Academic Regulations-M.Pharm. 2009-10

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY ANANTAPUR
ACADEMIC REGULATIONS FOR THE AWARD OF FULL TIME
M. Pharm. DEGREE
(WITH EFFECT FROM THE ACADEMIC YEAR 2009-10)

The Jawaharlal Nehru Technological University Anantapur shall confer M.Pharm. Post Graduate degree to candidates who are admitted to the Master of Pharmacy Programs and fulfill all the requirements for the award of the degree.

1.0 ELIGIBILITY FOR ADMISSIONS:

Admission to the above programme shall be made subject to the eligibility, qualifications and specialization prescribed by the University for each programme, from time to time.

1.1. Admissions shall be made either on the basis of merit rank obtained by the qualified candidates at an Entrance Test conducted by the University or on the basis of GATE / PGECET score, subject to reservations prescribed by the University or Government policies from time to time.

2.0 COURSE WORK:

2.1 A Candidate after securing admission must pursue the M.Pharm.course of study for Four Semesters duration.
2.2 Each semester shall be of 20 weeks duration including all examinations.
2.3 A candidate admitted to a programme should complete it within a period equal to twice the prescribed duration of the programme from the date of admission.

3.0 ATTENDANCE

3.1 A candidate shall be deemed to have eligibility to write end semester examinations if he has put in at least 75% of attendance on cumulative basis of all subjects/courses in the semester.
3.2 Condonation of shortage of attendance up to 10% i.e., from 65% and above and less than 75% may be given by the college on the recommendation of the Principal.
3.3 Condonation of shortage of attendance shall be granted only on genuine and valid reasons on representation by the candidate with supporting evidence.
3.4 If the candidate does not satisfy the attendance requirement he is detained for want of attendance and shall reregister for that semester. He / she shall not be promoted to the next semester.

4.0. EVALUATION:

The performance of the candidate in each semester shall be evaluated subject wise, with a maximum of 100 marks for Theory and 100 marks for practicals, on the basis of Internal Evaluation and End Semester Examination.

4.1 For the theory subjects 60% of the marks will be for the External End Examination. While 40% of the marks will be for Internal Evaluation, based on the better of the marks secured in the two Mid Term-Examinations held, one in the middle of the Semester (I-IV units) and another immediately after the completion of instruction (V-VIII) units with Three questions to be answered out of four in 2 hours, evaluated for 40 marks.

*****Note: All the Questions shall have equal weightage of 10 marks and the marks obtained for 3 questions shall be extrapolated to 40 marks, any fraction rounded off to the next higher mark

4.2 For practical subjects, 60 marks shall be for the End Semester Examinations and 40 marks will be for internal evaluation based on the day to day performance.

4.3 For mini project there will be an internal evaluation of 50 marks. The candidate has to secure a minimum of 50% to be declared successful. The assessment will be made by a board consisting H.O.D. and two internal staff members/experts.

4.4 For Seminar there will be an internal evaluation of 50 marks. A candidate has to secure a minimum of 50% to be declared successful. The assessment will be made by a board consisting of HOD and two internal experts at the end of IV semester instruction.

4.5 A candidate shall be deemed to have secured the minimum academic requirement in a subject if he secures a minimum of 40% of marks in the End Examination and a minimum aggregate of 50% of the total marks in the End Semester Examination and Internal Evaluation taken together.

4.6 In case the candidate does not secure the minimum academic requirement in any subject (as specified in 4.5.) he has to reappear for the Semester Examination either supplementary or regular in that subject, or repeat the course when next offered or do any other specified subject as may be required.

5.0 RE-REGISTRATION FOR IMPROVEMENT OF INTERNAL EVALUATION MARKS:

Following are the conditions to avail the benefit of improvement of internal evaluation marks.

5.1 The candidate should have completed the course work and obtained examinations results for I & II semesters.

5.2 He should have passed all the subjects for which the Internal evaluation marks secured are more than 50%.

5.3 Out of the subjects the candidate has failed in the examination due to Internal evaluation marks secured being less than 50%, the candidate shall be given one chance for each Theory subject and for a maximum of two Theory subjects for Improvement of Internal evaluation marks.

5.4 The candidate has to re-register for the chosen subjects and fulfill the academic requirements.

5.5 For each subject, the candidate has to pay a fee equivalent to one third of the semester tuition fee and the amount is to be remitted in the form of D.D. in favour of the Registrar, JNTUA payable at Anantapur along with the requisition through the Principal of the respective college.

5.6 In the event of availing the Improvement of Internal evaluation marks, the internal marks as well as the End Examinations marks secured in the previous attempt(s) for the reregistered subjects stand cancelled.

6.0 EVALUATION OF PROJECT WORK:

Every candidate shall be required to submit thesis or dissertation after taking up a topic approved by the college/ institute.

6.1 Registration of Project work: A candidate is permitted to register for the project work after satisfying the attendance requirement of all the courses (theory and practical courses of I & II Sem)

6.2 An Internal Departmental Committee (I.D.C) consisting of HOD, Supervisor and one internal senior expert shall monitor the progress of the project work.

6.3 The work on the project shall be initiated in the penultimate semester and continued in the final semester. The duration of the project is for two semesters. The candidate can submit Project thesis with the approval of I.D.C. after 36 weeks from the date of registration at the earliest and one calendar year from the date of registration for the project work. Extension of time within the total permissible limit for completing the programme is to be obtained form the Head of the Institution.

6.4 The student must submit status report at least in three different phases during the project work period. These reports must be approved by the I.D.C. before submission of the Project Report.

6.5 A candidate shall be allowed to submit the thesis / dissertation only after passing in all the prescribed subjects (both theory and practical) and then take viva voce examination of the project. The viva-voce examination may be conducted once in two months for all the candidates submitted during that period.

6.6 Three copies of the Thesis / Dissertation certified in the prescribed from by the supervisor & HOD shall be presented to the University.

6.7 The college shall submit a panel of three experts for a maximum of 5 students at a time. However, the thesis / dissertation will be adjudicated by one examiner nominated by the University.

