat and Mass Transformer	G.K. Roy Knanna Publishers, 1999
4.	Analytical Chemicstry	Vogel.

(b) Others:

- Lab manuals available
- CAI packages
- OHP transparencies
- Models.

PRACTICALS:

Suggested list of experiments:

- Sublimation of camphor/ ammonium chloride
- Preparation of saturated solution of soluble salts i.e. NaCl, Sugar etc.
- Crystallization of carbohydrates (sugar)
- Osmosis expansion of kishmish contraction of grapes in dil. sugar solution.
- Separation of sugar and salt from one solution
- Partition co-efficient of organic compound i.e. CCl_4.
- Preparation of colloidal solution
- Coagulation of colloidal solution
- Separation of two liquids by fractional distillation.
- Distillation and condensation of water
- Extraction of chlorophyll from green leaves.

FORMULATION DEVELOPMENT

L	T	P	Curri. Ref. No.: HT-407
3	1	4	

Total Contact hrs.: Lecture: 45, Tutorial: 15, Practical: 60
Credit :6

Total marks: 200

Theory:
End Term Exam.:75
P.A: 25
Practical:
End Term Exam: 50
P.A: 50

RATIONALE

Nowadays, a number of herbal formulations are available in the market. This paper will provide knowledge of developing formula with herbal products.

DETAIL COURSE CONTENT

THEORY:

UNIT TOPIC / SUB-TOPIC	Lecture Hrs.

1.0 PHARMACEUTICAL PRE FORMULATION PRODUCT DEVELOPMENT **11**

1.1 Pre-formulation studies for candidate drug selection, qualification of preformulators, microscopy, thermal analysis, x-raypolymorphism, hygroscopicity, density, powder flow, solubility, pka, P-C dissolution

1.2 Study of chemical properties of drugs like hydrolysis, oxidation, reduction, racemization, polymerization etc. and their influence on formulation and stability of products.

2.0 BIOPHARMACEUTICAL STUDIES FOR DRUG SELECTION **11**

2.1 Pre-formulation for product design and development,

2.2 Bio-pharmaceutics for product design and development, product optimization.

2.3 Design, development and process validation methods for pharmaceutical operations involved in the production of pharmaceutical products with special reference to tablets, suspensions.

3.0 PRINCIPLE, PRODUCTION AND EVALUATION OF ORAL CONTROLLED RELEASED FORMULATIONS **10**

3.1 Dissolution testing and data evaluation for oral solid dosage forms

3.2 Design, development and evaluation of controlled release formulations

SUGGESTED LEARNING RESOURCES

(a) Reference Books:

S. No.	Title	Author, Publisher, Edition & Year
1.	Modern Pharmaceutics	Rhodes and Banker
2.	Dissolution, Bio-availability and Bio-equivalence	Abdou H.M
3.	Industrial Pharmacy	Lachman
4.	Tablets Vol. I, II and III	Leon Lachman
5.	Remington Pharmaceutical Sciences	
6.	Pharmaceutics	M.E.Aulton
7.	Physical Pharmacy	Martin
8.	Harry's cosmeticology	J.B.Wilkimsson
9.	Paucher's Perfumes, cosmetics & soaps	W.A.Paucher

PRACTICALS:
Suggested list of experiments:

1. Accelerated stability studies of various formulations or drugs with respect to
   (a) Temperature
   (b) Effect of buffers / pH dependent (2 – 4 Expts.)
2. Formulations and evaluation of some liquid orals such as Analgesic-antipyretics, Antihistamines, Co-trimoxazole, suspensions etc. (2 – 3 Expts.)
3. Formulation and evaluation of stability of reconstituted dry syrups of Amoxicillin, Ampicillin etc. (2 Expts.)
4. Preparation and evaluation of diclofenac sodium gels containing two different bases. (2 Expts.)
5. Formulation and evaluation of semisolid dosage forms using different – bases and drugs (cetrimide, salicylic acid) of current interest.
6. To study the effect of particle size, moisture content and lubricants on flowability and compressibility of powders.
7. Study of effect of various binding agents on the properties of tables (2 Expts.)
8. Preparation and evaluation of Skin care and Hair care products (4-5 Expts)

BIOPHARMACEUTICS

L	T	P	Curri. Ref. No.: HT- 408
3	1	0	

Total Contact hrs.: Lecture:45 Tutorial:15 Practical: 0
Credit : 4

Total marks: 100

Theory: End Term Exam.:75 P.A: 25

RATIONALE

The study provides knowledge about the drug absorption, bioavailability and distribution processes of drug. Further, the methods of assessment of some biopharmaceutical parameters are also incorporated.

DETAIL COURSE CONTENT

THEORY:

UNIT TOPIC / SUB-TOPIC	Lecture Hrs.

1.0 INTRODUCTION TO BIOPHARMACEUTICS 16

1.1 Measures of bioavailability, Cmax, tmax, Keli and Area Under the Curve (AUC);
1.2 Design of single dose bioequivalence study and relevant statistics;
1.3 Review of regulatory requirements for conducting bioequivalent studies.
1.4 Biopharmaceutical Classification System (BCS) of drugs
1.5 Role in formulation development and clinical setting.

2.0 PASSAGE OF DRUGS ACROSS BIOLOGICAL BARRIER 5

2.1 Passive diffusion
2.2 Active transport, facilitated diffusion
2.3 Ion-pair formation and pinocytosis

3.0 FACTORS INFLUENCING DRUG ABSORPTION 4

3.1 Biological, physico-chemical factors
3.2 Physiological and pharmaceutical factors

4.0 DRUG DISTRIBUTION IN THE BODY 8

4.1 Importance of drug protein binding.
4.2 Reciprocal plots, Seatchard plot & Sandberg's equation

4.3 Estimation of rate of drug
4.4 Plasma-protein binding

SUGGESTED LEARNING RESOURCES

Reference Books:

S. No.	Title	Author, Publisher, Edition & Year
1.	Bio-pharmaceutics and Clinical Pharmacokinetics	Milo Gibaldi
2.	Remington's Pharmaceutical Sciences	Mack publishing company, Pennsylvania
3.	Bio-pharmaceutics and Pharmacokinetics	Robert E. Notari
4.	Pharmaceutical Codex	
5.	Applied Biopharmaceutics and Pharmacokinetics	Leon. Shargel, Andrew B. C. Yes

FERTILIZER, MANURES AND PLANT PROTECTION MEASURES

L	T	P	*Curri. Ref. No.:* **HT-409**
3	1	0	

Total Contact hrs.: **Total marks: 100** **Theory:**
Lecture:45 End Term Exam.:75
Tutorial:15 P.A: 25
Practical: 0
Credit : 4

RATIONALE

Fertilizers and manures are very important for the proper growth of plants. They play an important role in the cultivation of crops. It is therefore essential to have knowledge about different kinds of fertilizers and manures and also about the time and amount of their application. The crop yield is also adversely affected by plant diseases, insects and pests. Hence, the knowledge of various plant protection methods form an essential element of any successful medicinal plant cultivation programme. This course shall enable the student to know the need and type of fertilizer or manuring required by the plants and also the use of various cultural, chemical and biological methods of plant disease control.

DETAIL COURSE CONTENT

THEORY:

UNIT TOPIC / SUB-TOPIC	Lecture Hrs.

1.0 INTRODUCTION ELEMENTS REQUIRED IN PLANT NUTRITION 6

1.1 Essentiality of elements in Plant Nutrition
1.2 Classification and role of elements required in Plant Nutrition-Macro-Nutrients
1.3 Micro-nutrients
1.4 Others beneficial elements
1.5 Mineral deficiency symptoms in plants

2.0 TYPES OF SOIL FERTILIZERS 8

2.1 Chemical Fertilizers
2.2 Organic Manures, Compost and Vermicompost
2.3 Bio-fertilizers
2.4 Legumes in crop rotation
2.5 Chemical versus organic and bio-fertilizers

3.0 FUNDAMENTALS OF FERTILIZER APPLICATION 7

3.1 Fertilizer placement methods
3.2 Time and amount of application of fertilizers
3.3 Mixed fertilizers, Fertilizer-pesticide mixtures
3.4 Effect of fertilizers application on water requirement of plants
3.5 Fertilizers use and farm Income

4.0 GENERAL ACCOUNT OF PLANT DISEASES 6

4.1 General symptoms of plant diseases caused by Bacteria, Virus, Mycoplasma and Fungi.
4.2 Study of common regional diseases of the medicinal plants.
4.3 Loss of crop due to insects and pests
4.4 Post harvest and storage diseases and their management
4.5 Biological control of plant diseases

5.0 CONTROL OF PLANT DISEASES 6

5.1 Cultural methods for disease control
5.2 Chemical methods for disease control
5.3 Preparation and use of fungicides for the treatments of soil, seed and plants
5.4 Methods of fungicide application
5.5 Hazards of use of fungicides, insecticides and pesticides

SUGGESTED LEARNING RESOURCES

(a) Reference Books:

