

॥ अत्सी ढेटवू ज्ञानज्योत ॥



**NORTH MAHARASHTRA UNIVERSITY,  
JALGAON**

**Syllabus for**

**B. PHARMACY**

**(THIRD YEAR)**

**(w.e.f. July, 2001)**

NORTH MAHARASHTRA UNIVERSITY, JALGAON

SCHEME OF EXAMINATION OF B. PHARMACY.

THIRD YEAR B. PHARMACY.

(With effect from July, 2001)

Sr. No.	Subjects	Theory				Practicals			
		University		Sessional	Total	University		Sessional	Total
		Hrs.	Marks	Marks	Marks	Hrs.	Marks	Marks	Marks
3.1	Pharmaceutics - II	03	80	20	100	06	80	20	100
3.2	Pharmaceutical Engineering	03	80	20	100	--	--	--	--
3.3	Organic Chemistry - II	03	80	20	100	06	80	20	100
3.4	Pharmaceutical (Medicinal) Chemistry - I	03	80	20	100	06	80	20	100
3.5	Pharmaceutical Analysis - II	03	80	20	100	04	80	20	100
3.6	Pharmacology & Toxicology	03	80	20	100	--	--	--	--
3.7	Pharmacognosy & Phytochemistry - I	03	80	20	100	04	80	20	100
3.8	Biotechnology & Fermentation Process	03	80	20	100	--	--	--	--

Total: 800

500

Grand Total: 1300

**NORTH MAHARASHTRA UNIVERSITY, JALGAON**

**STRUCTURE OF B. PHARMACY COURSE & SCHEME OF TEACHING**

**THIRD YEAR B.PHARMACY**

**( With effect from July, 2001)**

<b>Sr. No.</b>	<b>Subject</b>	<b>Theory</b>	<b>Practical</b>
3.1	Pharmaceutics - II	03	03
3.2	Pharmaceutical Engineering	03	--
3.3	Organic Chemistry - II	03	03
3.4	Pharmaceutical (Medicinal) Chemistry - I	03	03
3.5	Pharmaceutical Analysis - II	02	03
3.6	Pharmacology & Toxicology	03	--
3.7	Pharmacognosy & Phytochemistry - I	02	03
3.8	Biotechnology & Fermentation Process	03	--
	<b>Total :-</b>	<b>22</b>	<b>15</b>

**NORTH MAHARASHTRA UNIVERSITY, JALGAON.**  
**THIRD YEAR B. PHARMACY SYLLABUS.**

**3.1-Pharmaceutics-II. (Theory)**

(2hrs/week)

**(With effect from July, 2001)**

**Section-I**

TOPICS	Hrs.
1) <b>Tablets:-</b> Formulation development : types of tablets, properties of drugs such as compressibility, flowability, dose, stability, site of drug release & absorption, additives & factors affecting their selection viz.- diluents, binders, disintegrants, lubricants, preservatives, organoleptic agents. Direct compression - properties of drugs & additives & direct compressible additives, Formation wet & dry granulation properties of granules. Introduction to advance granulation techniques : Extrusion-sphoronisation & pelletization & spherical crystallisation, fluid bed granulation. Manufacturing : Environmental controls, processing steps, equipments for granulation (mixing, granulation & drying) & compression. I.P.Q.C. & Q.C. Problems in tableting & remedies thereof.	07
2) <b>Effervescent Tablets :-</b> objectives, raw materials, effervescent sources, binders, diluents & lubricants. Processing, environmental control, dry granulation, wet granulation & fluidized bed granulation, Mfg. operation & equipments, packaging & evaluation.	02
3) <b>Chewable Tablets :-</b> Formulation factors including organoleptic considerations. Formulation & Mfg. of antacid, cough & vitamin- mineral products, packaging & evaluation.	02
4) <b>Coating of Tablets :-</b> Types (sugar, film & press coating). Material used & processed employed for each, coating equipments including diff. Types of coating pans, fluid bed coating. Evaluation of coated tablets & packaging of coated tablets.	03
5) <b>Hard Gelatine &amp; Soft Gelatine Capsules :-</b> Introduction, shell excipients, Mfg. of shells, properties of raw materials, environmental controls, evaluation, filling equipments for hard gelatine capsules. Processing, I.P.Q.C., evaluation of finished capsules & official standards.	07
6) <b>Microencapsulation :-</b> Definition, applications, methods of microencapsulation, coacervation, phase separation, pan coating, air suspension coating, solvent evaporation, multiorifice centrifugal, spray drying & spray congealing. Advances in microencapsulation technology. Mfg. Processes & equipments for coacervation phase separation. Quality control standards & evaluation of microencapsules.	05

**Section-II**

TOPICS	Hrs.
1) <b>Cosmetics:-</b> Definition, types, cosmetics Vs drug formulation, formulation, Mfg. & evaluation of following cosmetics a) <b>Creams :-</b> cold cream, vanishing cream, hand & body lotion, protective cream, shaving cream.	08

b) <b>Coloured Cosmetics</b> :- lipstick, eye shadow, eye makeup, mascara	
c) <b>Dental products</b> :- Dentifrices, dental creams, tooth powder.	
d) <b>Hair cosmetics</b> :- Shampoos, Hair removing preparations.	
e) <b>Toxicity of cosmetics</b> :- Irritation, sensitisation, photoirritation, photoallergy, ocular irritation, baby cosmetics requirements	
2) <b>Semisolid Dosage Forms</b> :- Classification, dermatological & transdermal preparations, transdermal preparation enhancer Ointments bases, formulation factors. Mfg processes & equipments, packaging & evaluation, quality control.	07
3) <b>Disperse Systems</b> :- Free energy considerations, thermodynamic Vs. Kinetic stability. Classification of disperse systems. Suspensions : physicochemical principles, theory of suspension, DLVO theory, wetting, sedimentation, flocculated & deflocculated systems. Structured vehicles, particle size charges & caking in suspensions, imp. of changes in solubility because of change in particle size Formulation of P'ceutical suspensions (oral & topical), suspending agents, wetting agents, dispersants, deflocculating agents & flocculating agents.	09
4) <b>Emulsions</b> :- Physicochemical principles, theory of emulsification. Creaming coalescence, cracking, role of viscosity, energy barriers to coalescence, film barriers, steric stabilisation, emulsifiers & choice of emulsifiers, HLB value & phase inversion temperature	09
<b>Total Hrs. :- 59</b>	