6.8 If the report of the examiner is favorable viva-voce examination shall be conducted by a board consisting of the Supervisor, Head of the Department and the examiner who adjudicated the thesis / dissertation. The board shall jointly report candidates work as:

1.	Very Good	Grade A
2.	Good	Grade B
3.	Satisfactory	Grade C
4.	Not satisfactory	Grade D

If the report of the viva-voce is not satisfactory (Grade D) the candidate will retake the viva-voce examination after three months. If he fails to get a satisfactory report at the second viva-voce examination he will not be eligible for the award of the degree unless the candidate is permitted to revise and resubmit thesis.

7.0 AWARD OF DEGREE AND CLASS:

A candidate shall be eligible for the award of respective degree if he satisfies the minimum academic requirements in every subject and secures 'satisfactory' or higher grade report on his thesis/dissertation and viva-voce. Based on overall percentage of marks obtained, the following class is awarded.

First class with Distinction:	70% or more
First class	below 70% but not less than 60%
Second class	below 60% but not less than 50%

8.0 WITH – HOLDING OF RESULTS:

If the candidate has dues not paid to the university or if any case of in- discipline or malpractice is pending against him, the result of the candidate shall be withheld and he will not be allowed/ promoted into the next higher semester. The issue of degree is liable to be withheld in such cases.

9.0 TRANSITORY REGULATIONS:

Candidates who have discontinued or have been detained for want of attendance or who have failed after having undergone the course in earlier regulations and wish to continue the course are eligible for admission into the unfinished semester from the date of commencement of class work with the same or equivalent subjects as and when subjects are offered, subject to 4.6 and 2.3 sections. Whereas they continue to be in the academic regulations they were first admitted.

10.0 GENERAL:

i. **The academic regulations should be read as a whole for purpose of any interpretation**.
ii. **Disciplinary action for Malpractice/improper conduct in examinations is appended.**
iii. **There shall be no place transfer within the constituent colleges and affiliated colleges of Jawaharlal Nehru Technological University Anantapur.**
iv. **Where the words "he", "him", "his", occur in the regulations, they include "she", "her", "hers".**
v. **In the case of any doubt or ambiguity in the interpretation of the above rules, the decision of the Vice-Chancellor is final.**
vi. **The University may change or amend the academic regulations or syllabi at any time and the changes or amendments shall be made applicable to all the students on roles with effect from the dates notified by the University.**

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RULES FOR DISCIPLINARY ACTION FOR MALPRACTICE / IMPROPER CONDUCT IN EXAMINATIONS

	Nature of Malpractices/Improper conduct	Punishment
	If the candidate:	
1. (a)	Possesses or keeps accessible in examination hall, any paper, note book, programmable calculators, Cell phones, pager, palm computers or any other form of material concerned with or related to the subject of the examination (theory or practical) in which he is appearing but has not made use of (material shall include any marks on the body of the candidate which can be used as an aid in the subject of the examination)	Expulsion from the examination hall and cancellation of the performance in that subject only.
(b)	Gives assistance or guidance or receives it from any other candidate orally or by any other body language methods or communicates through cell phones with any candidate or persons in or outside the exam hall in respect of any matter.	Expulsion from the examination hall and cancellation of the performance in that subject only of all the candidates involved. In case of an outsider, he will be handed over to the police and a case is registered against him.
2.	Has copied in the examination hall from any paper, book, programmable calculators, palm computers or any other form of material relevant to the subject of the examination (theory or practical) in which the candidate is appearing.	Expulsion from the examination hall and cancellation of the performance in that subject and all other subjects the candidate has already appeared including practical examinations and project work and shall not be permitted to appear for the remaining examinations of the subjects of that Semester/year. The Hall Ticket of the candidate is to be cancelled and sent to the University.
3.	Comes in a drunken condition to the examination hall.	Expulsion from the examination hall and cancellation of the performance in that subject and all other subjects the candidate has already appeared including practical examinations and project work and shall not be permitted for the remaining examinations of the subjects of that semester/year.

4.	Smuggles in the Answer book or additional sheet or takes out or arranges to send out the question paper during the examination or answer book or additional sheet, during or after the examination.	Expulsion from the examination hall and cancellation of performance in that subject and all the other subjects the candidate has already appeared including practical examinations and project work and shall not be permitted for the remaining examinations of the subjects of that semester/year. The candidate is also debarred for two consecutive semesters from class work and all University examinations. The continuation of the course by the candidate is subject to the academic regulations in connection with forfeiture of seat.
5.	Leaves the exam hall taking away answer script or intentionally tears of the script or any part thereof inside or outside the examination hall.	Expulsion from the examination hall and cancellation of performance in that subject and all the other subjects the candidate has already appeared including practical examinations and project work and shall not be permitted for the remaining examinations of the subjects of that semester/year. The candidate is also debarred for two consecutive semesters from class work and all University examinations. The continuation of the course by the candidate is subject to the academic regulations in connection with forfeiture of seat.
6.	Possess any lethal weapon or firearm in the examination hall.	Expulsion from the examination hall and cancellation of the performance in that subject and all other subjects the candidate has already appeared including practical examinations and project work and shall not be permitted for the remaining examinations of the subjects of that semester/year. The candidate is also debarred and forfeits the seat.

7.	Impersonates any other candidate in connection with the examination.	The candidate who has impersonated shall be expelled from examination hall. The candidate is also debarred and forfeits the seat. The performance of the original candidate who has been impersonated, shall be cancelled in all the subjects of the examination (including practicals and project work) already appeared and shall not be allowed to appear for examinations of the remaining subjects of that semester/year. The candidate is also debarred for two consecutive semesters from class work and all University examinations. The continuation of the course by the candidate is subject to the academic regulations in connection with forfeiture of seat. If the impostor is an outsider, he will be handed over to the police and a case is registered against him.
8.	Refuses to obey the orders of the Chief Superintendent/Assistant – Superintendent / any officer on duty or misbehaves or creates disturbance of any kind in and around the examination hall or organizes a walk out or instigates others to walk out, or threatens the officer-in charge or any person on duty in or outside the examination hall of any injury to his person or to any of his relations whether by words, either spoken or written or by signs or by visible representation, assaults the officer-in-charge, or any person on duty in or outside the examination hall or any of his relations, or indulges in any other act of misconduct or mischief which result in damage to or destruction of property in the examination hall or any part of the College campus or engages in any other act which in the opinion of the officer on duty amounts to use of unfair means or misconduct or has the tendency to disrupt the orderly conduct of the examination.	In case of students of the college, they shall be expelled from examination halls and cancellation of their performance in that subject and all other subjects the candidate(s) has (have) already appeared and shall not be permitted to appear for the remaining examinations of the subjects of that semester/year. The candidates also are debarred and forfeit their seats. In case of outsiders, they will be handed over to the police and a police case is registered against them.