S. No.	Title	Author, Publisher, Edition & Year
1	Fertilizers and soil Fertility	Ulysses S. Jones, Prentice-Hall of India Pvt. Ltd., New Delhi, 1987
2	Soils and Soil Fertility	Thompson & Troch. T.M.H. Tata McGraw-Hill Publishing Co. Ltd., New Delhi, 1975
3.	Commercial Fertilizers	Gilbeart H. Collngs T.M.M. Tata McGraw-Hill Pub. Co. Ltd., New Delhi, 1962
4.	Fertilizer Guide	Dr. H.L.S. Tandon, Fertiliser Development & Consultation Organisation, New Delhi, II Edition, 1994
5.	Fertilizers, Organic Manures, Recyclable Waste and Bio-fertilizers	Ed. By Dr. H.L.S. Tandon FDCO, New Delhi, 1994
6.	Bio-fertilizers Technology, Marketing and Usage-A source Book with Glossary	Drs. Motsara Bhattacharya & Shrivastava-1 FDCO, New Delhi, 1995

S. No.	Title	Author, Publisher, Edition & Year
7.	Bio-fertilizers in Agriculture and Forestry	N.S. Subba Rao, Oxford & IBH, Publishing Co. Pvt. Ltd., New Delhi, Third Edition-1995
8.	Fertilizers & Crop Production	Dr. Lucius Van Slyke, Agro-Botanical Publishers, India
9.	Soil Fertility and Fertilizers	Samuel L. Tisdale, Werner L. Nelson, James D. Beaton, Max Well Macmillan International Edition, Macmillan Publishing Company, New York, IV Edition, 1990
10.	Systemic Fungicides	S.C.Vyas Tata McGraw-Hill Pub. Co. Ltd., New Delhi, 1984
11.	Pesticide Application Equipment	D.S. Bandra & Harcharan Singh, Oxford & IBH Publishing Co. New Delhi, 1971
12.	Pesticides in the Environment	Ed. Robert-White-Stevens Marcel Dekker, Inc., New York & Basel, 1976
13.	Pesticide Application Methods	G.A. Mathews, Buttler & Tanner Ltd., 1979
14.	Analytical Methods for Pesticides, Plant Growth Regulators and Food Additives	Gunter Zweig Academic Press, New York, 1963
15.	A Practical manual of Fungi and Fungicides	Clarence M. Weed, Logos 1890, Press, New Delhi, 1990
16.	Diseases of Crop Plants in India	G. Rangaswamy Prentice Hall of India, New Delhi, 1993
17.	A Text-book of soil Analysis,	T.C. Baruah, H.P. Barthakur, Vikas Publishing House Pvt. Ltd., 1998

(b) Others:

- OHP transparencies
- Video-Audio cassettes
- Computer Aided Instructional package
- Use of soil testing kits

PHARMACOKINETICS

L	T	P	*Curri. Ref. No.:* **HT410**
3	1	0	

Total Contact hrs.:
Lecture:45
Tutorial:15
Practical: 0
Credit : 4

Total marks: 100

Theory:
End Term Exam.:75
P.A: 25

RATIONALE

The study provides knowledge about the determination of rate constants of absorption, distribution, metabolism and elimination of drug in/from the body using different kinetic equations, which cannot be normally determined.

DETAIL COURSE CONTENT

THEORY:

UNIT TOPIC / SUB-TOPIC	Lecture Hrs.
1.0 SIGNIFICANCE OF PLASMA DRUG CONCENTRATION MEASUREMENT	**2**
2.0 COMPARTMENT MODEL	**2**
2.1 Definition and Scope	
3.0 PHARMACOKINETICS OF DRUG ABSORPTION	**4**
3.1 Zero order and first order absorption rate constant using Wagner-Nelson and residual methods	
4.0 DISTRIBUTION AND DISTRIBUTION COEFFICIENT	**4**
4.1 Volume of distribution and distribution coefficient.	
4.2 Compartment kinetics- One compartment and two compartment models.	
5.0 DETERMINATION OF PHARMACOKINETIC PARAMETERS	**6**
5.1 Determination of pharmacokinetic parameters from plasma and urine data after drug administration by intravascular and oral route.	

6.0 CLEARANCE CONCEPT 6

6.1 Clearance concept,
6.2 Mechanism of renal clearance,
6.3 Clearance ratio,
6.4 Determination of renal clearance.
6.5 Extraction ratio,
6.6 Hepatic clearance, biliary excretion, extra-hepatic circulation.
6.7 Non-linear pharmacokinetics with special reference to one compartment model after I.V. drug administration.

7.0 CLINICAL PHARMACOKINETICS: 8

7.1 Definition and scope:
7.2 Dosage adjustment in patients with and without renal and hepatic failure
7.3 Design of single dose bio-equivalence study and relevant statistics;
7.4 Pharmacokinetic drug interactions and their significance in combination therapy.

SUGGESTED LEARNING RESOURCES

(a) Reference Books:

S. No.	Title	Author, Publisher, Edition & Year
1.	Modern Pharmaceutics	G. Banker
2.	Physical Characterization of Pharmaceutical Solids	H. Brittain
3.	Polymorphism in Pharmaceutical Solids	H. Brittain
4.	Solid State Chemistry of Drugs	S.R. Byrn
5.	Chemical Stability of Pharmaceuticals	K.A. Connors
6.	Pharmaceutical Preformulation and Formulation	M. Gibson
7.	Solubility Behavior of Organic Compounds	D.J.W. Grant and T. Higuchi
8.	Remingtons "Pharmaceutical Sciences"	19th edition
9.	Pharmaceutical Preformulation	J. Wells
10.	Solubility and Solubilization in Aqueous Media	S. Yalkowsky
11.	Pharmaceutics "The Science of Dosage form design"	Aulton
12.	Hand book of Preformulation	Sarfaraz K. Niazi

APPLIED TECHNOLOGY COURSES

CLINICAL ASSESSMENT OF HERBAL FORMULATION

L	T	P	Curri. Ref. No.: HT501
3	1	2	

Total Contact hrs.:
Lecture: 45
Tutorial: 15
Practical: 30
Credit : 5

Total marks: 150

Theory:
End Term Exam.:75
P.A: 25
Practical:
End Term Exam: 25
P.A: 25

RATIONALE

Studies related to Clinical trials provide knowledge about how well new medical approaches work in people. This subject gives an idea how the new products behaves when used for humans, their appropriate doses, frequency of administration, side effects, toxic effects etc.

The Clinical trials related knowledge for herbal products is almost at the rudimentary level. Hence knowledge in the field is very important to develop the subject.

D E T A I L C O U R S E C O N T E N T

THEORY

UNIT	TOPIC / SUB-TOPIC	Lecture Hrs.
1.0	Clinical trials: Definition and requirement.	2
2.0	Types of herbal formulations.	2
3.0	Different blood parameters for clinical assessment of herbal materials	6
4.0	Assessment of urinary excretion data	3
5.0	Various methods of assessment of herbal formulation with specific examples.	14
6.0	Clinical trials, classification and methodology of phase I, II, III and IV trials.	12

SUGGESTED LEARNING RESOURCES

Reference Books:

S. No.	Title	Author, Publisher, Edition & Year
1.	Pharmacognosy	Trease and Evans
2.	Pharmacognosy	Kokate, Purohit and Gokhale
3.	Wealth of India	CSIR Publication
4.	Essential of Pharmacognosy	Dr.S.H.Ansari

S. No.	Title	Author, Publisher, Edition & Year
5.	Pharmacognosy & Phytochemistry	V.D.Rangari
6.	Phytochemical Methods	J.B.Harborne
7.	Herbal Drug Industry	R.D.Chaudhury
8.	Drug Discovery & Evaluation	Vogel

PRACTICALS:
Suggested list of experiments:

1. Preparation of herbal formulation and its biological evaluation.
2. Standardization of some herbal formulations.
3. Biological Screening of plant extracts – Anti-inflammatory, Antidiabetic, Diuretics, Antimicrobial, Antipyretic, Antiulcer, Analgesic
4. Preparation of extractive values of plant materials using various solvents.
5. Extraction of volatile oil from plant and its characterization.

PHARMACOGNOSY

L	T	P	Curri. Ref. No.: HT502
3	1	4	

Total Contact hrs.:
Lecture: 45
Tutorial: 15
Practical: 60
Credit : 6

Total marks: 200

Theory:
End Term Exam.:75
P.A: 25
Practical:
End Term Exam: 50
P.A: 50

RATIONALE

It is imperative for the student of Herbal Technology to know about the Medicinal and Aromatic plants of the region. They should be able to identify the plant parts of medicinal & aromatic importance. They should be acquainted with the distribution of these plants in the region. They should be aware of any untapped, potentially important and also over exploited or endangered medicinal & aromatic plants. This course is aimed at providing the above mentioned knowledge to the students so that they not only become aware of the medicinal & aromatic plants but also become part of any future conservation strategies for these plants.

This course aims at acquainting the students with Natural Drugs-their nature, sources, chemical constituents and cosmetic uses. This knowledge will help the students to understand the need of growing a large variety of herbs containing these drugs occurring in this region. This understanding of factors affecting the purity and quality of drugs will enable them to raise herbs with enhanced quality and quantify of these drugs.