#### References Books :-

- 1) P'ceutical dosage forms - Ansel.
- 2) American Pharmacy - Dittert
- 3) Remington's Pharmaceutical Sciences - Alfonso R. Gennaro.
- 4) Bentleys T B. of pharmaceutics - Rawling.
- 5) Frbisher - Fundamentals of microbiology.
- 6) Industrial Pharmacy (Lea & Febiger), Modern Pharmaceutics - (Dekker).
- 7) Groves - Parenteral Products.
- 8) Hanlon - H. B. of Package Ringg
- 9) Swarbrick & Boyan - Encyclopedia of Pharm Tech.

### NORTH MAHARASHTRA UNIVERSITY, JALGAON. THIRD YEAR B. PHARMACY SYLLABUS.

#### 3.1-Pharmaceutics-II. (Practicals)

(3hrs/week)

**( With effect from July, 2001 )**

- 1) Evaluation of any 4 excipients
- 2) Preparation & evaluation of compressed tablet (wet & dry granulation).
- 3) Tablet coating (Demonstration).
- 4) Filling of hard gelatine capsule & its evaluation.
- 5) Dry syrup formulation
- 6) Microencapsulation of any solid drug
- 7) Topical semisolids (covering creams, pastes, gels, ointments)
- 8) Emulsions (liq paraffin emulsion & Turpentine liniment)
- 9) Suspensions (calamine lotion & antacid suspension).
- 10) Cosmetics :- Vanishing cream, Hand & Body lotions, Sunscreen cream, Shaving cream, Eye Shadow, Lipstick, Tooth paste, Mouthwash, Tooth Powder, Shampoo, Depilatory, Baby cosmetics.

NORTH MAHARASHTRA UNIVERSITY, JALGAON.

THIRD YEAR B. PHARMACY SYLLABUS.

3.2-Pharmaceutical Engineering. (Theory)

(3hrs/week)

(With effect from July, 2001)

Section-I

TOPICS	Hrs.
<b>Note :- Numerical problems not included.</b>	
1) <b>Fluid flow :-</b> Fluid status, mechanism of fluid flow, Bernoulli's theorem, fluid heads.	03
2) <b>Heat Transfer :-</b> Modes of heat transfer, heat transfer in solid & liquids, heat transfer equipments, heater & heat exchanger.	03
3) <b>Handling &amp; conveying :-</b>	03
a) <b>Solids :-</b> Portable power driven machines, trucks, trailers, power shovels, gantry cranes. Permanent installations for handling solids, conveyors-belt, chain, screw & pneumatic conveyors.	
b) <b>Fluids :-</b> Pipes & fittings, valves, plugs, globe, gate & check valves, pipe connections, application in pharmacy e.g. In water management, & handling of liquid dosages forms.	
4) <b>Distillation :-</b> Boiling point & equilibrium diagrams, principles of fractionation, small scale & large scale batch type & continuous type fractionation, fractionating columns & their accessories, reflux, vacuum, steam distillation & their molecular distillation. Application of distillation to solvent purification, mfg. of essential oils & alcohol distillation.	06
5) <b>Drying :-</b> Theory & mechanism of drying, equipments, classification, batch dryers, continuous dryers, atmospheric pressure & vacuum dryers, introduction to tray, cabinet, truck, tumbling, fluidized bed, spray, drum, rotary & freeze drying. Uses of dryers in pharma departments like tablets.	04
6) <b>Measurements :-</b>	04
a) <b>Flow :-</b> classification & description of various fluid flow measuring devices like orifice, venturi, pilot tube, rotameter, & current meters.	
b) <b>Pressure :-</b> Classification & description of various pressure measuring devices.	
c) <b>Temperature :-</b> Various direct & indirect (remote) methods using mechanical & electrical principles.	
7) <b>Safety :-</b> Hazards & their classification - mechanical, fire, chemical & occupational, their types & prevention, fire & explosion - Chemistry of fire, classification of fire, method of extinguishing accidents - unsafe actions, unsafe conditions, financial losses, costs prevention. Accidents safety training & education.	02
8) <b>Electrical engineering :-</b> Single & three phase current, transformers, voltage stabiliser, surge suppressors, isolation transformers, circuit breakers, electrical motors (AC, DC, Fractional), electrical fitting & wiring - diff. type of switches, socket wires & cables, industrial power distribution, internal wiring, illumination or lighting.	02