9.	If student of the college, who is not a candidate for the particular examination or any person not connected with the college indulges in any malpractice or improper conduct mentioned in clause 6 to 8.	Student of the colleges expulsion from the examination hall and cancellation of the performance in that subject and all other subjects the candidate has already appeared including practical examinations and project work and shall not be permitted for the remaining examinations of the subjects of that semester/year. The candidate is also debarred and forfeits the seat. Person(s) who do not belong to the College will be handed over to police and, a police case will be registered against them.
10.	Uses objectionable, abusive or offensive language in the answer paper or in letters to the examiners or writes to the examiner requesting him to award pass marks.	Cancellation of the performance in that subject.
11.	Copying detected on the basis of internal evidence, such as, during valuation or during special scrutiny.	Cancellation of the performance in that subject and all other subjects the candidate has appeared including practical examinations and project work of that semester/year examinations.
12.	If any malpractice is detected which is not covered in the above clauses 1 to 11 shall be reported to the University for further action to award suitable punishment.	

Malpractices identified by squad or special invigilators

1. Punishments to the candidates as per the above guidelines.
2. Punishment for institutions : (if the squad reports that the college is also involved in encouraging malpractices)
   (i) A show cause notice shall be issued to the college.
   (ii) Impose a suitable fine on the college.
   (iii) Shifting the examination centre from the college to another college for a specific period of not less than one year.

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY ANANTAPUR

Course Structure and Syllabi for M. Pharm- Pharmacognosy
for affiliated Pharmacy Colleges 2009-10

I YEAR I SEMESTER

S. No	Course code	Subject	Theory	Lab.	Credits
1.	9S01101	Modern Pharmaceutical Analysys.	4		4
2.	9S01102	Biostatistics, Intellectual property rights and regulatory affairs	4		4
3.	9S06103	Advanced Pharmacognosy and phytochemistry- I	4		4
4.	9S06104	Industrial Pharmacognosy - I	4		4
5.	9S01105	Modern Pharmaceutical Analysis-Practical		6	4
6.	9S06106	Advanced Pharmacognosy and phytochemistry- I Practical		6	4
7.	9S06107	Mini-project- I		3	2
		contact periods/week	16	15	26
			Total	31	

I YEAR II SEMESTER

S. No	Course code	Subject	Theory	Lab.	Credits
1.	9S06201	Advanced Pharmacognosy and photochemistry- II	4		4
2.	9S06202	Industrial Pharmacognosy - II	4		4
3.	9S06203	Medicinal plant biotechnology	4		4
4.	9S06204	Herbal drug development and standardization	4		4
5.	9S06205	Industrial Pharmacognosy- Practical		6	4
6.	9S06206	Medicinal plant biotechnology- Practical		6	4
7.	9S06207	Mini-project- II		3	2
		contact periods/week	16	15	26
			Total	31	

II YEAR (III & IV Semesters)

S. No	Course code	Subject		credits
1	9S06401	Seminar		2
2	9S06402	Project work		16

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M.Pharm I year I semester Pharmacognosy **Th 4** **C 4**

(9S01101) MODERN PHARMACEUTICAL ANALYSIS

1. **UV-VISIBLE SPECTROSCOPY**: Brief review of electromagnetic spectrum, UV-Visual range, energy, wavelength and color relationships. Interaction of electromagnetic radiation (UV-visible) with matter and its effects. Chromophores and their interactions with E.M.R. Absorption spectra of organic compounds and complexes illustrating the phenomenon and its utilization in qualitative and quantitative studies of drugs. Shifts and their interpretation (including solvent effects). Empirical correlation of structure with absorption phenomena (Woodward's rules etc) Quantitative estimations, Modern instrumentation.

2. **a) INFRARED SPECTROSCOPY**: Nature of Infra-red radiation. Interaction of I.R radiation with I.R molecules and effects on bonds. Molecular Infrared Spectra. Brief outline of classical I.R instrumentation and practical details of obtaining spectra, including sample preparation for spectroscopy, quantitative interpretation of I.R spectroscopy including FT-IR, ATR.
   b) OPTICAL ROTATORY DISPERSION: Fundamental principles of ORD, cotton effect curves, their characteristics and interpretation. Octant rule and its application with examples. Circular dichroism and its relation to ORD.

3. **NMR SPECTROSCOPY:** Fundamental principles of NMR (Magnetic properties of nuclei, applied field and precession; absorption and transition; frequency). Chemical shifts concept: Isotopic nuclei, Reference standards: Proton magnetic spectra, their characteristics, presentation terms used in describing spectra and their interpretation (Signal No., Position, Intensity). Brief outline of instrumental arrangements and some practical details. Signal multiplicity phenomenon in high resolution PMR. Spin-spin coupling. Application of Signal split and coupling constant data to interpretation of spectra. De-coupling and shift reagent methods. Brief outline of principles of FT-NMR with reference to 13CNMR. Spin-spin and spin-lattice relaxation phenomenon. Free induction decay (FID) proton noise de-coupling signal, average time domain and frequency domain signals nuclear overhauser enhancement 13CNMR spectra, their presentation; characteristics, interpretation, examples and applications. Brief indication of application of magnetic resonance spectral data of other nuclei by modern NMR instruments. Introduction to 2-D NMR techniques.

4. **MASS SPECTROSCOPY:** Basic principles and brief outline of instrumentation. Ion formation and types; molecular ion, Meta stable ions, fragmentation processes. Fragmentation patterns and fragmentation characteristics in relation to parent structure and functional groups. Relative abundances of isotopes and their contribution to characteristic peaks. Mass spectrum, its characteristics, presentation and interpretation. Chemical ionization Mass Spectroscopy. GC-MS, other recent advances in MS. Fast atom bombardment mass spectrometry. LC-MS, LC MS-MS.