D E T A I L C O U R S E C O N T E N T

THEORY

UNIT	TOPIC / SUB-TOPIC	Lecture Hrs.
1.0	**INTRODUCTION TO PHARMACOGNOSY**	3
1.1	Scope of Pharmacognosy	
1.2	Definition	
1.3	History of Pharmacognosy	
1.4	Classification of medicinal plants	
1.5	Macroscopic studies of above plants/ parts	

2.0 IDENTIFICATION OF MEDICINAL PLANT 18

2.1 Plant parts of medicinal importance – Biological sources, chemical constitutes and uses –

- Root – Ashwagandha, Shatavri, Musli, sarpgandha.
- Stem – Giloy, Vijaysar, Jyeshthavaadh etc.
- Leaf – Bramhi, Sonamukhi, Aloevera, Vaska Adlusa.
- Flower – Jasvand, Rose, Jasmine etc.
- Fruit – Amla, Bel, etc.
- Seed – Jamun, Koatch (Muluna Prusita), Bauschi etc.
- All parts – Atis, Neem, Tulsi etc..
- Other parts

2.2 Direct fragrance from plant and their parts.

2.3 Oil from different parts of plant – Biological sources, chemical constitutes and uses -

- Flowers – Rose, Jasmine, Tube-rose, Champa etc.
- Leaves – Eucalyptus, Clove, Tulsi, Patchuli, etc.
- Fruit/Seeds – Orange, Bergamot, Juniper, Ambrette, Josota etc.
- Roots – Ginger, Kachur Sugandhi, Bach, Anantmul, Mulethi etc.
- Grasses–Motia Rosia, Ginger-grass, Sofia, Lemon grass Peppermint etc.
- Woods – Chandan, Cade, Cedar, Rosewood etc
- Bark – Cinnamon (Dalchini)
- Gums – Olibenum, Guggul etc.

2.4 Macroscopic studies of above plants/ parts

2.5 Microscopic study of above plants/ parts.

3.0 CONSERVATION OF MEDICINAL PLANTS OF ARUNACHAL PREDESH 4

3.1 Over exploited, rare and threatened medicinal plants.

3.2 Untapped medicinal plants.

3.3 Sustainable development and conservation of medicinal & aromatic plants.

4.0 PHARMACOGNOSTIC STUDIES 6

Systematic pharmacognostic studies of traditional drugs of Arunachal Pradesh like –

- Morphological studies
- Microscopic studies
- Physico-chemical studies
- Uses & economic importance

5.0 DRUG ADMINISTRATIONS 6

5.1 Drug administration in Ayurvedic and Traditional systems of medicine

5.2 Natural products

5.3 Bio synthetic apparatus

5.4 Herb based plantation
5.5 Extinction plantation
5.6 Production of natural plantations

SUGGESTED LEARNING RESOURCES

(a) Reference Books:

S. No.	Title	Author, Publisher, Edition & Year
1	Botany Part II	Dr. P.C.Jain, Dr. Amarjeet Bajaj Madhya Pradesh, Hindi Granth Academy, 2002
2	The useful Plants of India	PID Staff, CSIR New Delhi, 1986
3	Wealth of India	PID Staff, CSIR New Delhi
4	Pharmacognosy	Trease and Evans, WS Bailliere – Tindall, Eastbourne, UK
5.	Indian Pharmacopocia	Ministry of Health and Family Welfare, Govt. of India, New Delhi
6.	Pharmacognosy	C.K. Kokate, Nirali Prakashan, 41 Budhwar Peth, Jogeshwari Mandir Lane, Pune
7.	Ras Ratna Samuchays	Dr. Ambika Datt Shashtri, Dr. Indradev Tripathi Choukhamba Surbharti Prakashan, K 37/ 117 Gopal Mandir lane, P.B. No. 9129 Varanasi
8.	Bav Prakash Nighantu	Bhavprakash Choukhamba Surbharti Prakashan, K 37/ 117 Gopal Mandir lane, P.B. No. 9129 Varanasi

(b) Others:

- OHP transparencies
- Computer Aided Instructional packages
- Journals
- Charts of cosmetic and medicinal products from Herbs.
- Models
- Maps
- Reference books on Pharmacognosy

PRACTICALS:
Suggested list of experiments:

1. Identification and Evaluation of Crude drugs and products like Isabgula, Fennel, Nuxvomica, Clove, Digitalis, Coriander, Cinchona
2. Macroscopic studies of parts of plants/ plant

3. Morphological, Microsopic and physico-chemical studies of traditional drugs of Arunachal Pradesh.
4. Standarisation of some traditional drugs formulations.
5. Chemical testing of aminoacids & carbohydrates.
6. Isolation of Phytocontituents like Capsicin, Caffein from Capsicum, Tea & Coffee
7. Fibre determination of cotton.

PLANT TOXICOLOGY

L	T	P	Curri. Ref. No.: HT503
3	1	0	

Total Contact hrs.:
Lecture: 45
Tutorial: 15
Practical: 0
Credit : 4

Total marks: 100

Theory:
End Term Exam.:75
P.A: 25

RATIONALE

A knowledge of this paper is important as the student must be aware of the different types of toxins in plants and their effect on the human body. Students will also learn about the various categories of toxins and their classification.

D E T A I L C O U R S E C O N T E N T

THEORY

UNIT	TOPIC / SUB-TOPIC	Lecture Hrs.
1.0	**GENERAL INTRODUCTION TO PLANT TOXICOLOGY**	**6**
	1.1 Definition of plant toxins	
	1.2 Classification of plant toxins, chemical nature and types of toxicities caused by these in animals and human subjects.	
2.0	**HIGHER PLANT TOXIN**	**10**
	2.1 Essential oils Terpene (cineol, pine oil), Phenyl propane (apiol, safrole, myristicin), Monoterpene (thujone, menthafuran)	
	2.2 Plant acids (oxalic acid, amino acid, resin)	
	2.3 Glycosides (Cardiotonic Cyanognic)	
	2.4 Alkaloids (imidazole, pyrrolizidine, tropane)	
3.0	**STUDY OF TOXINS**	**12**
	3.1 Description of plant,	
	3.2 Pharmacognostic features,	
	3.3 Pharmacological actions,	
	3.4 Chemical constituents, side-effects, contra-indications, warnings, treatment.	

4.0 PREVENTION AND CONTROL METHODS 7

4.1 Prevention and control methods of Abrus, Aconite, Nux-vomica,, Castor, Aloe, Podophyllum, Ephedra, Opium, Eucalyptus, Tobacco, Cannabis, Digitalis, Datura.

SUGGESTED LEARNING RESOURCES

Reference Books:

S. No.	Title	Author, Publisher, Edition & Year
1.	Plant Toxicology	Seawright A.A., Hegarty M.P., James L.F. and Keeler R.F. (Eds.), Dominion Press, Melbourne
2.	A Colour Atlas of Poisonous Plants	Frohne D. and Pfan¬der H.J., Wolfe Publishing Ltd., Stuttgrt
3.	Hand Book of Natural Toxins, Vol.1-2	Keeler R.F. and Tu A.T. Marcel Dekker lflC; New York
4.	Effect of Poisonous Plants on Live Stock	Keeler R.F., Kampen K.R.V. and James L.F., Academic Press, London
5.	Natural Toxicants in Feeds & Food Stuff	Cheeke P.R. and Shull L.R. The Avi Publication Co. Ltd., Connecticut
6.	Natural Products Medicine, A Scientific Guide to Food, Drug, Cosmetics	Lawrence ARA. DER
7.	Poisonous Plant of Pakistan	Baqar Hussain
8.	Toxins of 30 Arabian Poisonous Plants	Mansoor Ahmad.. Philadelphia University

PHARMACOLOGY

L	T	P	Curri. Ref. No.: HT504
3	1	0	

Total Contact hrs.:
Lecture: 45
Tutorial: 15
Practical: 0
Credit : 4

Total marks: 100

Theory:
End Term Exam.:75
P.A: 25

RATIONALE

Pharmacology is the study of how substance interacts with living organisms, to produce a change in function. If the substance has medical properties, they are considered Pharmaceuticals. Pharmacology encompasses drug composition, properties, action interaction on body and its therapy.

D E T A I L C O U R S E C O N T E N T

THEORY:

UNIT	TOPIC / SUB-TOPIC	Lecture Hrs.
1.0	**INTRODUCTION TO PHARMACOLOGY**	**4**
	1.1 Sources of natural drugs.	
	1.2 Dose, dose calculation and dose determination	
	1.3 Dosage forms	
	1.4 Routes of administration.	
2.0	**DRUGS USED IN DIFFERENT SYSTEMS OF BODY**	**7**
	2.1 Composition and properties of drugs used in –	
	- Cardiovascular systems	
	- Urinary system	
	- Endocrine system	
	- Haematopoietic system and others	
3.0	**ACTION OF DRUGS ON BODY**	**6**
	3.1 Effect of drugs.	
	3.2 Factors affecting drug action.	
	3.3 Basics of drug interactions.	

