

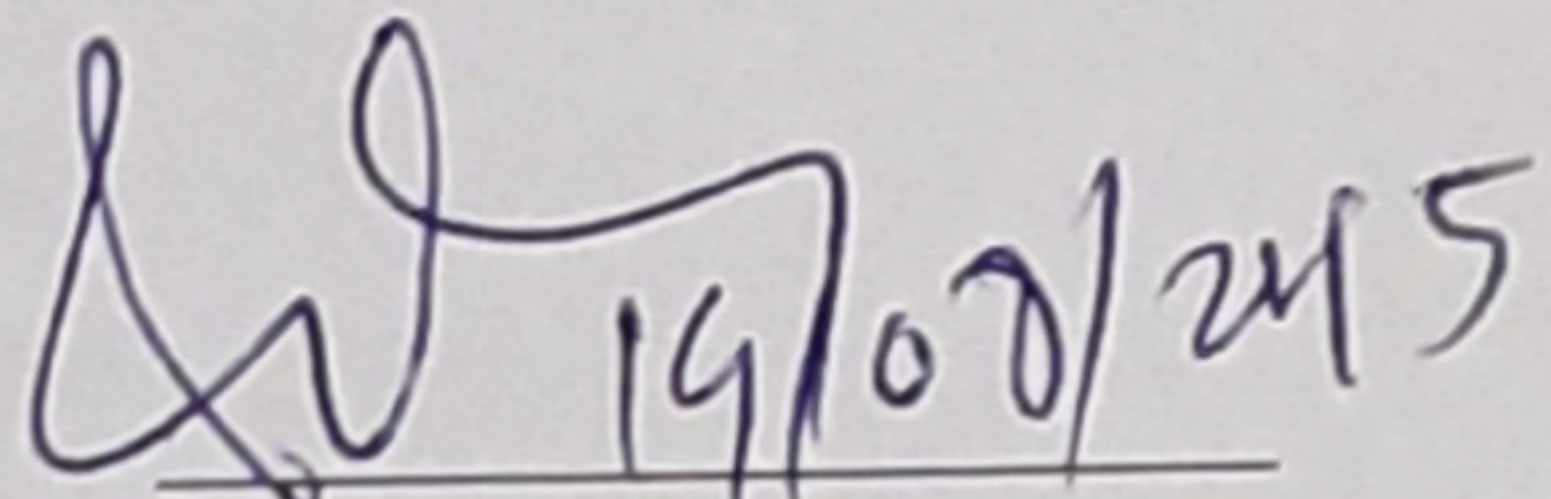
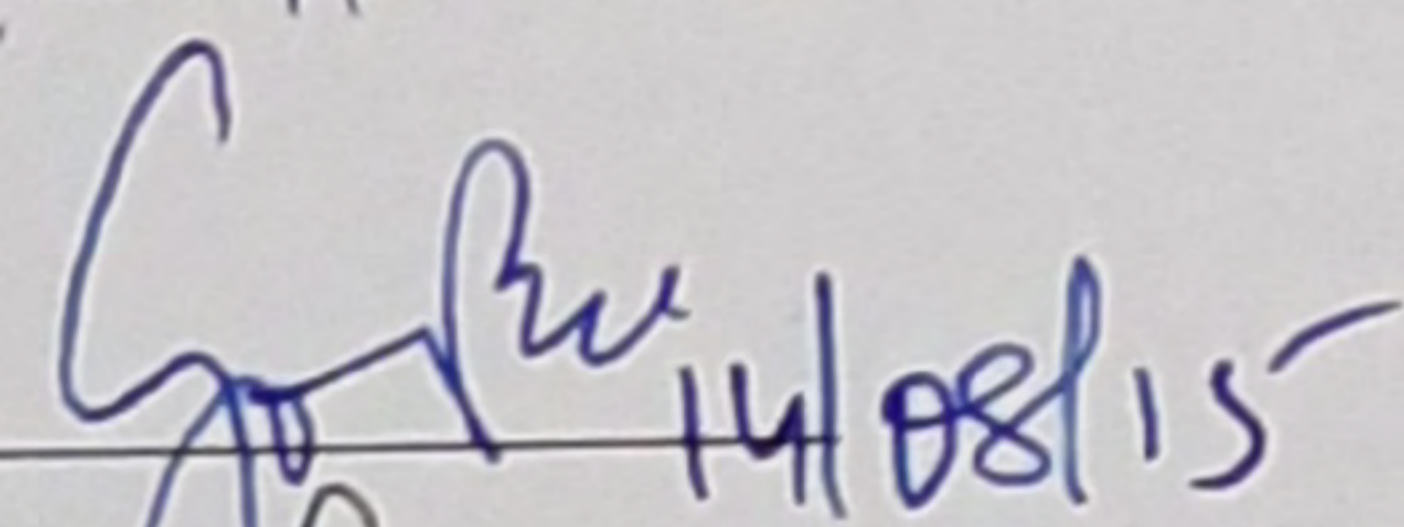