5. **CHROMATOGRAPHIC TECHNIQUES:** Classification of chromatographic methods based on mechanism of separation. Column chromatography, column materials, merits and demerits. Paper chromatography; techniques and applications. Thin Layer Chromatography, comparison to paper chromatography and HPLC, adsorbents for TLC. Preparation techniques, mobile phase selection, reversed phase TLC, High performance TLC detection methods, quantitative methods in TLC. Programmed multiple development techniques.

6. **GAS CHROMATOGRAPHY:** Instrumentation packed and open tubular column, Column efficiency parameters, the Vandeemeter equation, Resolution, liquid stationary phase, derivatization methods of GC including acylation, perfloro acylation, alkylation and esterification. Detectors: FID, ECD, TCD, NPDA. Critical comparison of sensitivity, selectivity and field of applications of these detectors. Examples of GC applications in pharmaceutical analysis.

7. **LIQUID CHROMATOGRAPHY:** Comparison of GC and HPLC, instrumentation in HPLC, analytical, preparative and microbore columns, normal and reversed phase packing materials, reverse phase HPLC, Column selection, Mobile phase selection, Efficiency parameters, resolution, detectors in HPLC refractive index, photometric and electrochemical. Comparison of sensitivity, selectivity and field of applications of these detectors. HPTLC-instrumentation and applications.

8. **ELECTROPHORESIS:** Moving boundary electrophoresis, Zone electrophoresis, Iontophoresis, PAGE, Isotacophoresis and applications in pharmacy.
   X-ray Diffraction methods: introduction, generation of X-rays, elementary crystallography, Miller Indices, X-rays diffraction, Bragg's law, X-ray powder diffraction, X-ray powder diffractometer, obtaining and interpretation of X-ray powder diffraction data. Principle, instrumentation and application of the following: Differential Scanning Colorimetry (DSC), DTA &TGA in analysis of pharmaceuticals.

REFERENCES:

1. Instrumental methods of chemical analysis by chatwal. K, anand, 5th edition.
2. Vogel's text book of quantitative chemical analysis by G.H.Jeffery, J.Bassett, J.Mendhan, R.C.Denny.
3. Instrumental methods of analysis by Willard, Merit, Dean, Settle.
4. Organnic spectroscopy by Y.R.Sharma.
5. Spectrometric identification of organic compounds by silverstein, Webster.
6. Spectroscopy by B.K.Sharma
7. Fundamentals of analytical chemistry by Skoog
8. Instrumental methods of analysis by Skoog.

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M.Pharm I year I semester Pharmacognosy **Th 4** **C 4**

(9S01102) BIO-STATISTICS, INTELLECTUAL PROPERTY RIGHTS & REGULATORY AFFAIRS

I. BIO-STATISTICS

1. **An introduction** to statistics and biostatistics-collection and organization of data, graphical, pictorial presentation of data, measures of central tendency and dispersion, sampling techniques, sample size, Coefficient of variation, mean error, relative error, precision and accuracy
2. **Tests of significance**: Testing hypotheses – Principles and applications of Z, t, F–ratio and chi-square tests in pharmaceutical and medical research. Non-parametric tests: sign test, Wilcoxon signed rank test, Wilcoxon rank sum test, Kruskal Wallis test, run test and median tests.
3. **Design of Experiments**: Principles of randomization, replication and local control; CRD, RBD, LSD – their applications and analysis of data; Factorial Experiments – Principles and applications; Probit analysis: Dose – effect relationships, calculation of LD_{50}, ED_{50}.

Statistical quality control : Meaning and uses , Construction of $\overline{X}$, R, P, ηp and Ċ chart-s.

II. INTELLECTUAL PROPERTY RIGHTS & REGULATORY AFFAIRS

1. Patents and Intellectual Property Rights (IPR): Definition, scope, objectives, sources of patent information, patent processing and application. Patents, Copyrights, Trademarks, Salient features, international and regional agreements.
2. GATT & WTO: GATT – Historical perspective, objectives, fundamental principles, impact on developing countries. WTO – objectives, scope, functions, structure, status, membership and withdrawal, dispute settlement, impact on globalization, India – task and challenges, trade related aspects (TRIPS).
3. Regulatory Affairs : Indian context – requirements and guidelines of GMP, understanding of Drugs and Cosmetics Act 1940 and Rules 1945 with reference to Schedule N ,U & Y.
4. a) Related Quality Systems: Objectives and guidelines of USFDA, WHO and ICH. Introduction to ISO series.
   b) Documentation: Types related to pharmaceutical industry, protocols, harmonizing formulations, development for global filings, ANDA, NDA, CTD, dealing with post – approval changes – SUPAC, handling and maintenance including electronic documentation.

REFERENCES:

1. 'Biostatistics', KS Negi, AITB Publishers, Delhi.
2. 'Fundamentals of Biostatistics',Irfan Alikhan, Ukaaz Publications
3. 'Biostatistics for Pharmacy', Khan and Khanum, Ukaaz Publications
4. 'Basic statistics and Pharmaceutical applications', J.E, Demuth,Mercel & Dekker.
5. 'Applied statistics' by S.C.Gupta & V.K.Kapoor
6. 'Fundamentals of mathematical statistics' by S.C.Gupta & V.K.Kapoor
7. 'Good Manufacturing Practices for Pharmaceuticals', S.H.Wiling, Vol.78, Marcel Decker.
8. 'Protection of Industrial Property rights', P. Das & Gokul Das
9. 'Law and Drugs', S.N. Katju, Law Publications.
10. 'Original Laws' Published By Govt. of India
11. 'Laws of drugs in India', Hussain
12. 'New Drug Approval Process', R.A.Guarino,Vol 100, Marcel Decker, NY
13. fda.org, wipo.int, patentlawlinks.com, hc-sc.gc.ca, ich.org, cder.org

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M.Pharm I year I semester Pharmacognosy **Th 4** **C 4**

(9S06103) ADVANCED PHARMOCOGNOSY AND PHYTOCHEMISTRY-I

1. Plant drug cultivation: General aspects involved in the cultivation of medicinal plants. Conservation of medicinal plants: *ex-situ* and *in-situ* cultivation; Biodiversity loss; WTO and TRIPS agreement.

2. Factors involved in production of crude drug:
   i. Exogenous
   ii. Edaphic factors
   iii. Mineral supplements
   iv. Nutrients and growth regulators and inhibitors

3. Pest and weed control: study of pesticides and weedicides with special importance to natural pesticides and weedicides. Disease management of medicinal and aromatic plants.