**Section-II**

TOPICS	Hrs.
1) <b>Pumping and compression:-</b> Various types of positive displacement ,centrifugal and jet pump for fluids, compression of gases. application in pharmacy in water and effluent handling and in liquid dosage forms mfg.	03
2) <b>Environmental control:-</b> air handling , air conditioning ,refrigeration , water vapour - air mixture ,humidity and particulates in air refrigeration , application of environmental control in pharma department like powder , Tablets,capsules.	03
3) <b>Evaporation :-</b> Introduction ,Factors influencing rate of evaporation, classification of evaporates, pan kettles, horizontal tube, vertical tube & film evaporators. Evaporator accessories, multiple effect evaporators application related to galenicals.	06
4) <b>Water purification:-</b> Deionization, reverse osmosis and distillation processes and large scale for mfg	02
5) <b>Boilers:-</b> main parts, mountings and accessories -industrials boilers including Cochran, Babcock Wilcox and Lancashire.	03
6) <b>Extraction:-</b> Solid -liquid and liquid-liquid extraction ,various small scale and large scale equipment , application of various extractors in the extraction of drugs.	04
7) <b>Crystallisation:-</b> Crystal forms and habits , solubility curves , supersaturation, nucleation , growth, yield and purity -Mier's theory- crystallizers, their classification, design, operation and selection, uses of crystallizers in the mfg. of various therapeutic entities having specific crystalline nature	04
8) <b>Maintenance:-</b> Objective , preventive and corrective maintenance, maintenance record keeping , maintenance of machineries and equipments in P'ceutical Depts. Like - mills, micropulverizer, sifter, mixers & homogenous granulators, compression equipments,coating equipments, packaging equipments, balance, pHmeter, polarimeter, microscope, colorimeter & flame photometer	02
9) <b>Mechanical Engineering :-</b> Basic of engineering drawing, various projection (without the use of drawing board & other engineering drawing accessories) & reading the plan practically. Basic tools, toolbox, hammers, screw, screwdrivers, pliers, wrenches, drills, saws, knives, brushes, spirit levels, files, sand papers, emery papers, measuring tapes, drawing instruments. Introduction to machine parts, various types of gears, belt & chains, bearings, couplings, threaded fasteners, clutches, springs, flywheels, cam & lub & common machine parts present in various pharma. machineries.	04

**Total Hrs. :- 58**

**Books :-**

- 1) **Pharmaceutical Engineering.** - K. Sambamurthy.
- 2) **Introduction to Chemical Engineering.** - W.L.Badger & J. T. Banthero.
- 3) **Unit Process in Pharmacy** - David Ganderton.
- 4) **Unit Operations.** - G.G. Brown
- 5) **Perry's Chemical Engineering Hand Book,** 7<sup>th</sup> edition - Robbert H. Perry, Don W, Green
- 6) **Elements of Mechanical & Electrial Technology.** - B.H Desbamukh., P V Mondke.
- 7) **Machine Drawing.** - N D Bhat.
- 8) **Elements of Heat Engines.**- N G Padya., C.S.Shaha.
- 9) **Industrial Instrumentation** - Donald P Eckman

**NORTH MAHARASHTRA UNIVERSITY, JALGAON.**  
**THIRD YEAR B. PHARMACY SYLLABUS.**

**3.3 Organic chemistry-II . (Theory)**

(3hrs/week)

( *With effect from July, 2001* )

**Section-I**

TOPICS	Hrs
<p>1) <b>Stereochemistry :-</b></p> <p>a) Definition of terms like configuration, conformation.</p> <p>b) Isomerism &amp; its types.</p> <ul style="list-style-type: none"> <li>• Geometrical Isomerism Z &amp; E nomenclature</li> <li>• Any over cis &amp; trans naming.</li> <li>• Cahn - Ingold - Prelog system for assigning Z &amp; E .</li> <li>• Physical &amp; chemical methods for determining the configuration of geometrical isomers.</li> <li>• Optical Isomerism :- Definition of dextrorotatory, laevorotatory, enantiomers, chirality &amp; representations of a chiral centre - Dotted - Line - Wedge, fischer formula, Saw horse &amp; Newman</li> <li>• D &amp; L &amp; R &amp; S nomenclature for one &amp; two chiral centres.</li> <li>• Resolution of racemic mixture</li> </ul> <p>c) Conformation - potential energy for ethane &amp; n-butane, conformation of cyclohexane, potential energy curve, no. of stereoisomers &amp; relative stabilities of di-substituted cyclohexanes,</p>	10
<p>2) <b>Stereoselectivity &amp; stereospecificity :-</b> Definition,</p> <p>a) Stereochemistry of SN1, SN2 reactions &amp; SN1 reaction.</p> <p>b) Syn and Anti Elimination - E1, E2, E1cb elimination pyrolysis of esters, Chugaer elimination (T schuzaeff), Cope elimination (emphasis on stereochemistry)</p> <p>c) Syn and Anti Addition Reactions - catalytic hydrogenation of alkenes and alkynes addition of halogens, hydroxylation , hydroboration (emphasis on stereochemistry)</p>	10
<p>3) <b>Molecular Rearrangements - Mechanism and Stereochemistry,</b></p> <p>a) Rearrangement of electron deficient systems, General Theory, Whitmore - 1, 2 shift, Wegner - Meerwein rearrangement, Pinacol rearrangement, wolff rearrangement, Beckman rearrangement, Hoffman rearrangement, Losses rearrangement, Curtius rearrangement, Schmidt rearrangement, Baeyer - Villiger oxidation.</p> <p>b) Election-rich rearrangements Stevens rearrangement, Wittig rearrangement, Neber reaction, Benzilic acid rearrangement, Dakin oxidation, Sommelet rearrangement, Favourskii rearrangement</p> <p>c) Migration of aromatic rings Fries rearrangement, Claisen rearrangement, Willgerodt reaction</p> <p>d) Migration involving double and triple bounds, Cope rearrangement.</p>	20



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**Section-II**

TOPICS	Hrs
4) <b>Free Radicals</b> Structure and stereochemistry, Stability. Generation of free- radicals - Thermal decomposition photochemical, oxidation reduction and electrolysis. Radical anions and cations - definitions and some organic reactions involving them as intermediates. Free radical reactions - Kolbe electrolysis, Hunsdiecker reaction, Sandmeyer reaction. Gomberg reaction.	05
5) Chemistry structure (Structure, Synthesis and reactions) of polycyclic compounds like naphthalene, anthracene and phenanthrene involving substituents	15
6) Chemistry (Structures, synthesis and reactions) of heterocyclic compounds like furan, pyrrole, thiophene, indole, pyridine, quinoline isoquinoline, imidazole, thiazole, oxazole and pyrimidine both the parent compounds and also substituted compounds .	15