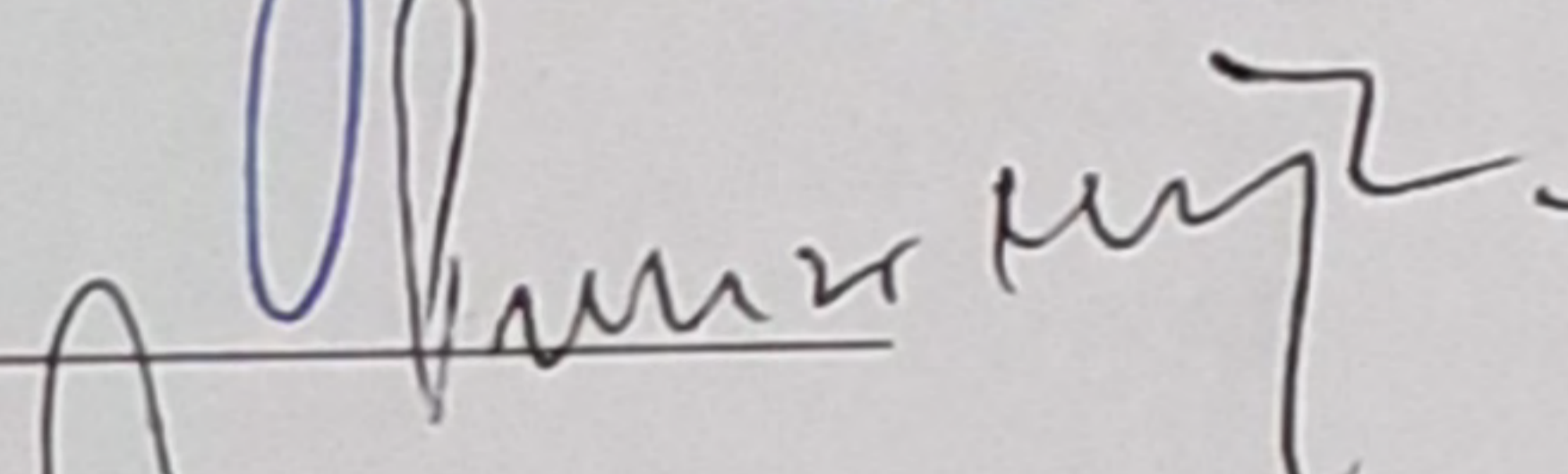