3.4 Absorption, distribution, excretion and metabolism of drugs
3.5 Adverse drug reactions and treatment of poisoning.

4.0 DRUGS ADDICTION AND DRUG ABUSE 3

4.1 Concept of essential drugs, use and abuse.
4.2 Drug addiction.

5.0 THERAPEUTICAL GROUPING OF NATURAL DRUGS 5

5.1 Laxative – Aloe vera
5.2 Astringents – Catechu, Amla
5.3 Cardio tonics – Arjuna/ Digitalis
5.4 Carminative & Gastro intestinal regulators - cinnamon, Ginger, Clove.
5.5 Nervous System – Opium, Ashwagandha
5.6 Antitumous – Vinca
5.7 Antihpertesive – Sarpagandha, Reserpine
5.8 Antitussive – Vasaka, Tulsi
5.9 Antirheumatics – Guggul
5.10 Antileprotics – Chalmogra oil
5.11 Antidiabetics – Vijaysar, Jamun
5.12 Diuretics – Gokhru, Punarnava
5.13 Antidysenterics – pecacuanha
5.14 Antiseptic – Neem, Haldi
5.15 Antimalarial – Cinchona
5.16 Oxytocics – Ergot
5.17 Vitamins – Amla
5.18 Enzymes – Papaya, Yeast
5.19 Flavouring Agents – Chandan, Sandle wood / oil, Lemon
5.20 Pharmaceutical acids – Bee Wax, Honey, Gelatin

6.0 INTRODUCTION TO PHYTO CHEMICAL NATURE OF DRUGS 7

6.1 Alkaloids
6.2 Terpenoids
6.3 Glycosides
6.4 Tannins
6.5 Lipids
6.6 Volatile oils
6.7 Resins
6.8 Carbohydrates

SUGGESTED LEARNING RESOURCES

(a) Reference Books:

S. No.	Title	Author, Publisher, Edition & Year
1.	Handbook of Experiment Pharmacolgoy	Kulkarni, S.K. Vallabh Prakashan, New Delhi
2.	Principles of Pharmacology	Paul, L. Chamman and Hall
3.	Pharmacognosy	Kokate, Nirali Prakashan 41 Budhwar Peth, jogeshwari Mandir Pune
4.	Pharmacognosy	Iyangar
5.	Hand Book of Pharmacology	N Murugesh Satya Publisher, Arvind Gardens, Balaji Niwas No. 1, Sowbhagaya Nagar, 3rd street opp. Sitalakshmi mills, Tirunagar, Madurai
6.	Medical Pharmacology	K.D. Tripati, Jaypee Brothers Medical Publisher EMCA House, 23/23 B Ansari Road, Daryaganj, New Delhi - 110002

(b) Others:

- O.H.P. Transparencies.
- Charts.
- Computer aided instructional package.
- Demonstration of different herbal plants, Minerals and Animal derivatives.

BIOTECHNOLOGY - II

L	T	P	Curri. Ref. No.: HT505
3	1	4	

Total Contact hrs.:
Lecture: 45
Tutorial: 15
Practical: 60
Credit : 6

Total marks: 200

Theory:
End Term Exam: 75
P.A: 25
Practical:
End Term Exam: 50
P.A: 50

RATIONALE

Biotechnology has developed by leaps and bound in the present age providing a healthy and better life to mankind. This subject aims at providing an array of knowledge related to Plant Biotechnology with special emphasis to tissue culture, biotransformation, genetic transformation, finger print analysis and their applications.

D E T A I L C O U R S E C O N T E N T

THEORY:

UNIT	TOPIC / SUB-TOPIC	Lecture Hrs.
1.0	**INTRODUCTION**	**3**
	1.1 Historical perspectives, prospects for development of plant biotechnology as source of medicinal agents.	
	1.2 Applications in pharmacy and allied fields.	
2.0	**PLANT TISSUE CULTURE**	**12**
	2.1 The *in vitro* culture technique – an outline	
	2.2 Tissue culture laboratory & culture room	
	2.3 Sterilization techniques	
	2.4 Nutrient media	
	2.5 Explant (cell, tissue, organ) culture	
	2.6 Callus and suspension culture	
	2.7 Proliferation of cultured explant.	
	2.8 Induction of adventitious buds, bulbs and protocorms	
	2.9 Somatic embryogenesis.	
	2.10 Somaclonal variations	
	2.11 Artificial/ Synthetic seeds.	
	2.12 Micropropagation and Green house	

2.13 Advantages and limitations
2.14 Secondary metabolites
2.15 Production of plant compounds in cell and suspension culture
2.16 Tissue culture in pharma industry.
2.17 Nutrient Medium, Aseptic conditions, Sterilization Techniques, Culture Technique Aeration, Organogenesis, Transplantation in green houses and field

3.0 TECHNIQUES 6

3.1 Types, techniques, nutritional requirements and growth of plant tissue cultures.
3.2 Organogenesis and embryogenisis.
3.3 Protoplast fusion and cultures, artificial seeds.
3.4 Micropropogation of medicinal and aromatic plants.
3.5 Genetic stability of tissue cultures.

4.0 SECONDARY METABOLISM IN TISSUE CULTURES 2

4.1 With emphasis on production of medicinal agents and its impact in pharmacy.

5.0 BIO-TRANSFORMATION 2

5.1 Introduction to biotransformation, bioreactors.
5.2 Totipotency and cryopreservation — Introduction and definition.

6.0 APPLICATION 2

6.1 Use of techniques for genetic engineering for obtaining plants resistant to—
- Diseases
- Pests
- Abiotic and biotic stress

7.0 CELL IMMOBILIZATION 2

7.1 Definition
7.2 Techniques

8.0 GENETIC TRANSFORMATION 6

8.1 Direct and indirect gene transfer
8.2 Direct gene transfer by gene gum, protoplast fusion and electroporation
8.3 Indirect gene transfer by carrier molecule –

- Agrobacteria
- Plant virus (CaMV, TMV)

SUGGESTED LEARNING RESOURCES

Reference Books:

S. No.	Title	Author, Publisher, Edition & Year
1.	Elements in biotechnology	P. K. Gupta
2.	Molecular biology and biotechnology	J. M. Walker and E. D. Gingold
3.	An introduction to plant tissue culture	M. K. Razdan
4.	Breeding field crops	John. M. P and David A. S.
5.	Advanced methods in plant breeding and biotechnology	David. R. Murray
6.	Experiments in plant tissue culture	John H. D and Lorin W. R.
7.	Pharmaceutical biotechnology	S. P. Vyas and V. K. Dixit
8.	Plant cell and tissue culture	Jeffrey W. Pollard and John M. Walker
9.	Plant tissue culture	Dixon
10.	Plant tissue culture	Street
11.	Pharmacognosy	G. E. Trease and W. C. Evans
12.	Biotechnology	Purohit and Mathur
13.	Biotechnological applications to tissue culture	Shargool
14.	Pharmacognosy	Varro E. Tyler, Lynn R. Brady and James E. Robberrt
15.	Introduction to biotechnology	Bullock John
16.	Biotechnology of higher plants	Gordon E. Russel
17.	Antibiotics isolation and separation	M. L. Wenisten and G. H. Wagman
18.	Plant cell culture technology	M. M. Yeoman
19.	Plant tissue culture	Dennis N. Butcher and David .S. Ingram
20.	Plant tissue culture	Pitman
21.	Plant tissue culture – Theory and practice	S. S. Bhajwani and M. K. Razdan
22.	Secondary plant metabolism	Margaret L. Vikery and Brian Vikery
23.	Plant tissue culture	W. E. George

PRACTICALS:
Suggested list of experiments:

1. Description of species based on herbarium and live specimen. Identification (Families and binomials) of specimens belonging to the families mentioned in theory. Preparation and use of keys at generic and species levels.

Problems in Nomenclature. Field visit for 5-7 days to collect specimens in and out side the state. Submission of 20 herbarium sheets representing the families studied.

2 Sterilization of explants and inoculation Protoplast isolation Meristem culture Suspension culture Somatic embryogeny Isolation of Anabaena azollae from Azolla Mass cultivation of Azolla-demonstration Mass cultivation of BGA-demonstration Isolation and identification of Rhizobium and Azospirillum Isolation of P-solubilizing microbes Isolation and identification of VAM Seed application of bioinoculants Immobilization techniques Estimation of BOD Accessing information from database using computer Eg: Retrieving Nucleic acid sequence, Protein sequence etc.

3 Study of dividing cells - squash and smear techniques. Study of induced aberrations in onion root tips employing chemical and plant extracts. Demonstration of salivary gland chromosomes of Drosophila. Chromosome mapping.

4 Estimation of nucleic acids, Isolation of plant DNA, plasmid DNA, Preparation of competent E. coli. Demonstration of Southern and Northern blots. Encapsulation of cells in alginate beads. Genetics problems based on the theory.

5 Calculation of various patterns in fruits/leaves/seeds - standard deviation - standard error, based on the data given. Chi square test.

QUALITY CONTROL OF HERBAL FORMULATION

L	T	P	Curri. Ref. No.: HT506
3	1	2	

Total Contact hrs.:
Lecture: 45
Tutorial: 15
Practical: 30
Credit : 5

Total marks: 150

Theory:
End Term Exam.:75
P.A: 25
Practical:
End Term Exam: 25
P.A: 25

RATIONALE

A number of herbal medicinal formulations are available in Indian markets. Many reputed companies produce those herbal formulations. It is, therefore, important to know how the quality of the herbal products should be maintained, regulated and studied. The following course material is designed for that purpose.