**Total Hrs. :- 75**

**BOOKS:**

- 1 Pine, Hendrickson, Cram and Hammond - Organic Chemistry (McGraw- Hill)
  2. Allinger, Cava, De Jough Johnson, Lebel, Stevens - Organic Chemistry (Worth)
  - 3 Neckers and Doyle - Organic Chemistry (John Wiley)
  - 4 Morrison and Boyd - Organic Chemistry (Prentice Hall)
  - 5 Agronomov et al - Problems and exercises in Organic Chemistry (Mir Publishers)
  6. Organic Chemistry - Streitweiser and Heathcock (Academic press)
  7. D. Nasipuri - Stereochemistry of Organic compounds - Principles and Applications (Wiley Eastern LTD )
  8. Peter Sykes - The search for Organic reaction pathways. (Longman Group Ltd.)
  9. Gurdeep Ghatwal - Synthetic Organic Chemistry (Himalaya Publishing house).
  - 10 Finar - Problems and there solution in Organic chemistry (Logman Group Ltd )
- Criddle and Ellis - Spectral and chemical characterization of Organic compounds. A laboratory handbook (John wiley and sons).

**NORTH MAHARASHTRA UNIVERSITY, JALGAON.**  
**THIRD YEAR B. PHARMACY SYLLABUS.**

**3.3 Organic chemistry-II . (Practicals)**  
(3hrs/week)

**( With effect from July, 2001 )**

1. Separation of binary mixtures by physical and chemical methods is using acidity/basicity, solubility in water and ether and volatility. \characterisation and identification of the individual components followed by preparation of a suitable derivative.
2. Quantitative Analysis (Estimation of functional groups)
  - a) Hydroxy group in alcohols (by acetic anhydride) and phenols (Acetic anhydride and iodometry)
  - b) Acyl group (by alkali hydrolysis)
  - c) Amino group in aliphatic amines (by acetylation) and aromatic amines (by acetylation and iodometry).
  - d) Nitro group (reduction by  $\text{SnCl}_2$  solution)
  - e) Amido group (Hydrolysis with alkali)
  - f) Carboxyl group (volumetric and gravimetric silver salt method)
  - g) Analysis of oils - Acid value, sap value, peroxide number and iodine value.

**BOOKS:**

1. Practicals Organic Chemistry by F,G,Mann et al Publishers Orient Loughman.
2. An introductory course in Practical Organic Chemistry by F.D. Crenstone et al.
3. A text book of Practical Chemistry for B.Sc. by V.V. Nadkamy Publisher : Popular prakashan.
4. Introduction of Organic Laboratory Techniques a contemporary approach by D.L. Pavia publisher Saunders Golden Smburst.
5. Furniss B.S. & other - Vogel's Text book of practical Organic Chemistry Pub. ELBS.
6. Clanke and others - A hand book of Organic analysed - Quantitative and Quantitative - 5<sup>th</sup> edition, Publisher - Aronold Herneman.
7. Williamson K.L. Macroscale Organic Experiments Pub. D.C. Health and camb.

**NORTH MAHARASHTRA UNIVERSITY, JALGAON.**  
**THIRD YEAR B. PHARMACY SYLLABUS.**  
**3.4-Pharma(Medicinal) chemistry-I. (Theory)**

(3hrs/week)

( With effect from July, 2001 )

**Section-I**

TOPICS	Hrs.
1) <b>Theoretical aspects of drug action:-</b> a) The Ferguson principle b) Physicochemical parameters and pharmacological activity-solubility, partition coefficient, surface activity, pka, ionisation, steric factor, c) Stereochemistry and biological activity	06
2. <b>Metabolism:-</b> a) Routes of elimination b) Factor affecting metabolism- genetic factors, physiological factors, pharmaceutical factors, drug interactions c) Metabolic process- Phase-I (Oxidation, reduction, hydrolysis) Phase - II(Glucuronide conjugation, acylation, methylation, mercapturic acid formation and sulphate conjugation) d) Relationship of drug metabolism to drug design	05
3. <b>Antitubercular and antileprotic agents:-</b> PAS, isoniazide, pyrazinamide, ethionamide, ethambutol, and antitubercular antibiotics, like rifampin, cycloserine, and streptomycin. Dapsone and derivative, clofazimine General principals involving drug combination	06
4. <b>Antimalarials:</b> Life cycle of parasite and drug acting on the various stages Cinchona alkaloids, Artemisinin and derivatives, synthetic antimalarials, 4- aminoquinoline- chloroquine and other 5- aminoquinoline - primaquine and others 6- aminoacridine- quinacrine Quinoline methanol derivatives- Mefloquine Folic acid inhibitors Misc like- halofantrine	06
5. <b>Anthelmintics</b> Trematodes diseases (Schistosomiasis), lucanthone, hycanthone, niridazole, oxamiquine praziquantal Cestode disease (tapeworm)- niclosamide Nematode infection on onchocerciasis ("river blindness")- diethylcarbamazine, ivermectin Gastrointestinal nematodes infections- benzimidazole like mebendazole, parbendazole and others, pyrantel pamoate, levamisole	05
6. <b>Antoamibics:</b> Life cycle of parasite, Ipecac alkaloid- emetine, Metronidazole and tinidazole, diclohexanide, furoate, quinfamide	03

7. <b>Diagnostic agent:</b> Contrast media, classification, agent and to detect dysfunctioning of kidney, heart and other organs	04
8. <b>Hormones:</b> Thyroid hormone, Pancreatic hormone- Insulin preparations	03