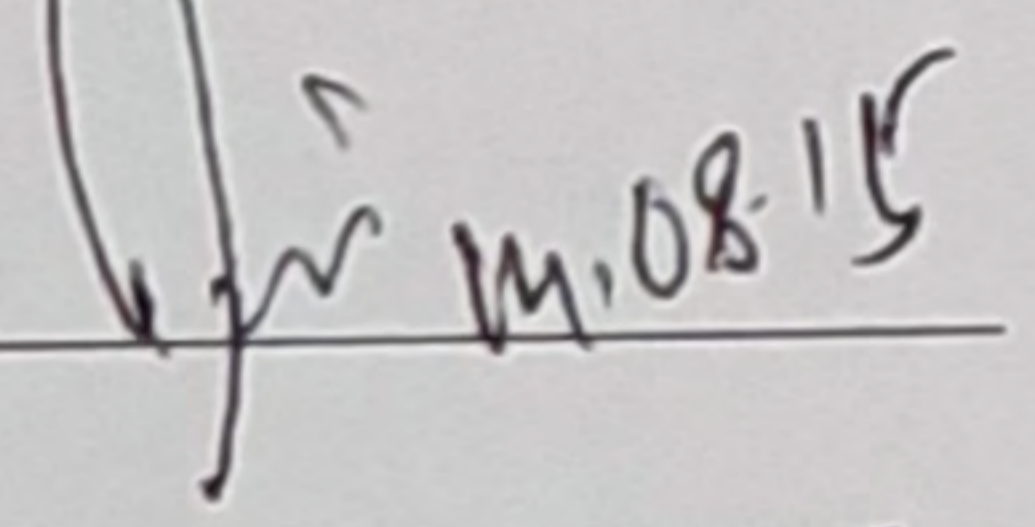
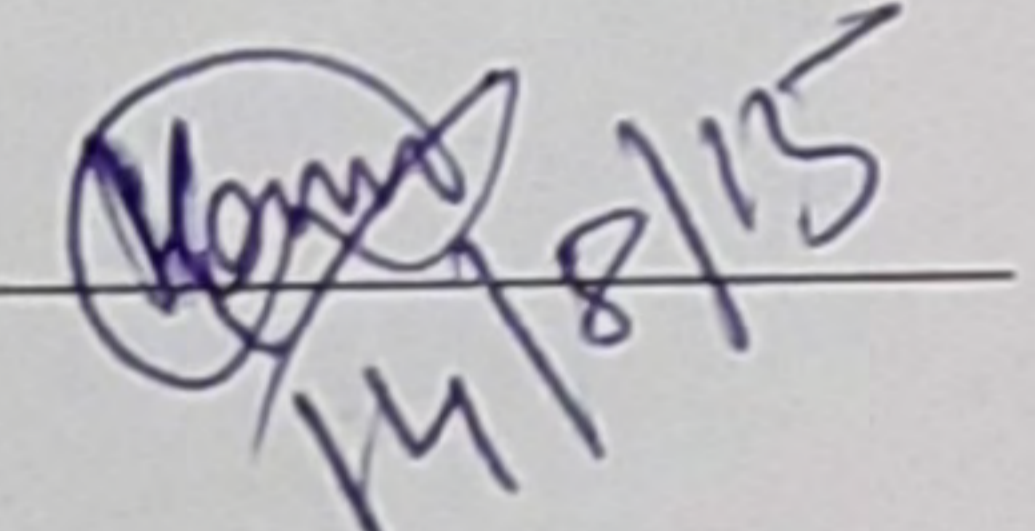