4. Detailed Phytochemical study of following classes of phyto constituents including important drugs -I.
   i. Plantlipids
   ii. Terpenes and terpenoides
   iii. Resins and related compounds
   iv. Plant phenols

5. Detailed Phytochemical study of following classes of phyto constituents including important drugs-II
   i. Alkaloids
   ii. Glycosides
   iii. Steroids
   iv. Flavanoids

6. Study of information retrieval methods of natural plants and herbal data bases. Screening and review of literature for the following activities:

i. Hepatoprotectives
ii. Anti-fertility agents
iii. Anti-microbial and anti-viral
iv. Anti-cancer agents
v. Hypolipidemics

7. Study of information retrieval methods of natural plants and herbal data bases. Screening and review of literature for the following activities:

i. Anti-obesity agents
ii. Anti-diabetics
iii. Anti-allergic
iv. Adoptogenics
v. Immuno-modulators
vi. Cardiovascular agents

8. Chemotaxonomy:

a. Definition, significance, types.
b. Chemotaxonomic significance of flavanoids and alkaloids.

REFERENCES:

1. 'An introduction to pharmacognosy and phyto chemistry', Durai Swamy and Dr.K.N.Jayaveera, S.Chand
2. 'Cultivation of medicinal and aromatic crops', 1/e, by AA Farooqui and B.S.Sreeramu. University Press, 2001.
3. 'Medicinal Plants of India', 1st edition, by S.N. Yoganarasimhan, Interlilne Publishing Pvt. Ltd.. 2000.
4. 'Medicinal natural products (a biosynthetic approach)',, 1st edition, by Paul M. Dewick, John Wiley & Sons Ltd., England, 1998.
5. 'Natural Products from Plants', 1st edition, by Peter B. Kaufman, CRC Press, New York, 1998
6. 'Glimpses of Indian Ethano Pharmacology', by P. Pushpangadam. Ulf Nyman. V.George Tropical Botanic Garden & Research Institute, 1995.
7. 'Natural products: A lab guide', by Raphael Ikan , 2nd Edition, Academic Press 1991
8. 'Pharmacognosy', – T. E. Trease and W.C. Evans. 15th Edition W.B. Saunders Edinburgh, New York.
9. 'Pharmacognosy',-Tyler, Brady, Robbers
10. 'Modem Methods of Plant Analysis',- Peach & M.V. Tracey, Vol. I&II
11. 'Phytochemistry -Vol. I to IV', Miller Jan Nostrant Renhold.
12. 'Chemistry of Marine Natural Products',- Paul J. Schewer 1973.
13. Marine Natural Products-Vol.I to IV.
14. Ayurvedic Formulary of India, Government of India.
15. 'Herbal Drug Iudustry', by RD. Choudhary, 1st edition, Eastern Publisher, New Delhi, 1996.

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY ANANTAPUR

M.Pharm I year I semester Pharmacognosy **Th 4** **C 4**

(9S06104) INDUSTRIAL PHARMOCOGNOSY-I

1. General methods of isolation, purification, identification and estimation of phytoconstitutents.
2. Phytochemical screening of natural compounds
3. Isolation and characterization of the following phytopharmaceuticals.
   a. Adhatoda vasica-Vasicine
   b. Andrographis paniculata-Andrographolides
   c. Bacopa monnieri-Bacosides
   d. Curcuma longa-Curcumin
   e. Gymnema sylvestre-Gymnemic acid
   f. Phyllanthus amarus-Phyllanthin
   g. Pipernigrum/longum-Peperine
   h. Tinospora cordifolia-Cordifolioside
   i. Tribulus terestris-Total saponins
   j. Withania somnifera-Withanolides
   k. Zingiber officinale-gingerol
   l. Commiphora mukul-guggulosterone

4. Commerce and Quality control of drugs:
   a. Indian & international trades in medicinal and aromatic plants.
   b. Factors affecting herb quality
5. Quality control methods for medicinal plant materials:
   Development of standardization parameters according to WHO guidelines for assessment of crude drugs:
   a. Evaluation of identity, purity and quality of crude drugs.
   b. Determination of pesticide residue.
   c. Determination of Arsenic and heavy metals.
   d. Determination of microorganisms.
   e. Determination of aflotoxins
6. Pharmacopoeial studies: Study of Herbal Pharmacopoeia and Compendiae; Indian Pharmacopoeia, Ayurvedic Pharmacopoeia, Chinese Pharmacopoeia and USP for herbal monographs.
7. Fermentation technology: Industrial production of anti-biotics with their preparation methods.
8. Pilot scale-up techniques: Production of standardized extracts by suitable techniques with special reference to some folklore medicinal plants.

REFERENCES:

1. 'Organic Chemistry', by I.L. Finar vol.ii
2. 'Chemistry of Natural Products', by K.W. Bentley
3. 'Biosynthesis of Aromatic Compounds', by Ulrich Weiss & J. Michael Edwards.
4. 'Pharmacognosy', by Trease and Evans, ELBS.
5. 'Clark's isolation and Identification of drugs', by A.C. Mottal.
6. 'Introduction to chromatography theory and practical', by Srivastava, K. Kishore.
7. 'Plant Drug Analysis', by Wagner.
8. 'Practical Evaluation of Phytopharmaceuticals', by K.r. Brain, T.D.Turner.
9. Research guideline for evaluating the safety and efficacy of herbal medicines WHO publications.
10. CMPC Guidelines.
11. 'Techniques in Organic Chemistry', by Weiss Creger.
12. 'Wilson and Gisvolds text book of organic Medicinnal and Pharmaceutical chemistry', by Deorge. R.F.
13. 'Recent Progress in Medicinal Plants Vol1-22',, D.K. Majumdar, J.N. Govil, V.K. Singh, Rajeev. Kr. Sharma, Studium Press, LLC. U.S.A.,
14. 'The Chemistry of Natural Products', Edited by R.H.Thomson, Springer International Edn. 1994.
15. 'Natural Products Chemistry Practical Manual by Anees A Siddiqui and Seemi Siddiqui.
16. 'Indian Pharmacopoeia, United States Pharmacopoeia, Journals:
    a) Phytochemistry, b)Planta medica, c) Phytotherapy search, d) Fitoterapia