**Section-II**

TOPICS	Hrs
1. <b>Antibiotics</b> Introduction to fermentation, procedure for production of antibiotics. B-lactum antibiotics –penicillin and cephalosporin, tetracycline, macrolides, Aminoglycoside antibiotics, lincomycins and the polypeptides. chloramphenicol	10
2. <b>Antifungal agents:</b> Antibiotics like amphotericin B, nystatin, and griseofulvin, Imidazole derivatives like miconazole, fluconazole, ketoconazole, clotrimazole, flucytosine, tolnafate	04
3. <b>Antivirals:</b> Viral replication and difficulties involved in designing an effective antiviral agent as opposed to a antibacterial drug, nucleoside derivatives like idoxuridine, vidarabine, trifluridine, acyclovir, ganciclovir. Inhibitors of reverse transcriptase like zidovudine and (AZT) and nivarapine HIV - protease inhibitors like saquinavir, indinavir, and ritonavir. Other agents like amantadine, enviroxime and ritonavir and its properties.	04
4. <b>Sulphonamides :-</b> Importance of pKa in designing good sulphonamides for ophthalmic infections, burn therapy, and ulcerative colitis synergism with DHFR Inhibitors	05
5. <b>Quinoline Antibacterial agents:-</b> Nalidixic acid, norfloxacin, ciprofloxacin, sparfloxacin	01
6. <b>Antineoplastic agents:</b> Problems faced in cancer chemotherapy, Alkylating agents -Nitrogen mustards, cyclophosphamide, busulfan, carmustine, lomustine, mitomycin-C, dacarbazine and procarbazine.	10
7. <b>Vitamins and Related compounds:-</b> water soluble and lipid soluble vitamins	03

**Total Hrs. :- 75**

**Books :-**

- 1) Principles of Medicinal Chemistry - Foye.
- 2) Wilson & Gisvold, Textbook of Medicinal Chemistry.
- 3) Burger's Medicinal Chemistry.
- 4) Principles of Medicinal Chemistry. - Kadam, Mahadik, Bothra.
- 5) Profiles in Drug Synthesis. - V. N. Gogte.

NORTH MAHARASHTRA UNIVERSITY, JALGAON.

THIRD YEAR B. PHARMACY SYLLABUS.

3.4-Pharma(Medicinal) chemistry-I. (Practicals)

(3hrs/week)

( With effect from July, 2001 )

1. Synthesis of 1,2,3,4 tetrahydrocarbazol
2. Synthesis of Benzylidene acetophenone
3. Synthesis of Pthalamide
4. Synthesis of anthranilic acid
5. Synthesis of O -chlorobenzoic acid
6. Synthesis of Benzoin
7. Synthesis of benzil
8. Synthesis of benzillic acid
9. Synthesis of 8- hydroxy quinoline
10. Friedal crafts acylation / alkylation
11. Synthesis of Acetanilide
12. Synthesis of p- nitro acetanilide
13. Synthesis of p-nitroaniline
14. Synthesis of Hippuric acid
15. Synthesis of p- methoxy phenyl urea.
16. Synthesis of 2- hydroxy 4-methyl quinoline
17. Synthesis of 2,4,6 tribromoacetanilide
18. Synthesis of nitrobenzene

**NOTE:-**

1. 3 hrs/ week
2. Annual practical exam - 4 hrs
3. Atleast 15 experiments should be carried

**BOOKS:**

1. Text Book of Practical Organic Chemistry- A.I Vogel
2. Practical Organic Chemistry- Mann and Sanders,
3. Systematic identification of Organic Composition- Shriner and Fuson.

**NORTH MAHARASHTRA UNIVERSITY, JALGAON**  
**THIRD YEAR B. PHARMACY SYLLABUS**  
**3.5 –Pharmaceutical Analysis-II (Theory)**  
 (2Hrs/week)  
 ( *With effect from July, 2001* )

**Section- I**

TOPICS	Hrs
<b>1. Introduction to Solvent Extraction and its Application</b> <ul style="list-style-type: none"> <li>• Principles of solvent extraction, Distribution ratio, efficiency of extraction, Separation factor</li> <li>• Practical aspects of solvent extraction( factors affecting liquid – liquid extraction)</li> </ul> Selection of solvent as extraction solvent, Method of extraction: Batch, counter-current, continuous extraction, stripping extraction and pH effect	08
<b>2. Principles and theory and instrumentation, application of refractometry. Polarimetry</b>	03
<b>3. Basic concepts in electronics:</b> Ohms Law, vacuume Diode, methods and causes of emission- thermionic emission, photoelectric emission, electric and field emission. Advantages of semiconductors over vacuum tubes-Diodes, triodes, teride, pentode, transistor , digital electronic. Memory devices- Primary(Internal memories) and secondary memory. Digital computers and terminologies –ALU, register unit, control unit. input, output electronic devices, photomultiplier tube. Advantages and disadvantages of computerization. Safety precaution for protecting electronic devices.	03
<b>4. Electrochemical methods:</b> Introduction, theory, instrumentaion and application of conductometry, potentiometry, voltametry, polarography, coulometry, electrogravimetry & amperometry	07
<b>5. Thermal analysis:</b> Introduction to thermal methods of analysis a) Thermogravimetry(TG): Introduction isothermal or static thermogravimetry, Quasistatic thermaogravimetry, recording of result, information from TG curves, factors affecting TG curve, Instrumentation for TG, application of TG b) Differential thermal analysis: (DSC) Introduction, theory, application	04