D E T A I L C O U R S E C O N T E N T

THEORY:

UNIT	TOPIC / SUB-TOPIC	Lecture Hrs.
1.0	**FACTORS AFFECTNG QUALITY OF PLANT DRUGS**	**7**
1.1	Scope of plant drugs cultivation	
1.2	Factors affecting quality of plant drugs	
1.3	Substitution and adulteration of crude drugs.	
2.0	**STATUTORY NORMS ON CULTIVATION AND COLLECTION OF HERBAL FORMULATION**	**5**
2.1	WHO guidelines on good agricultural and collection practices (GACP) for medicinal plants.	
3.0	**STABILITY STUDY OF HERBAL FORMULATION**	**5**
3.1	Definition	
3.2	Methods of stability study	
3.3	Accelerated stabilities study.	

4.0 PRESERVATION AND WASTE PRODUCT MANAGEMENT 12

4.1 Cultivation and management of medicinal plants like: Dioscorea, Belladonna, Hyoscyamus, Cinchona, Opium, Digitalis, Senna, Plantago, Mentha, Rauwolfia, Lemmon Grass, Basil, Geranium. Utilization of waste product of herbal industries.

5.0 PHARMACEUTICAL USE 10

5.1 Methods of preparation of herbal cosmetics for skin, hair and dental care.
5.2 Determination of shelf life of raw drugs, powered drugs, extracts, fractions and finished products.

6.0 ADULTERATION AND EVALUATION OF NATURAL PRODUCTS 6

6.1 Qualitative and quantitative method of detection of adulteration.
6.2 Quality & purity of drugs exhausted.
6.3 Drug adulteration
6.4 Factors affecting quality & purity of drugs.
6.5 Methods of evaluation of drugs.

SUGGESTED LEARNING RESOURCES

Reference Books:

S. No.	Title	Author, Publisher, Edition & Year
1.	Cultivation and Utilization of Medicinal and Aromatic Plants	Atal, C.K., Kapur, B.M., , R.R.L. Jammu
2.	Cultivation of Medicinal and Aromatic Plants	Farooqui, A.A., Sreeramu, B.S., University Press, 2001
3.	Medicinal Plants of India	Yoganasimhan, S.N., , 1st Edition, Interlive Publishing Pvt. Ltd.
4.	Medicinal and Aromatic Plant abstracts (MAPA)	CSIR, New Delhi
5.	Pharmacognosy	Evans, W.C., Trease and Evans, W.B. Saunder & co., London
6.	Text Book of Pharmacognosy	Wallis, T.E.
7.	Indian Herbal Pharmacopoeia	
8.	Textbook of Industrial Pharmacognosy	Kalia, A.N.
9.	Pharmacognosy and Phytochemistry	Mohammad Ali
10.	Pharmacognosy and Phytochemistry of Medicinal Plants	Bruneton Jean,.

S. No.	Title	Author, Publisher, Edition & Year
11.	Natural Products from Plants	Kaufmann, CRC Press, New York
12.	Poucher's Perfumes, Cosmetics and Soaps	Butler, M
13.	Herbal Soaps and Detergents	Panda
14.	Text Book of Cosmetics	Vimladevi
15.	Botanicals, A Phytocosmetic Desk reference	D'Amelio,

PRACTICALS:
Suggested list of experiments:

1. Quantitative & qualitative studies of crude drugs
2. Yield percentage calculation.
3. Percentage determination of finished products.
4. Determination of biological load in formulation.
5. Preparation of Powders, lotions, Ointments, Tablets and capsules of Therapeutic drugs.
6. Stability study of Herbal formulation.

MANUFACTURING OF HERBAL FORMULATION

L	T	P	Curri. Ref. No.: HT507
3	1	0	

Total Contact hrs.:
Lecture: 45
Tutorial: 15
Practical: 0
Credit : 4

Total marks: 100

Theory:
End Term Exam.:75
P.A: 25

RATIONALE

This paper is designed to provide introductory idea related to herbal formulation based on the therapeutic dosage forms. It will provide a detailed idea about the collection of crude drugs, extraction and pharmacological screening, preparation and standardization. It will also provide an idea about the packaging technique of the formulation.

D E T A I L C O U R S E C O N T E N T

THEORY:

UNIT	TOPIC / SUB-TOPIC	Lecture Hrs.
1.0	**KNOWLEDGE OF HERBAL DRUGS**	**6**
1.1	Definition of herbal drug and formulation	
1.2	Cultivation, Collection, Preparation of Herbs for the market- Introduction and Definition	
1.3	Standardization of Raw herbs procured from the market/collected from wild/cultivated sources.	
1.4	Geographical/Botanical sources of various herbal drugs utilized in traditional system of medicine.	
1.5	Key to Identification of medicinal plants	
2.0	**SCREENING & EXTRACTION OF HERBAL DRUGS**	**6**
2.1	Herbal sources of food supplements, Taste enchancers colours and cosmetics.	
2.2	Phytochemical screening of various medicinal plants for the presence of therapeutically active principles.	
2.3	Extraction of medicinal plants	
2.4	Herbal extracts	

3.0 MANUFACTURING METHODS & STANDARDISATION OF HERBAL DRUGS 8

3.1 Methods of manufacturing of different types of herbal extracts (individual drugs like senna, digitalis, nux vomica, Tropane derivatives, Isopgol, Reserpine (Industrial Process)
3.2 Isolation, purification and standardization of herbal extracts by instrumentation techniques.
3.3 Pharmacological and Biological screening of herbal drugs by experimental methods.

4.0 MANUFACTURING OF HERBAL DRUGS SINGLE & CPD FORMULATIONS 4

4.1 Different methods of manufacturing pharmaceutical formulations.
4.2 Manufacturing of herbal formulations, drugs

5.0 CONCEPT OF HERBAL DRUGS MANUFACTURING UNIT 3

5.1 Structure of manufacturing unit as per statutory norms.
5.2 Rules & regulation as per GMP guideline.
5.3 Documentation
5.4 Master Formula Record

6.0 COSTING AND PACKAGING OF HERBAL DRUGS 3

6.1 Cost determination of doses forms
6.2 Marketing viability
6.3 Packaging of doses forms

SUGGESTED LEARNING RESOURCES

Reference Books:

S. No.	Title	Author, Publisher, Edition & Year
1.	Text book of Pharmacognosy	Wallis - Fifth edition
2.	Pharmacognosy	Tyler Brady - Nineth Edition
3.	Pharmacognosy	Kokate, Purohit and Gokhale -19th Edition

S. No.	Title	Author, Publisher, Edition & Year
4.	Practical Pharmacognosy, Techniques and Experiments	Khandelwal, Pawar, Kokate, & Gokhale- Third Edition
5.	Pharmacognosy	Trease and Evans 14th Edition
6.	Monographs on selected medicinal plants -Volume I	WHO
7.	Indian Herbal Pharmacopoeia	New edition 2002.
8.	The Ayurvedic Pharmacopoeia of India -Part I, Volume II	First edition

SEMINAR

L	T	P	Curri. Ref. No.: HT508
0	0	6	

Total Contact hrs.:	**Total marks: 100**	**Practical:**
Lecture: 0		End Term Exam: 50
Tutorial: 0		P.A: 50
Practical: 90		
Credit : 3		

RATIONALE

Students need to develop skill of presenting the fact and data related to technical matter through vocal presentation and hence the arrangement of seminar is necessary. This will enable the student to develop the skill of effective presentation of a technical topic in a gathering and also be able to interact with the audience during questionnaire session.

SUGGESTED IMPLEMENTATION STRATEGIES

- Individual has to speak for minimum fifteen minutes during examination and explain the related questions at time of oral examination to a panel of three members out of which one will be external.
- Soft copy of Presentation should be submitted for evaluation in due time.
- Concerned faculty member should do continuous assessment.

PROJECT

L	T	P	Curri. Ref. No.: HT509
0	0	8	

Total Contact hrs.:	Total marks: 150	Practical:
Lecture: 0		End Term Exam: 100
Tutorial: 0		P.A: 50
Practical: 120		
Credit : 4		

RATIONALE

The aim of this course is to provide practical experience in Project Planning design and implementation related to aromatic and medicinal plants and their applications. The course will develop students to accept challenges and develop confidence, which they are required to face during their initial career span. Also they will understand the concepts of subjects, which they have studied in theory. The student will have an opportunity to apply his knowledge and skills which he has gained during the span of this course in presentable and practical form through this course.

PROJECT

Student of this diploma programme will have an opportunity at the end of the course to integrate knowledge, skills and attitude (which he has gained during the entire span of this course) and to apply to real/ practical problems of cultivation, processing, marketing of herbs and their applications in different systems of medicines like Ayurvedic, and also in Beauty culture.

The students can undertake the projects at different herbal farms/ fields and near by Research Laboratory like RRL.

- The student must submit outline and action plan for the project execution (time schedule) and the same approved by the concerned faculty.
- The project group should not include more than 5 students.
- The project development must be carried out according to the following steps and write-up should have the same sequence-
  - Project objectives.
  - Selection of tools.
  - Data collection.
  - Analysis and Interpretation of data.
  - Project outcome.
  - Future scope.