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY ANANTAPUR

M.Pharm I year I semester Pharmacognosy **L** **C**

6 **4**

(9S01105) MODERN PHARMACEUTICAL ANALYSIS - PRACTICAL

1. Simultaneous estimation of Paracetamol and Ibuprofen, Rifampicin and INH, Aspirin and Caffeine.
2. UV-Visible spectrum scanning of certain organic compounds- absorption and co-relation of structures, comparisons.
   Ex: a. Chloramphenicol b. Sulphadiazine c. Analgin
3. Effect of pH and solvent on UV spectrum of certain drugs.
4. Two dimensional paper chromatography and TLC.
5. Gradient elution and other techniques in column chromatography.
6. Separation by electrophoresis.(PAGE and agarose Gel electrophoresis)
7. Experiments based on HPLC and GC.
8. IR, NMR and Mass spectroscopy of compound each.
9. DSC/XRD curves of a sample and mixture to understand polymorphism.
10. Determination of insulin / any other hormones by ELISA method.

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M.Pharm I year I semester Pharmacognosy **L** **C**
6 **4**

(9S06106) ADVANCED PHARMOCOGNOSY AND PHYTOCHEMISTRY - I PRACTICAL

1. Phytochemical screening of plant extracts and drugs.
2. Isolation, separation, purification and identification of important phytoconstitutents belonging to different classes:
    a. Starch, Amylose and Amylopectin
    b. Meristicin and Trimeristicin from nut meg.
    c. Eugenol from clove.
    d. Stigmasterol from soyabean.
    e. Lycopean from tomato.
    f. Curcumin from turmeric.
    g. Sennoides from senna.
    h. Glycyrrhizin from Glycyrrhiza.
    i. Strychnine and Brucine or quinine or caffeine or nicotine or piperine or hesperidine.
3. Anti-microbial screening of plant extracts and drugs.
4. Screening of drugs for the presence of enteric organisms.
5. Screening of drugs for microbial count
6. Isolation, separation, purification of bioactive agents from marine source.
7. Extractive value determination
8. Ash value determination
9. Moisture content determination
10. Volatile oil content determination
11. Estimation of volatile oil content by UV, spectral analysis

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY ANANTAPUR

M.Pharm I year I semester Pharmacognosy **St** **C**
3 **2**

(9S06107) Mini-project- I

The mini projects can be taken up as industrial visit/training and report submission.

Or

A suitable project shall be carried out in the college.

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY ANANTAPUR

M.Pharm I year II semester Pharmacognosy **Th 4** **C 4**

(9S06201) ADVANCED PHARMOCOGNOSY AND PHYTOCHEMISTRY-II

1. Biosynthetic studies on the following:
    a. Shikimic acid pathway –Atropine and Morphine
    b. Acetate pathway – Cardiac glycosides and Anthraquinone glycosides, terpenoids

2. Structural elucidation of important phytoconstituents belonging to different groups.
    a. Alkaloids – Nicotine, Atropine, Morphine, Caffeine.
    b. Glycosides – Amygdalin, Strophanthin.
    c. Steroids – cholesterol.
    d. Terpenes – Citral.

3. Marine Pharmacognosy:
    a. Definition, present status, classification of important bioactive agents.
    b. General methods of isolation and purification.
    c. Study of important bioactive agents including chemistry and uses

4. Plant toxins: An overview of poisonous plants and their mode toxicity with special emphasis to indigenous poisonous plants

5. Recent advances in phytochemical research.Natural substances as raw materials in Drug synthesis. Biomolecules of recent discovery.

6. Nutraceuticals: Food pharmacy, guidelines on food safety includes HACCP, WHO, FPO, FDA, USFDA etc.

7. Problems encountered in and prospects of discovering new drugs from plants.

8. Use of computers in Pharmacognosy

REFERENCES:

1. An introduction to pharmacognosy and phyto chemistry', Durai Swamy and Dr.K.N.Jayaveera, S.Chand
2. 'Medicinal Plants of India, 1st edition', by S.N. Yoganarasimhan, Interlilne Publishing Pvt. Ltd.. 2000.
3. 'Medicinal natural products (a biosynthetic approach)', 1st edition, by Paul M. Dewick, John Wiley & Sons Ltd., England, 1998.
4. 'Natural Products from Plants', 1/e, by Peter B. Kaufman, CRC Press, New York, 1998
5. 'Pharmacognosy' - G. E. Trease and W.C. Evans. 15th Edition W.B. Saunders Edinburgh,New York.

6. 'Pharmacognosy'-Tyler, Brady, Robbers
7. 'Modem Methods of Plant Analysis'- Peach & M.V. Tracey, Vol. I&II
8. 'Phytochemistry -Vol. I to IV', Miller Jan Nostrant Renhold.
9. Recent Advances in Phytochemistry- Vol. 1&4',: Scikel Runeckles- Appleton Century Crofts.
10. 'Chemistry of Marine Natural Products',- Paul J. Schewer 1973.
11. 'Marine Pharmacognosy Ed.', by Dean F. Martin & George Padilla.
12. Marine Natural Products-Vol.I to IV.
13. 'Text book of Pharmacognosy', by C.K.Kokate, Purohit, Ghokhale, 4th edition, Nirali Pakasshan ,1996.
14. 'Pharmacognosy and Pharmacobiotechnology by Ashutoshkar, New Age Publications, New Delhi.
15. 'Text Book of Pharmacognosy', by T.E. Wallis

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M.Pharm I year II semester Pharmacognosy **Th 4** **C 4**

(9S06202) INDUSTRIAL PHARMACOGNOSY-II

1. Herbal based industries-types, forms, scope and applications.
Study of infrastructure for different types of industries involved in making standardized extracts and various dosage forms including traditional ayurvedic dosage forms and modern dosage forms.

2. Research in Herbal based industries: Needs, area and current on going research. Application of pharmacy concepts, analytical methods and clinical evaluation techniques.

3. Quality assurance in Herbal Drug Industry concept of TQM, GMP, GLP, ISO-9000 and HACCP in traditional system of medicine.

4. Patents:
   a. Indian and international patent loss, proposed amendiments as applicable to herbal/natural products and process important points to be kept in mind while drafting and filing a patent.
   b. Plant breeder's rights.