**Section- II**

TOPICS	Hrs
<b>1. Basic Concepts in Spectroscopy :</b> Introduction – Electromagnetic radiation, Wavelength, wave number, frequency, atomic spectra, molecular spectra. Instrumentation – light sources-IR, Visible & UV. Monochromators – filters, grating. Cells – silica, glass, quartz. Detectors – photo tubes, photo	06

diodes, read out system. Spectrophotometer -- simple beam, double beam.	
<p><b>2. UV – Visible absorption spectroscopy:</b>  Introduction, origin and theory of UV spectra, bathochromic &amp; hypsochromic shift, choice of solvents. Beers Lambert's law, standard absorptivity value, use of calibration graph, single or double standardization, optimum condition for spectrophotometric measurements, quantitative spectrophotometric assay of medicinal substances, assay of substances in multi components samples. Assay using absorbance corrected for interference &amp; absorptiometric assay of following drug monographs in IP : Propranolol tablets, Paracetamol tablets, Carbamazepine / carbamazepine tab , Rifampicin / Rifampicin capsules, Albendazole tab , application to structural analysis ( No problems to be asked in exam.)</p>	06
<p><b>3. Fluorescence spectroscopy :-</b>  Introduction, fluorescence spectra, excitation &amp; emission spectra, Instrumentation, Factors affecting fluorescence intensity, quantitative aspects, application of spectrofluorimeters and photofluorimeters</p>	04
<p><b>4. Infrared spectroscopy:</b>  Introduction, range of IR radiation, Requirments of IR radiation, correct wavelength of radiation, electric dipole, theory of IR absorption spectroscopy, modes of vibration of atoms in polyatomic molecules- stretching vibration, bending vibration, types of stretching and bending vibration, interpretation of IR spectra, quantitative analysis, routine maintenance - dispersive and FT-IR instruments, instrumentations-single beam, double beam spectrophotometer, application to pharmaceuticals, limitation of IR spectrophotometry</p>	06
<p><b>5. Atomic emission and atomic absorption spectrophotometry:</b>  Principle, difference between atomic absorption spectroscopy and flame emission spectroscopy, advantages of AAS over flame emission spectroscopy, limitation, instrumentation, single and double beam spectrophotometer , pharmaceutical application of atomic emission and atomic absorption spectroscopy</p>	03
<b>Total Hours:</b>	<b>50</b>

#### BOOKS:

1. Grant - Statistical Quality Control (MaGraw Hill).
2. Lamprecht- Implementing ISO-9000 series (Dekker)
3. Instrumental methods of analysis- Willard, Dean
4. Instrumental methods of analysis-Ewing.
5. Pharmaceutical analysis-Higuchi and brochmann
6. The quantitative analysis of drugs- Garra
7. Analytical chemistry- MEITES H B.
8. IP, USP,BP, European Pharmacopoeia, International pharmacopoeia
9. Analytical profiles of drug substances -Florey
10. Analytical chemistry- garry Chrisian
11. Principles of instrumental analysis- Skoog
12. Chromatography- Haftmann.
13. Chromatography-Browning
14. Calculation of analytical chemistry- Hamilton, simpson and ellis
15. Quality assurance Guide- OPPI
16. Quality control handbook-Juran
17. Vogel textbook of quantitative chemical analysis.

**NORTH MAHARASHTRA UNIVERSITY, JALGAON**  
**THIRD YEAR B. PHARMACY SYLLABUS**  
**3.5 –Pharmaceutical Analysis-II (Practical)**  
(3Hrs/week)  
( *With effect from July, 2001* )

**List of Experiments:**

1. Potentiometric titration of strong acid Vs strong base.
2. Assay of Diclofenac sodium injection I.P. 1996 potentiometrically.
3. Calibration of conductometer and estimation of conductivity of distilled water.
4. Conductometric titration of strong acid- strong base
5. Conductometric titration of weak acid- strong base
6. Estimation of boric acid by conductometric titration.
7. Calibration of uv-visible spectrophotometer as per I.P
8. Assay of Dextrose injection by polarimeter as per I.P 1996.
9. Assay by fluorimetry of a given drug e.g. Quinine sulphate, Riboflavin.
10. Determination of  $K^+$  from KCl by flame photometry after preparation of calibration curve.
11. Determination of  $Na^+$  from NaCl by flame photometry after preparation of calibration curve
12. Determination of percentage of chloroquine phosphate using solvent extraction (Ether)
13. Estimation of paracetamol by colorimetry.
14. Estimation of salicylic acid by colorimetry
15. Assay of Ergometrine inj/ tablet I.P.
16. Assay of rifampicin tablet as per I.P.
17. Estimation of sodium bicarbonate using pH meter.
18. Determination of refractive index of given sample by refractometry.
19. Estimation of critical micellar conc. of n-butyric acid by Abbe's refractometer.
20. Assay of prednisone/ prednisolone tab. as per I.P.



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**THIRD YEAR B. PHARMACY SYLLABUS.**  
**3.6-Pharmacology & Toxicology. (Theory)**

(3hrs/week)

( *With effect from July, 2001* )

**Section-I**

TOPICS	Hrs.
1) <b>General principles of Pharmacology :-</b> Route of drug administration with special reference to their advt. & disadvt. Absorption, Distribution, Metabolism & Elimination of drugs, factors affecting absorption of drugs Study of drug receptor interaction, Dose-response relationship, drug antagonism. Drug toxicity in man.	20
2) <b>Drugs used in Disorders of Gastrointestinal tract :-</b> a) Antidiarrhoeals. b) Emetics & antiemetics. c) Purgatives. d) Drugs used in the treatment of Peptic Ulceration. e) Digestants & Carminatives.	07
3) <b>Autacoids :-</b> Kinins, Prostaglandins, Histamine-Antihistamines, 5-HT & Antagonist, Leukotriens & cytokines.	08

**Section-II**

TOPICS	Hrs.
1) <b>Drugs acting on Autonomic Nervous System :-</b> a) Cholinergic, Adrenergic transmission & other peripheral transmitters. b) Cholinergic and anticholinergic drugs c) Sympathomimetics and sympatholytic drugs d) Skeletal muscle relaxants e) Ganglion stimulants and blocking drugs f) Miscellaneous- local anaesthetics	15
2) <b>Diuretics and drugs acting on cardiovascular system</b> A) Diuretics B) Drugs used in the treatment of - a) Hypertension b) Angina Pectoris c) Arrhythmias d) Congestive cardiac failure e) Antihyperlipidemic C) Anticoagulants and fibrinolytics	14
3) <b>Drugs effective in respiratory disorders-</b> a) Pharmacotherapy of cough b) Pharmacotherapy of bronchial asthma	02
4) <b>Toxicology:-</b> General principles, management of poisoning due to drugs and chemicals Pesticides , heavy metals, air pollutants	07