SEMINAR ON PROJECT REPORT

- Each student in the group or individual has to speak for five minutes during examination and explain the problem in parts at time of oral examination to a panel of three members out of which one will be external.
- Hard copy of Project Report should be submitted for oral examination in due time.
- Concerned faculty member should do continuous assessment.

INDUSTRIAL TRAINING

L	T	P	Curri. Ref. No.: HT510
0	0	0	

Total Contact hrs.:	Total marks: 200	Practical:
Lecture: 0		End Term Exam: 100
Tutorial: 0		P.A: 100
Practical: 0		
Credit : 10		

RATIONALE

The purpose of industrial training is to expose students to the latest practices, equipments and techniques used in the field and to provide opportunities for hands on experiences in their field. Such opportunities expose them to the intricacies of the world of work.. The basic purpose of this course is to provide an opportunity to student during their course of study for such a experience. This would not only improve their technical competency but at also develop non technical skills such as planning, scheduling, problem solving, team work, decision making, time management etc. The nature of training may vary with the discipline and the area selected. Some of the widely used forms of industrial training in the country are: designing a component/ part/machine for a specific purpose, Engineering Analysis, Innovative Product Development, Feasibility Study and Generating solution/s for real life problem.

On the basis of the electives and the courses/subjects completed student can undergo training of four-week duration in any of the following areas in consultation with faculty. For example in Herbal Technology the areas could be :

- Extraction of valuables from Herbs
- Cultivation of Herbs in North East States
- Skin care through Herbs
- Hair care through Herbs
- Ayurvedic and Unani preparations from Herbs
- Herbs in health and diet
- Herbs in Aromatherapy

The students may also be given projects within the institute and field in case it is not feasible to place them in various industries/agencies. The projects could be identified by the teachers which are very close to industry/and also looking the resources that can available/made in the institute.

The Industrial Training has basically the following three components: -

1. Orientation Programme
2. Training in the Industry
3. Report Writing and
4. Evaluation

Note:
Orientation programme: During the orientation programme, complete guidelines will be provided to the students regarding planning, implementation and evaluation of industrial training.

Training in industry: During the training student will have to maintain a daily dairy to record his observations and experiences in various department/section and on the basis of daily dairy student will prepare and submit the Industrial Training Report. Competent faculty / staff member shall follow-up the student's progress regularly. The student should be encouraged to seek & collect relevant forms; brochures; & other print material from the various organization related to training/project.

Report writing: Daily dairy will form the basis for report writing. The formats for the report preparation will vary, depending upon the type of training/project and will be generated by the teacher.

Evaluation : For the industrial training as per teaching and assessment scheme equal weightage is given for end of term and progressive assessment.

For the end of term evaluation each student has to prepare and present a seminar paper related to experience gained during the industrial training. Each student will be evaluated on the basis of training report, seminar presentation and viva-voce.

For progressive assessment proper recording of events in daily dairy and generation of weekly reports will form the basis.

ELECTIVE COURSES

AROMATHERAPHY

L	T	P	Curri. Ref. No.: HT601
3	1	0	

Total Contact hrs.:
Lecture: 45
Tutorial: 15
Practical: 0
Credit : 4

Total marks: 100

Theory:
End Term Exam.:75
P.A: 25

RATIONALE

Fragrances, the wonderful gift of the plant kingdom, have been known to have various effects on human body and mind since ancient times. They have been shown to have calming, stimulating, or elevating on human mind for spirit. They have also been used therapeutically for wring various diseases like insomnia, depression and anxiety etc. These essential oils are also use in perfumery and have played important part in our daily dress-up. It is essential for the student of this course to know about sources, methods of extraction, blending and application of these aromatic oils. This course aims at equipping the student with basic knowledge about this aspect of herbs associated with aromatherapy.

These values of aromatic oils have been rediscovered recently and an entire new field of Aromatherapy as an alternative system of Medicine has come up.

D E T A I L C O U R S E C O N T E N T

THEORY:

UNIT TOPIC / SUB-TOPIC	Lecture Hrs.
1.0 INTRODUCTION TO AROMATHERAPY	**5**

1.1 History of Fragrance
1.2 Aromatic Approach & Considerations
1.3 Ancient Approaches
1.4 Natural V/s Synthetic Oil
1.5 Purity -
- Botanical origin of essential oil
- Growth & Cultivation
- Country of Origin
- Blended essential oils
- Adulteration
- Irritant Oil

1.6 Applications of Aromatherapy –
Air Freshner
As Compress
Size Bath
Inhalation
Oil Massage
1.7 Oil for Orally use

2.0 METHOD OF EXTRACTING OIL AND BLENDING TECHNIQUES 4

2.1 Methods of Extracting
Distillation Method
Cold Press Method (Expression)
Resinoid Method
Chemical Solvent Method
2.2 Blending Process & Technique
Adjustment in healing capability
Therapeutic Blending
Magical Blending

3.0 AROMATHERAPY IN HAIR CARE 6

3.1 Nutritious Oil To Hair (Conditioner)
Rosemary, Lavender, Geranium,. Wheat germ, Avocado etc.
Oily Hair
Cedar, Bergamot, Lavender, Leman, Cypress, Jojoba, Wheat germ, Avocada etc.
Dry Hair
Ylang-ylang, Rosewood, Geranium etc.
Grey Hair
Motia Rosha, Sofia, Lavender, Coriander, Lemon etc.
Dandruff in Hair
nilgiri (Eucalyptus), Cade, Clarysage, Cypress, Cedarwood, Rosemary, Yarrow etc.
Hair Fall (Baldness-Alopecis0
Swisspine, Motia Rosha, Ylang, Rosemary, Cade Oil, Lavender, Neem, Juniper, Rosemary etc.
Split Ends &Trauma
Rosewood, Sandalwood, Ylang-Ylang, Geranium, Chandan etc.
3.2 Detoxification of Scalp
Cedar, Tea tree etc.
Lice & Nits
Rosemary, Feranium, Lavender, Nilgiri etc.
3.3 Glowing Hair (Hair Rinses)
Orange, Rosemary, Birth etc.

4.0 AROMATHERAPY IN SKIN CARE 6

4.1 Facial Treatment through essential Oil
Types of Skin
Normal Skin - Jasmine, Neroli, Ylang, Rose, Carrot-seed, Geranium, Lavender etc.
Dry Skin – Sandelwood, Rose, Wheatgerm, Ylang-ylang, Benzoin, Patchouli, Chamomile, Geranium, Rosewood etc.
Oil Skin – Bergamot, Juniper, Cypress, Lemon, Cedar etc.
Irritated Troubled Skin – Mint, Eucalyptus, Rosemary, Yarrow etc. Oils (Blend with Creams)

4.2 Skin Cleansing & Complexion –
Lavendar
Olive
Almond
Sesame (Til)
Chamomile
Lanolin etc.

4.3 Skin Tightening (Scrub)
Orange
Lemon
Almond etc.

4.4 Retexturing & Balancing (Face Masks or Packs)
Apricot, Mint.

4.5 Toning –
Sunflower, Wheatgerm .

4.6 Firming –
Orange, Rose, Almond, Olive etc.

4.7 Moisturing –
Lemon, Avocado, Apple etc.

4.8 Nourising –
Marigold, Marshmallow, Oatmeal, Olive, Almonds etc.

4.9 Facial Steam Bath Method
Roman & German Chamomile, Myrtle, Sage, Lemongrass, Neroli, Lavender etc.

4.10 Other Beauty Problems
Black-heads and acne – Geranium, Lavender, Rosewood, Sandalwood, Teatree, Cypress, Camphor, Bergamot (Facialwash, Massage)
Dark Circler under Eyes – Almond, Lemon, Wheatgerm
Wrinkles – Olive, Apricot, chandan, Aloevera
Stretch marks – Rosewood, Rose, Wheatgerm, Geranium, Almond, Lavendar, Neroli, Jojoba etc. Massage.
Breast Development –
Geranium, Jojoba, Ylang, Aloe Vera, Almond (Massage)

5.0 THERAPEUTIC & MAGICAL BLENDS IN BEAUTY CULTURE 6

5.1 The Body –

Muscular Acnes and Plains – Juniper, Lavendar, Rosemary, Almond, Cinnanmon etc.

Nourishing Hands and Body – Grapeseed, Rosewood, Almond, Geranium etc.

Insomnia – Lavendar, Sandalwood, Cedar, Bay Galangal, Lemon, Peppermint, Orange, eucalyptus etc.

Weight & Flat Loss – Cade, Lemon, Juniper, Lavendar, Patchavli etc.

5.2 The Breath –

Bronchitis' – Bergamot, Sandalwood, Eucalyptus, Camphor

Asthama & Sinusitis – Liky, Myrtle, Sage, Thyme, Rosemary, Lavender etc.

Coug –Frankincense, Jasmine, Eucalyptus, Peppermint,

5.3 The Blood –

Stimulate Circulation – Rosemary, Bay, Camphor, Cinnamon, Pine etc.