5. Study of herbal extracts: Estimation techniques and principle behind them for the following drugs with special emphasis on HPLC and HPTLC
   a. Adhatoda vasica-Vasicine
   b. Andrographis paniculata-Andrographolides
   c. Bacopa monnieri-Bacosides
   d. Curcuma longa-Curcumin

e. Gymnema sylvestre-Gymnemic acid
f. Phyllanthus amarus-Phyllanthin
g. Pipernigrum/longum-Peperine
h. Tinospora cordifolia-Cordifolioside
i. Tribulus terestris-Total saponins
j. Withania somnifera-Withanolides
k. Zingiber officinale-gingerol
l. Commiphora mukul-guggulosterone

6. Profile for commercial cultivation technology and post harvest technology of following medicinal plants: Ashwagandha, Periwinkele, Medicinal yams, Guggul, Senna, Isapgol, Neem, Psyllium, Artemesia, Stevia, Gymnema, Coleus, Ammimajus, Spirolina and Hypericum species.

7. Technology for commercial scale cultivation and processing of following aromatic plants: Lemongrass, Geranium, Basil, Vitiver, Peppermint, Thyme, Celery, Rose, Clove, Jasmine, sandal, Cinnamon, Dill, Anise, Eucalyptus and Davana.

8. Bio-Assays: In-Vitro and In-Vivo methods with reference to Anti cancer, Anti diabetic, Anti obesity, Hepato protective, Anti inflammatory, Analgesics, Hypolipidemics, Immunomodulatory activities, etc.

REFERENCES:

1. 'Chemistry of Alkaliods', by S.W. Pelletier
2. 'Organic chemistry', by i.L. Finar Vol.II
3. 'Chemistry of Natural Products', by k.W. Bentley
4. 'Biosynthesis of Aromatic Compounds', by Ulrich Weiss & J. Michael Edwards.
5. 'Pharmacognosy', by Trease and Evans, ELBS.
6. 'Clark's isolation and Identification of drugs', by A.C. Mottal.
7. 'Plant Drug Analysis', by Wagner.
8. Indian Pharmacopoeia, United States Pharmacopoeia, Ayurvedic Pharmacopoeia
9. 'Practical Evaluation of Phytopharmaceuticals', by K.r. Brain, T.D.Turner.
10. Research guideline for evaluating the safety and efficacy of herbal medicines WHO publications.
11. CMPC Guidelines.
12. 'Techniques in Organic Chemistry', by Weiss Creger.
13. 'Wilson and Gisvolds text book of organic Medicinnal and Pharmaceutical chemistry', by Deorge. R.F.
14. 'Recent Progress in Medicinal Plants', Vol1-22, D.K. Majumdar, J.N. Govil, V.K. Singh, Rajeev. Kr. Sharma, Studium Press, LLC. U.S.A.,
15. 'The Chemistry of Natural Products', Edited by R.H. Thomson, Springer International Edn. 1994.
16. 'Natural Products Chemistry Practical Manual', by Anees A Siddiqui and Seemi Siddiqui.

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY ANANTAPUR

M.Pharm I year II semester Pharmacognosy **Th 4** **C 4**

(9S06203) MEDICINAL PLANT BIOTECHNOLOGY

1. Introduction to genetics & molecular biology:
   a. Structural and molecular organization of cell.
   b. Genetic material – DNA, RNA, Protein, replication, genetic code, regulation of gene expression, structure and complexity of genome.
   c. Cell cycle, cell signaling.
   d. Recombinant DNA Technology- principles, tools, process and applications.

2. Methods of improving quality of crops & their applications:
   a. Plant breeding
   b. Chemo demes
   c. Hybridization
   d. Mutation
   e. Polyploidy

3. Tissue Culture:
   a. Types, techniques & application of Callus, suspension, haploid, embryo, organ and immobilized Culture.
   b. Organogenesis, Embryogenesis, synthetic seed & Somaclonal variation.
   c. Micropropagation.
   d. Production of Secondary metabolities- Strategies involving use of precursor, growth regulators and elicitors: Production of Shikonin and other biomolecules.
   e. Hairy root culture & Multiple shoot culture & their applications.
   f. Protoplast culture and protoplast fusion.
   g. Biotransformation.

4. Germplasm conservation :
   a. In-situ conservation
   b. Invitro methods of conservation.

5. Gene transfer in plant: Introduction, transgenic plants, methods used in gene identification. Gene transfer using
   a i. vectors of Agarobacterium
      ii. DNA mediated gene transfer electroporation, micro projectile, macro & micro injection, liposomes, Ultra-sonication & chemical mediated gene transfer.
   b Localization of transfer gene in genetically modified plants:
      i. Nucleic acid hybridization
      ii. Use of radio isotopes & molecular markers

iii. Autoradiography
iv. Electrophoresis

6. Applications of transgenic plants:
a. Resistant to herbicide
b. Resistant to insect, fungus & Virus.
c. Resistant to physiological stress
d. Production of phytopharmaceutical
e. Edible vaccine

7. Gene Mapping & Molecular Maps of Plant Genomes
a. Plant chromosome analysis.
b. Uses of PCR in gene mapping.
c. Molecular maps – RFLP, RAPD.
d. Physical maps used in-situ hybridization

8. Enzymes:
a. Types & properties of enzymes.
b. Isolation & Purification of enzymes.
c. Immobilization of enzymes & its applications
d. Enzyme reactors
e. Detailed study of Plant enzymes – Papain & Bromelain.