**Total Hrs. :- 73**

**BOOKS:**

1. Goodman and Gilman- Pharmacological basis of therapeutics Vol-I & Vol II
2. Satoskar R.S and Bhandarkar- Pharmacology and therapeutics Vol. I & II
3. Lewis pharmacology - Crossland
4. Lourence D.R. and Bennett- Chemical pharmacology
5. Rang and Dale- Pharmacology
6. Sheth and others- selected topics in experimental pharmacology
7. Perry- Pharmacological experiments on isolated preparation
8. McLeod L.J. -Pharmacological experiments on intact preparations
9. Gaitonde B.B. and Nanivadekar -Tutorials in pharmacology

**NORTH MAHARASHTRA UNIVERSITY, JALGAON**  
**THIRD YEAR B. PHARMACY SYLLABUS**  
**3.7 – Pharmacognosy And Phytochemistry-I (Theory)**  
(2Hrs/week)

**( With effect from July, 2001 )**

**Section-I**

TOPICS	Hrs
1. <b>Introduction-</b> Meaning, origin, scope and historical background of Pharmacognosy , alternative system of medicines(Ayurveda, Homeopathy, Unani , Siddha.)	02
2. <b>Introduction to Botany:</b> a) study of different tissue-parenchyma, cholenchyma, sclerenchyma, xylem, phloem, medullary rays, primary and secondary growth in dicots-meosis and mitosis b) General characteristics of woods, barks, leaves, flowers, seeds, fruits, roots and rhizomes	03
3. <b>Sources of drug of natural origin(DONOS)-</b> vegetable, mineral, and marine, their classification(morphological, taxonomically, therapeutically, chemical, and pharmaceutical aids, organized & unorganized drug )]	03
4. <b>Analytical Pharmacognosy :-</b> a) Evaluation & quality control of DONO – Organoleptic, microscopic, chemical, physical, biological including LOD, toluene distillation, foreign organic matter, chemical tests, RF values & spectral analysis data. b) Microscopy & Micrometry – co-oxalate crystals, starches, pollen grains, lycopodium spores, trichomes & leaf constants ( palisade ratio, stomatal no., stomatal index, vein- islet no., & vein termination no.,)	06
5. <b>Cultivation, Collection, Processing of crude drugs</b> including harvesting, drying, garbling, packaging, storage & preservation against enzymatic hydrolysis, Microbes, insects, light ,oxygen and sterilization	02
6. <b>Commence in drugs of DONO-</b> Requirements of identity, purity, potency, safety, efficacy and freedom from microbes	02
7. Sources in variation in quality of DONO-species Variation, time, season of collection, post collection treatment & effect of heredity (Mutation, Chemical races and hybrids).	03
8. <b>Different methods of extraction of crude drugs-</b> infusion, decoction, Maceration, Modified Maceration, percolation, Modified percolation, soxhlet extraction, Different types of extracts- soft, dry, liquid extract. Evaluation of extracts (density, viscosity, optical rotation, R.I. & solid content.	04

**Section-II**

TOPICS	Hrs
1 <b>Introduction to phytopharmaceutical-</b> different classes of active constituents viz., Alkaloids, Glycosides, Vol. oils, Resins, Flavonoids and carbohydrates.	02
2. <b>General biosynthetic pathway of :</b> Alkaloids, carbohydrates, Volatile oils, Glycosides- Sennoside, Diosgenin.	04
3. Detailed study of each category of drug under pharmacognostical and phytochemical scheme.	
A) Carbohydrate and related compounds- Starches and Modified starches- Cellulose, Gums and Mucilage.	05
a) Starches and Modified starches-Including manufacture and characterization of maize, wheat, rice, arrowroot, potato	
b) Inulin (Tarraxacum)-Method of preparation, uses	
c) Cellulose- Cotton(Manufacture of absorbent and non-absorbent cotton wood cellulose and derivatives.	
d) Gums- Guar, Locust bean, Acacia, Tragacanth, Ghatti, karaya, Xanthan and Sterculia Gum	
e) Alginates and Alginic acid	
f) Agar	
g) Carrageenan(Chondrurs & Irish moss)	
h) Mucilage(Psyllium and Isapgol)	
i) Pectins	
B) Glycosides.	
Defination, Description, Classification & study of following drug containing glycosides- Senna, Aloe, Rhubarb, Cascara, Digitalis, Squill, Strophanthus, Dioscorea, Liquorice, Quillaia, Wild Cherry bark, Black mustard, citrus, Psoralea, Cantharides Solanum, Picrorrhiza, Kalmegh, Asparagus, Chirata.	06
C) Resins and resin combinations:	
Defination of resin, oleoresins, oleogumresins, balsam, and glucocoresins, chemical composition of resin components, study of rosin, podophyllum, jalap, turmeric, cannabis, turpentine, capsicum, ginger, myrrh. Colophony, guggul, male fern, asafoetida, storax, tolu and peru balsam. benzoin and shellac	05
D) Drugs of mineral origin-	
Asbestos, bentonite, calamine, chalk, fullerearth, kieselguhr, talc, shilajit and mica.	02
E) Natural fibers:	
Cotton jute , Hemp, silk, wool.	01
<b>Total Hours:</b>	<b>50</b>

**BOOKS:**

1. India Pharmacopoeia
2. Pharmacognosy: Tyler, Brady and Robbers
3. Text book of Pharmacognosy- T. E. Wallis
4. Text book of Pharmacognosy- Trease and Evans
5. Text book of Pharmacognosy- Kokate and Purohit