Build-up Blood – Lemon,Galangal, Rosemary

Low Blood Pressure – Lavender, Orange, Ylang Ylang

Raise Blood Pressure – jasmine, Pine, Rosemary

5.4 The Life & Spirit –

Aphrodisiacs – Rose, Sandalwood, Cinnanon, Jasmine, Ylang, Patchouli

Impotence – Juniper, Rosemary, Sandalwood, Jasmine, Musk etc.

Painful Menstruation – Calarysage, Galangal, Lavender, Cypress, Geraniu, Rose Pine, Piperment etc.

Depression – lavender, Orange, Jasmine, Lemon, Bay, Frankincense, Ylang, Tulsi, Camomile, Bergamot etc.

Relief in Anxiety – Lavender, Benzoin, Patchouli, Rose, Camphor, Cedarlwood, Sandalwood, orange, Apple, Lemon, Marjoram etc.

Self-confidence – Amber, Lavender, Neroli, Basil, Eberry, Heliotrope, Carnation, Cinnamon, Bergamot

5.6 Magical Blends **-**

Happiness – Orange, Ylang, Gardenia, Bergamot, Apple etc.

Psycnic Development – Ylang, Mimosa, Bergamot, Thyme, Bay, Violet, Camomile, Ginger, Elderberry etc.

Health Rejuvenation – Myrrh, Bay, Clove, Sandalwood, Lily, Eucalyptus, Pine etc.

Attraction – Patchouli, Lavender, Cedarwood

Success – Haliotrope, Lavender, Patchouli, Cinnamon etc.

Calming – Rose, Gardenia, Eucalyptus, Amber etc.

Meditation – Violet, Myrrh, Gardenia,Violet etc.

6.0 MASSAGE METHODS IN AROMATHERAPY 6

6.1 Atmosphere -

Soft & Light

Colourful

No Sound Zone

6.2 Massage Table

6.3 Selection of Essential Oil –

As per Body Constitution

As per Healing Properties
Proper Blending
As per therapeutic Requirement

6.4 Strokes Used in Massaging

Gliding -
- Long Stroke
- Broad Circling
- Feathering

Medium Depth -
- Kneading
- Pulling
- Wringing

Deep Pressure -
- Thumb Rolling
- Fingertip Pressure

Percussion -
- Hacking
- Pummelling
- Plucking

6.5 The Basic Massage Sequence -

Back
Back of Leg's
Front of the Body –
- Shoulders, Neck and Head
- Face
- Arms & Hands
- Front of the Torse
- Front of the Leg's
- Connecting

SUGGESTED IMPLEMENTATION STRATEGIES:

- Theory should be synchronised with practical sessions.
- Visit to Massage centre should be arranged.
- Demonstration of different methods of application of oil to skin, hair and other parts
- of the body should be done.

SUGGESTED LEARNING RESOURCES :

(a) Reference Books:

S. No.	Title	Author, Publisher, Edition & Year
1	Essential Oils for Radiant Health	Susanne Fischer Rizzi , 1998
2	Aromatherapy a Complete Guide to the Healing Art	Kathi Kerlhi and Mindy Green
3	Ayurveda a brief introduction and Guide	Dr. Vasant New Mexico, 1996
4	The Magic of Aroma Therapy	Guydion O' Hara Texas, 1998
5	The Essential Oils	Van Nostrand Co. Inc., New York, 1949-52
6	Aroma Science : The chemistry and Bioactivity of Essential oils	Lis- Balchen, M. Christchurch, Dorset, Amberwood, 1995
7	Aromatherapy and the Health Professionals	Price, S. & Price, L. Edinburgh, Churchill, Livingstone, 1995
8	The Practice of Aromatherapy	Valnet, J. Saffron Walden, Essex, C.W. Daniel, 1980

(b) Others:

- Video & CD on Massage
- Charts on various types of oils and their application.

HERBS IN HEALTH & DIET

L	T	P	Curri. Ref. No.: HT602
3	1	0	

Total Contact hrs.:
Lecture: 45
Tutorial: 15
Practical: 0
Credit : 4

Total marks: 100

Theory:
End Term Exam.:75
P.A: 25

RATIONALE

This subject develops skills of using balanced and nutritive diet for health using the herbal species available in Arunachal Pradesh. The students will be able to identify the herbal species of Arunachal Pradesh for use in different ailments of the body.

D E T A I L C O U R S E C O N T E N T

THEORY:

UNIT	TOPIC / SUB-TOPIC	Lecture Hrs.
1.0	**IMPORTANCE OF DIET IN HEALTH**	**2**
	1.1 Introduction to dietetics	
	1.2 Dietary guidelines	
	1.3 Healthy eating and Malnutrition	
	1.4 Food safety and food value	
2.0	**FOOD REQUIREMENTS**	**2**
	2.1 Classification of food requirements	
	2.2 Balanced diet	
	2.3 Nutritional deficiency disorders their treatment and prevention	
3.0	**ESSENTIAL NUTRIENTS THEIR SOURCES & FUNCTION**	**4**
	3.1 Carbohydrates	
	3.1.1Types of Carbohydrates	
	3.1.2Sources of Carbohydrates	
	3.1.3Functions of carbohydrates	
	3.2 Fats	
	3.2.1Saturated Fats and Unsaturated Fats	

3.2.2Sources of Fats
3.2.3Functions of Fats

3.3 Proteins
3.3.1Types of Proteins
3.3.2Sources of Proteins
3.3.3Functions of Protein

3.4 Minerals
3.4.1Types of Body Minerals
3.4.2Sources
3.4.3Function of Minerals

3.5 Vitamins
3.5.1Classification of Vitamins
3.5.2Sources
3.5.3Functions of Vitamins

3.6 Water
3.6.1Sources
3.6.2Functions

3.7 Roughage
3.7.1Sources of Roughage and Function

4.0 BALANCED DIET FOR HEALTH 4

4.1 Basic ingredients of normal diet.
4.2 Requirement of calorie for healthy diet.
4.3 Balanced diet in terms of cost-vegetarian herbal diet and non-vegetarian diet.
4.4 Calorie need for different age group.
4.5 Identification of herbal species of Arunachal Pradesh for health and diet.
4.6 Diet for reducing and putting on weight.
4.7 Seasonal diet.

5.0 HERBAL DIET FOR AILMENTS OF DIGESTIVE SYSTEM 6

5.1 Herbal diet for Dypepsia
Ginger, Cinnamon, Cardamoms, Coriander, Lemon Juice, Amla, Harda, Tomato, Heengh (asafoetida) etc.

5.2 Herbal diet for Constipation
Rose buds, Sonamukhi leaves, Harad, Leafy Vegetables, Musk Melon, Papaya, Mangoes, Plenty of Water, Fiber base Fruits & Vegetables etc.

5.3 Herbal Diet for Diarrhoea

5.4 All parts of babul tree, Zeera (cumin Seeds), Caraway seeds, Catechu, Cinnamon, Long pepper (Pippali), Liquid or Semi liquid diet, Soups etc.

5.5 Herbal diet for Gastritis
Amla, Old-Rice, Wheat ,barley, Green Banana, Pumpkin, Pomegranate etc.

5.6 Herbal diet for Dysentery and Colic Pain
Bel (Marmelose), Mehandi seeds, Nagarmotha (Nut. Grass), Citrus fruits, Sunth, Tulsi, Lemon, Ginger etc.

6.0 HERBAL DIET FOR CARDIOVASCULAR SYSTEM 4

6.1 Herbal Diet for diseases & Blood Pressure

Bark of Arjuna tree (Terminalia arjuna), Cow Milk with Pippali, Juices of Fruits & Vegetable, Carrots, Unsaturated Fatty oils, Avoide Smoking etc.

7.0 HERBAL DIET FOR METABOLISM & ENDOCRINE GLANDS AND JOINT DISEASES 6

7.1 Herbal Diet for Diabetes Mellitus

7.2 Rose apple (Jamun), Karela, drum sticks, Leaves of Neem & bilva, Haldi, Amla, Lemon, Tomato, Garlic, Mozambique etc.

7.3 Herbal Diet for Obesity

7.4 Bittergourd, Drumstick, Harda (Chebulic Myrobalan) Powder, Guggule, Triphla (Amla, Harda, Behada),

7.5 Herbal Diet for Spondylosis and Arthritis

7.6 Bitter Vegetables, Drumstick, Neem Flowers, bittergourd, Wheat, Harad, Saunth, Beet Root, Orange, Carrot, Garlic, Carum Copticum (*Ajouan*), Apple, Mulberry, Banana, Guggule etc.

8.0 HERBAL DIET FOR URINARY AND REPRODUCTIVE SYSTEM 6

8.1 Herbal Diet For Stones or Calculi

Honey, Lemon water, Sugar cane, Haldi Cucumber, Apple, Raw Coconut

8.2 Herbal Diet for Prostate Gland

Seeds of Cucumber & black carrots, Garlic, Lemon, Mozambique, Orange etc.