REFERENCES:

1. Plant tissue culture – Bhagwani, Vol 5. (Elsevier)
2. Plant cell and Tissue Culture (Lab. Manual) – J.R.M.M. Yeoman.
3. 'Medicinal Natural products', IInd Edn. (A Biosynthetic Approach) Paul M. Dewick.
4. 'Elements in biotechnology' by P. K. Gupta.
5. 'Molecular biology and biotechnology', by J. M Walker and E. D. Gingold.
6. 'An introduction to plant tissue culture' by M. K. Razdan.
7. 'Breeding field crops', by John. M. P and David A. S.
8. 'Advanced methods in plant breeding and biotechnology' by David. R. Murray.
9. 'Experiments in plant tissue culture' by John H. D and Lorin W. R.
10. 'Pharmaceutical biotechnology' by S. P. Vyas and V. K. Dixit.
11. 'Plant cell and tissue c culture' by Jeffrey W. Pollard and John M Walker.
12. 'Plant tissue culture' by Dixon, Oxford Washington DC, 1985
13. 'Plant tissue culture' by Street.
14. 'Biotechnology' by Purohit and Mathur.
15. 'Biotechnological applications to tissue culture', by Shargool.
16. 'Introduction to biotechnology', by Bullock John.
17. 'Secondary plant metabolism', by Margaret L. Vikery and Brian Vikery.
18. 'Plant tissue culture' by W. E. George.
19. 'Biotechnology. Principles and Application', I.J. Higgins, D.J. Best, J. Jones, Blackwell Scientific Publications, Oxford, London 1988.
20. 'Cell and Tissue Culture Laboratory Procedures in Biotechnology', Edited by Alan Deyle and J. Bryan Griffiths, Johnwilley & Sons, 1998.

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M.Pharm I year II semester Pharmacognosy **Th 4** **C 4**

(9S06204) HERBAL DRUG DEVELOPMENT AND STANDARDISATION

1. Study of Indian system of medicine / ethno medicines: Ayurveda, unani, yoga and naturopathy, homeopathy, sidha and Chinese medicines
2. Herbal Cosmetics:
   a. Raw materials of herbal origin used in cosmetics ; Oils, waxes, gums, hydrophilic colloids, colors, perfumes, protective agents, bleaching agents, preservatives, anti-oxidants and other ancillary agents.
   b. Formulation aspects of incorporating herbal extracts in various preparations like skin care creams, deodorants, anti-perspriants, Hair care preparations.
   c. Detailed methods of preparation of few representative preparations and standardization of above categories.
3. Ayurveda: History, principle, formulations, types and their standardization of ayurvedic medicines with their applications.
4. Siddha: History, principle, formulations, types and their standardization of Siddha medicines with their applications.
5. Homeopathy: History, principle, formulations, types and their standardization of Homeopathy medicines with their applications.
6. Unani: History, principle, formulations, types and their standardization of Unani systems of medicines with their applications.
7. Study of traditional formulation as per Ayurvedic Formulary of India and few dosage forms (Modern) in market.
8. Shelf life study, stability studies for herbal based products, different approaches for both physical, physico-chemical parameters for in-process and finished herbal products, interpretation of data and its limitation

REFERENCES:

1. Ayurvedic pharmacopoeia
2. Merck index
3. 'Text book of Pharmacognosy', by Trease and Evans, ELBS
4. 'Text book of Pharmacognosy' by T.E.Wallis.
5. 'Text book of Pharmacognosy and Bio-technology', by Mohammed Ali
6. 'Text book of Pharmacognosy' by Lynn. R.Brady , Virro.E.Tyler and James E. Robert.
7. 'Plant drug analysis' by Wagner.
8. 'Ayurvedic formulary' by IMPCOPS
9. 'Siddha formulary' by IMPCOPS
10. 'Unani formulary' by IMPCOPS.
11. 'Herbal drug industry' by R.D.Choudhary 1/e Eastern publishers, New Delhi, 1996.

12. 'Pharmacopoeial standards for ayurvedic formulations', central council for research in Ayurveda And Siddha, New Delhi
13. 'Herbal cosmetics,formulation and standardization' by P.P.Sharma.
14. Remington's pharmaceutical sciences vol-I &II.

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY ANANTAPUR

M.Pharm I year II semester Pharmacognosy **L 6** **C 4**

(9S06205) INDUSTRIAL PHARMACOGNOSY-II
PRACTICAL

1. Thin layer chromatography
2. Paper chromatography
3. HPLC and HPTLC
4. Pharmacognostic evaluation of crude drugs.
5. Extractive value determination
6. Moisture content determination
7. ash value determination
8. Volatile Oil content determination
9. Determination of heavy metals, mycotoxins, pesticidal residues.
10. Spectroscopic analysis of isolated compounds.
11. Flourimetric analysis of isolated compounds.
12. Monograph analysis of crude drugs.
13. Evaluation and standardization of extract based on WHO guidelines.
14. Evaluation and standardization of formulations.
15. Preparation of two herbal medicinal and cosmetic formulation and their evaluation.
16. Titrimetric analysis of isolated compounds.
17. Quantitative microscopy.
18. Isolation and estimation of the following phytopharmaceuticals
    a. Curcumin
    b. Berberind
    c. Piperine
    d. Gingerol
    e. Forskolin

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M.Pharm I year II semester Pharmacognosy **L** **C**
6 **4**

(9S06206) MEDICINAL PLANT BIOTECHNOLOGY PRACTICAL

1. Media preparation and sterilization.
2. Initiation of Callus.
3. Growth determination- cell counts, cell staining, mitotic index, media analysis.
4. Organogenesis.
5. Chromosomal analysis by Onion root tip culture.
6. Suspension culture and secondary metabolite production.
7. Isolation of DNA & RNA from plant source.
8. Estimation of DNA & RNA.
9. Isolation of Enzymes
10. Immobilization of Enzymes and study of their activity.
11. Isolation & fusion of protoplast.
12. Gene transfer in plant cells in Agarobacterium.
13. Isolation of Plasmids.
14. Restriction enzyme digestion.
15. Transformation of bacteria
16. Ligation of DNA
17. Isolation of Chloroplast.

LIST OF EQUIPMENTS REQUIRED FOR PHARMACOGNOSY:

1. UV-Spectrophotometer
2. IR
3. HPLC and HPTLC
4. Rotary Flash Evaporator
5. Centrifuge and micro centrifuge
6. Gel Electrophoresis
7. Column Chromatography
8. Tissue Culture-Laminar Air Flow, Digital BOD incubator, Shaker incubator, Digital Single pan balance.

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M.Pharm I year II semester Pharmacognosy **St** **C**
3 **2**

(9S06207) Mini Projects-II:

The mini projects can be taken up as industrial visit/training and report submission.

Or

A suitable project shall be carried out in the college.

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M. Pharm IV semester Pharmacognosy **C 2**

(9S06401) SEMINAR

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY ANANTAPUR

M. Pharm IV semester Pharmacognosy **C 16**

(9S06402) PROJECT WORK

The Project Work should be on a contemporary topic relevant to the core subjects of the course. It should be original work of the candidate.

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