NORTH MAHARASHTRA UNIVERSITY, JALGAON  
THIRD YEAR B. PHARMACY SYLLABUS

3.7 –Pharmacognosy And Phytochemistry-I (Practicals)

(3Hrs/week)

( *With effect from July, 2001* )

1. Microscopy examination of various plants tissues, trichomes, stomata, starches and calcium oxalate crystals
2. Measurement of different types of Ca- oxalate crystal and starch grains.
3. To determine percent purity using lycopodium spores
4. To determine Leaf constants (Palisade ration, vein-islet number, vein termination number, stomatal number and stomatal index)
5. To determine foreign organic matter using lycopodium spores
6. Determination of moisture content of acacia by Toluene distillation and LOD
7. Determination of swelling factor of the drug
8. Identification of following unorganized drug by chemical test and morphological characters, asafoetida, myrrh, guggul, shellac, benzoir, colophony, acacia, tragacanth, aloe, agar, bentonite, kieselguhr.
9. Identification of fibers- cotton, jute, Hemp, silk and wool.
10. Morphology, histology and powder characteristics-  
Senna, wild-cherry bark, asparagus, glycerhiza, digitalis, ginger, cascara, turmeric, quassia.
11. Morphology  
Capsicum, jalap, squill, strophanthus, aloe leaves, kalinegh, chirata, dioscoria, rhubarb, citrus peel, solanum xanthocarpun fruits, piciorhiza, guggul, and psoralea.
12. To determine ash value and sulphated ash of any crude drug
13. Determination of alcohol and water extractive values of any given drug

**BOOKS:**

1. Practical pharmacognosy- Kokate
2. The practical evaluation of phytopharmaceuticals –Brin and Turner
3. Plant drug analysis- Wagner, blade & Zgainski
4. Anatomy of crude drug- Iyengar, Nayak
5. Pharmacognosy of powdered crude drug-Iyengar.

NORTH MAHARASHTRA UNIVERSITY, JALGAON.

THIRD SEMESTER B. PHARMACY SYLLABUS.

1.8-Biotechnology & Fermentation Process. (Theory)

(100% marks)

(Extract from July, 2001)

Section-I

TOPICS		Hrs.
1) Biotechnology :- Definition & scope, potential & achievements. Fundamental concepts & basic processes :-		02
A) Genetic Engineering :- Introduction, recombinant DNA technology, restriction endonucleases & their properties, polymerases, ligases, ligase promoters, Gene probes, cloning & expression vectors Plasmids, Types of plasmids & their role in r-DNA technology, Transposons & their uses		12
Strain construction :- Various methods including mutagenesis		
Gene Microarray, DNA hybridisation, southern, Northern, Western, Dot blot, Southern blot, Polymerase chain reaction & its applications, cDNA.		
B) Plant cell & Tissue culture :- Basic requirements of tissue culture technique, aseptic conditions, media for plant tissue culture, types of culture. Isolation of plant cell DNA, structure of chromosomes & gene. Genetic modification of plant cell & its applications, raising mutants in plant cell culture, protoplasts & cell fusion Plant cell cultivation & production of secondary metabolites Genetic engineering of plants, gene transfer through viruses & germ plasma storage		12
Animal cell culture & Biotechnology :- Collection of explants, culture of cells, cell fused culture, pharmaceutical application of animal cell cultures		06
3) recombinant DNA & gene splicing :- Conventional genetic recombination methods Gene splicing- types & applications.		04

Section-II

TOPICS		Hrs.
1) Fermentation Technology & Industrial Microbiology:- Introduction, fermentation as a biotechnological process, bioconversion, fermenter- its material of construction, assembly components & working of fermenter, fermentation monitoring, General applications of fermentation in the mfg. of antibiotics ( Penicillin, Streptomycin & tetracycline), Dextrans, Vitamins (Vit-B <sub>2</sub> & B <sub>12</sub> ) Microbial enzymes & its mfg.		08
2) Downstream processing :- methods of cell separation & cell disruption, collection of products.		04
3) Microbial assays of antibiotics, vitamins & amino acids		02
4) Immunology & Health :-		12
a) Periodic review of immunology types.		

b) Humoral & cell mediated immunity (B-cells & T-cells), antibodies, classes & properties of antibodies, structure of antibodies.	
c) <b>Antigen</b> :- Types, various antigen-antibody interactions, their principles & applications.	
d) <b>Hypersensitivity</b> :- Different types & reactions.	
e) <b>Vaccines</b> :- Live & killed vaccines, preparation & standardisation of vaccines, Sera, allergic extracts, diagnostics, biologicals, introduction to Veterinary vaccines.	
f) <b>Monoclonal Antibodies</b> :- Preparation & applications.	
g) Immunomodulating substances, lymphokines.	
5) <b>Biotechnology &amp; Biological Products</b> :- eg. & properties of biotechnology derived therapeutic products. Production of Human insulin, Interferons, somatotropin, human growth hormone, somatostatin, purification, characterisation & analysis- establishing safety & efficacy. Impurities present in biotechnology derived products such as foreign contaminants (eg. Host cells, proteins, DNA/RNA, pyrogens) & related substances.	07
6) <b>Principles &amp; Applications of Analytical Techniques</b> :- For eg. Gel electrophoresis, HPLC, Tryptic mapping, N-terminal sequencing, etc. for various products.	03
7) <b>Immunoassays</b> :- Principles & applications.	03

Total Hrs. :- 75

**References :-**

- 1) Pharmaceutical Biotechnology. - Vyas & Dixit.
- 2) Recombinant DNA debate, - David A. Jackson.
- 3) Biotechnology- Fundamentals & applications. - Purohit & Mathur.
- 4) Biotechnology. - Keshave Trehan.
- 5) A Text Book on Biotechnology. - H. D. Kumar.
- 6) Gene VII - Levin.
- 7) Genetic Engineering & its applications. - Joshi.

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