8.3 Herbal Diet for Cancer :

Neem leaves, Chopchina, Guggule, Tulsi, Fenugreek, Carrot, Tomato, Spinach

8.4 Herbal diet for Gynaecological Disorders:

White pumpkin, Papaya, Drumstick, Bittergourd, Cucumber, Garlic, Potatoes, Old rice, wheat, Moong dal, Amla,Jack Fruit, Sugar cane Juice, Banana, Ashok, Lodhra bark, Shatavari, Bala, Shilajit, Heeng (asafoetida)

9 BEAUTY WITH FRUITS & VEGETABLES 6

9.1 Importance of Fruits & Vegetable in health and diet

9.2 External Applications of fruits and vegetables

- Apple- Hair rinse, Face Pack
- Apricot- Skin Creams
- Banana- Face mask
- Carrot- Nourishing Cream, Swelling around eyes
- Castor oil- Penetration
- Clove- Antiseptic
- Cucumber- Cleansing3
- Dhania- Shave lotion

- Honey- Moisturisers
- Palak- Dandruff
- Tomato- Toning, Greasy Skin

9.3 Internal use of fruits and vegetables
- As per therapeutic effect

9.4 Herbal Beauty Care –
-

SUGGESTED IMPLEMENTATION STRATEGIES:

- Classroom demonstration should be arranged during teaching using different samples.
- Visit to health club.
- Expert lectures should be arranged by calling dietician.
- Motivation and counseling of students for taking herbal diet.(I)

SUGGESTED LEARNING RESOURCES

(a) Reference Books:

S. No.	Title	Author, Publisher, Edition & Year
1	Therapeutic Index	Pharmaceuticals Co. Latest
2	Pharmacopoeia of India	Ministry of Health New Delhi, 1985
3	Introductory Plant Physiology	Pay Noggle, G and Fritz G.J. Prentice Hall of India Pvt. Ltd, New Delhi, 1986
4	Phytochemistry	Miller.L.P. Van Nostrand Reinhold Co. , 1973
5	Practical Pharmacognosy	Vallabh Prakashan, Delhi, 1997
6	Exercises in Evaluation of drug and Surgical Dressings	Schellard.E.J. Pitman Medical Publishing Co.Ltd., London
7	Pharmacognosy	Nirali Prakashan Jageswari mandrilane, Pune, 1998

(b) Others:

- Samples of different herbal products.
- Calorie chart should be used.
- Video programmes can be used.
- Literature/ Journals on eating to be healthy.

QUALITY ASSURANCE OF HERBAL MEDICINES

L	T	P	Curri. Ref. No.: HT603
3	1	0	

Total Contact hrs.:
Lecture: 45
Tutorial: 15
Practical: 0
Credit : 4

Total marks: 100

Theory:
End Term Exam.:75
P.A: 25

RATIONALE

With the increase in use of herbal medicine and lack of effective quality regulation, their safety has become a major concern. This paper elaborates the regulatory requirements related to quality assurance, suitable methods for quality assurance and safety requirements & assessment procedures for herbal medicines as per USFDA Certain guidelines related to quality assurance are also discussed.

D E T A I L C O U R S E C O N T E N T

THEORY:

UNIT	TOPIC / SUB-TOPIC	Lecture Hrs.
1.0	**EVALUATION OF DRUGS**	**8**

1.1 Concept, considerations, parameters and methods of quality control for medicinal plant materials as per various pharmacopoeia and other guidelines.
1.2 Preparation of monograph of crude drug.
1.3 Comparative study of IP, European Pharmacopoeia, BP / Ayurvedic
1.4 Pharmacopoeia of India / Ayurvedic formulary of India and WHO guidelines in relation to above.
1.5 Application of chromatographic techniques in separation and identification of natural products.
1.6 Only interpretation of data UV, IR, NMR, H NMR, C NMR & Mass spectroscopy for purification and structural elucidation of phytoconstituents.
1.7 Herbal fingerprint profile of single and multi component herbal drugs.
1.8 Stability testing of natural products.

2.0 ANALYSIS OF AYURVEDIC FORMULATIONS AND CRUDE DRUGS 8

2.1 Analysis of Ayurvedic Formulations and crude drugs with references to: Identity, purity and quality of crude drugs.
2.2 Determination of pesticide residues, determination of arsenic and heavy metals,
2.3 Determination of microorganisms,
2.4 Determination of microbial load in crude drugs.
2.5 Identification of aflatoxins in crude drugs.
2.6 Quality assurance in herbal drug industry, concept of GMP and ISO-9000.

3.0 QUANTITATIVE MICROSCOPY 8

3.1 Quantitative microscopy, including lycopodium spore method as applied to drug evaluation pollen grain analysis.
3.2 Principles and procedures of microtomy and advanced histological techniques as applied to Pharmacognosy.
3.3 Principle and procedure involved in biological test of the following:
- Presence of Mycobacterium tuberculosis
- Living contaminants in vaccines
- Determination of toxic elements

4.0 STUDY OF PHARMACOLOGICAL SCREENING METHODS 8

4.1 Study of pharmacological screening methods of the following categories of drugs: Antiinflammatory, hypolipidemic, diuretics, cardiovascular, hepatoprotectives, anticancer, antidiabetics, antiulceratives, antioxidants, immunomodulators, antimalarial, antimicrobial, antiallergic and antifertility.

5.0 REGULATORY REQUIREMENTS FOR NEW DRUGS 8

5.1 Markers constituents - Definition, importance in crude drug standardization.
5.2 Examples of Biomarkers.
5.3 Standardization, quality, efficacy and safety requirements & assessment procedures for herbal medicines as per USFDA.
5.4 Evaluation of Drugs

SUGGESTED LEARNING RESOURCES

Reference Books:

S. No.	Title	Author, Publisher, Edition & Year
1.	Drug Discovery and Evaluation	Vogel
2.	Use of Pharmalogical Techniques for the Evaluation of Natural Products	Dhawan, B.N., Shrimal, R.C., , CDRI, Lucknow
3.	Ayurvedic Formulary of India	
4.	Ayurvedic Pharmacopoeia of India	
5.	Indian herbal Pharmacopoeia	
6.	Pharmacognosy and Pharmacobiotechnology	Ashutosh Kar, New Age International Publishers
7.	Indian Pharmacopoeia 2007	
8.	European Pharmacopoeia	6 th Edn. 2008
9.	Quality Control of Herbal drugs. An Approach to Evaluation of Botanicals	Pulok K. Mukherjee
10.	Quality Control Methods for Medicinal Plant Material	WHO Headquarters, Geneva
11.	Standardization of Botanicals	V. Rajpal, Vol. I & II, Eastern Publishers, New Delhi
12.	Pharmacognosy	Evans, W.C., Trease & Evans, W.B. Saunders & Co. London
13.	Instrumental Methods of Analysis	Willard, H.H., Merrit, L.L., Dean, J.A., Settle P.A.,
14.	Indian Herbal Pharmacopoeia, Vol. 1 & 2	
15.	Practical Pharmacognosy	Wallis, T.E.,.
16.	Plant Drug Analysis, A Thin layer Chromatography Atlas	Wagner

COLD CHAIN MANAGEMENT

L	T	P	Curri. Ref. No.: HT604
3	1	0	

Total Contact hrs.: Lecture: 45
Tutorial: 15
Practical: 0
Credit : 4

Total marks: 100

Theory:
End Term Exam.:75
P.A: 25

RATIONALE

The study provides knowledge how to store and transport the plant products at low or freezing temperature to keep it stable, with a proper theoretical background.

D E T A I L C O U R S E C O N T E N T

THEORY:

UNIT	TOPIC / SUB-TOPIC	Lecture Hrs.
1.0	**FUNDAMENTALS OF FREEZING**	**6**
	Glass transition in frozen foods and biomaterials, Microbiology of frozen food and medicinal products, thermophysical properties of frozen food, freezing loads and freezing time calculations, innovations in freezing process.	
2.0	**FACILITIES FOR THE COLD CHAIN**	**8**
	2.1 Freezing methods and equipment, 2.2 Cold storage design and maintenance, 2.3 Transportation of frozen products, retail display equipment and management, house hold refrigerators and freezers, 2.4 Monitoring and control of cold chain	
3.0	**QUALITY AND SAFETY OF FROZEN FOOD AND MEDICINAL PRODUCTS**	**12**
	3.1 Quality and safety of food, medicinal and related products. 3.2 Quality and safety of frozen vegetables, 3.3 Quality and safety of frozen fruits,	

4.0 MONITORING AND MEASURING TECHNIQUES FOR QUALITY AND SAFETY 8

4.1 Chemical measurements,
4.2 Sensory analysis of frozen foods, food and plant product borne illnesses and detection of pathogenic microorganisms,
4.3 Shelf life prediction of frozen food and medicinal product.
4.4 Packaging of frozen food

SUGGESTED LEARNING RESOURCES

Reference Books:

S. No.	Title	Author, Publisher, Edition & Year
1.	Preservation of Fruits and Vegetables	Lal, G., Siddappa, G. and Tondon G.L. :, Indian Council of Agricultural Research, New Delhi. (1986).
2.	Textbook of Food Science and Technology	Vijaya Khader, "", ICAR, NewDelhi (2001).
3.	Strategic Supply Chain Management : The five disciplines for top performance	S Cohen and J Roussel, , McGraw-Hill Co, (2004).