DEPARTMENT OF PHARMACY

Tripura University
(A Central University)
Suryamaninagar - 799022

The proceeding of the 1st meeting of the Board of Post-Graduate Studies (BPGS) held on 14th August, 2015 at 10:30AM (Friday) at HOD cabin.

Members Present:

1. Mr. Rajat Ghosh, Department of Pharmacy	Member Chairperson	 14/08/2015
2. Dr. Parthajyoti Gogoi	External Member	 14/08/15
3. Dr. Pulok Kumar Mukherjee	External Member	
4. Dr. Swapan Majumder	Member	 14/08/15
5. Dr. Kuntal Manna	Chairperson Member	 14/8/15

The chairperson of the Board of Post-Graduate Studies (BPGS), Department of Pharmacy extended a warm welcome to all the members and particularly thanked the external members Dr. Parthajyoti Gogoi and Dr. Pulok Kumar Mukherjee for making it convenient to be present in the meeting.

Agenda-1: Place the new syllabus of M. Pharm in Pharmaceutical Chemistry along with prescribed text books and reference book list under Choice Based Credits System (CBCS).

Resolution:

- a) Committee discussed in detail syllabus of M.Pharm and approved the syllabus with some modifications as follows:

Proposed title name of subject
i. Advanced Pharmaceutical Chemistry
ii. Modern Pharmaceutical Analysis
iii. Chemistry of Natural Products

Suggested name of subject
Pharmaceutical Chemistry-I (Drug Design)
Pharmaceutical Analysis-I
(Basic Instrumentation Methods)
Pharmaceutical Chemistry-II
(Natural Products)

- vii. Advanced Pharmaceutical Chemistry-Practical
- viii. Modern Pharmaceutical Analysis-Practical
- ix. Advanced Instrumental Methods
- x. Advanced Medicinal Chemistry
- xi. Advanced Organic Chemistry
- xii. Advanced Instrumental Methods-Practical
- xiii. Advanced Medicinal Chemistry

Pharmaceutical Chemistry – Practical
 Pharmaceutical Analysis –Practical
 Pharmaceutical Analysis-II
 (Advanced Instrumental Methods)
 Pharmaceutical Chemistry-III
 (Medicinal Chemistry)
 Pharmaceutical Chemistry-IV
 (Principles of Organic Synthetic Planning)
 Instrumental Methods –Practical
 Medicinal Chemistry -Practical

b) All prescribed text books and reference books were approved.

Agenda-2: New syllabus of Ph.D. Course work for Ph.D in Pharmacy along with prescribed text books and reference book list under Choice Based Credits System (CBCS) for approval.

Resolution:

Committee discussed in detail syllabus of pre-Ph.D course work and approved the syllabus with some modifications as follows:

- a) In Paper-II, named: Analytical Instruments and Other Techniques should be include pharmacological screening and assays for common interest.
- b) In Paper-III (option-II), named: Advanced Pharmaceutics should be include novel drug delivery systems (NDDS).
- c) In Paper-III (option-~~III~~^V), named: Advanced in Pharmacognosy & Phytochemistry should be change to Phytochemistry and Ethinopharmacology. In addition there should be inclusion of nutraceuticals.

Agenda-3: RAC (Research Advisory Committee) formation of Ph.D. candidates.

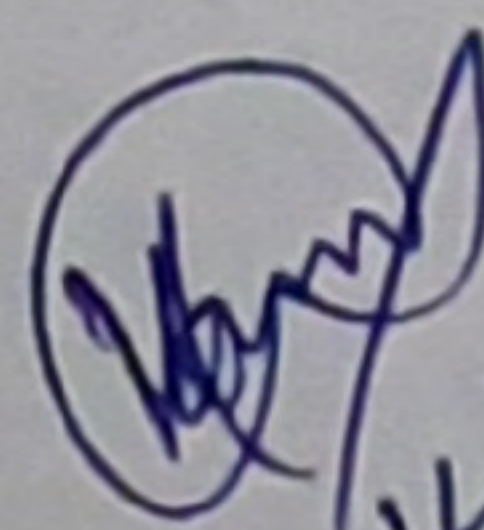
Resolution:

Proposed RAC committee for Mr. Manik Das (supervisor: Dr. Kuntal Manna) and Miss Sanchari Goswami (supervisor: Dr. Kuntal Manna) were approved.

Agenda-4: List of Examiners including paper setters and moderators for the M.Pharm and Ph.D coursework.

Resolution:

Approved and in addition two new names of experts should include in the list (Dr. Sanmoy Karmakar & Dr. Pallab Kanti Halder from Jadavpur University).


14/8/15

Agenda-5: Formation of Masters Research Advisory Committee (MRAC) for M.Pharm final year projects.

Resolution:

Formed and proposed committee approved. (MRAC list should be included in proceeds.)

Agenda-6 (i) List of Journals.

Resolution:

Approved

Agenda-6 (ii) Rules and regulations of M.Pharm dissertation work under CBCS.

Copy of Rules & Regulation of
M.Pharm dissertation should
be with the full
syllabus.

Resolution:

Committee discussed in detail Rules and regulations of M.Pharm dissertation work under CBCS approved with some modifications as follows:

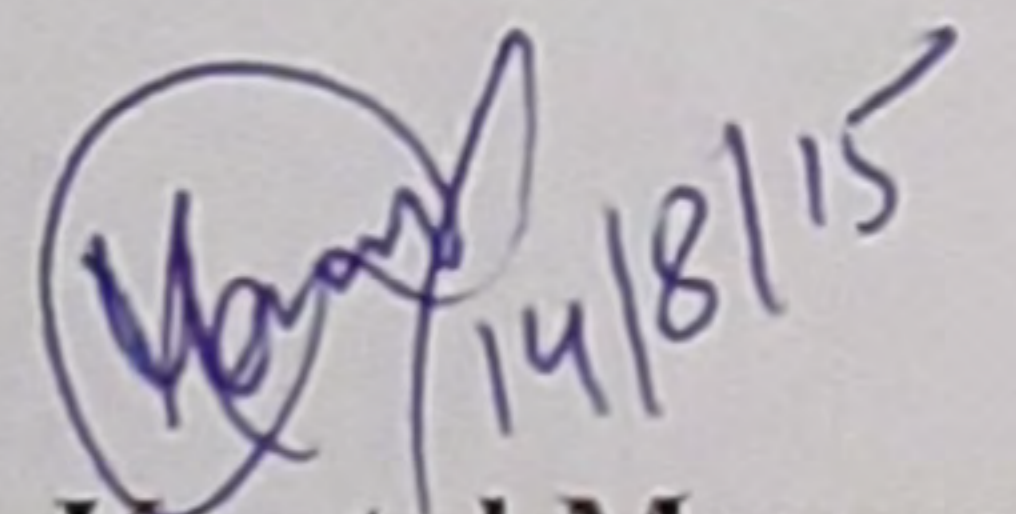
Point-3: should change as follow:

3. The project will be carried out singly either (a) under the supervision of one or more faculty members of the parent Department or (b) under the joint supervision of one faculty member of the parent department and (i) a faculty member of any science department (Depending upon the choice of supervisor of parent department) of the University, or (ii) a qualified member of an industry or hospital or research lab or business or AICTE recognised institute of higher learning in India. In (ii) the external joint-supervisor must have at least five years of professional experience in a responsible position and a M.Pharm or equivalent or higher degree from an AICTE/UGC recognised institute/university in a relevant pharmacy/medicine/science discipline (In the joint supervision, guide from parent department will be always treated as Supervisor or main guide, whereas guide from other departments or organizations will be treated as co-supervisor or co-guide). Students should select the supervisor towards the end of the second semester. The faculty members of the department may announce the various research projects available towards the end of the second semester.

Point-4: should change as follow:

4. Students should select the supervisor from parent department, either by lottery or preference (by the Department) or both towards the end of the second semester. The faculty members of parent department may announce the various research projects/proposal available in the end of the second semester. As much as possible the equal distribution of candidate/s must be encouraged among the available permanent faculty members in the Department.

The meeting ended with a vote of thanks to the Chair.


14/8/15

(Dr. Kuntal Manna)
Chairperson of BPGS



DEPARTMENT OF PHARMACY
TRIPURA UNIVERSITY (A CENTRAL UNIVERSITY)
SURYAMANINAGAR, TRIPURA-799022

Proceedings of the 4TH meeting of Board of Post Graduate Studies of Department of Pharmacy held on 26TH September 2018 (Wednesday) at 03:00 PM in the chamber of HOD.

Members Present:

- | | | | |
|--|-----------------|-------|----------------------------------|
| 1. Prof. Sukanta Banik, HOD & Dean, Faculty of Science | Chairperson | | <i>[Signature]</i>
26.9.18 |
| 2. Prof. Deepak Chetia | External Member | ..... |  |
| 3. Prof. Pulok Kr. Mukherjee | External Member | ..... |  |
| 4. Prof. S.K. Singh | External Member | ..... |  |
| 5. Prof. Swapan Majumder | Internal Member | | <i>[Signature]</i>
26/09/18 |
| 6. Prof. Samir Kumar Sil | Internal Member | | <i>Samir K Sil</i>
26/9/18 |
| 7. Dr. Bipin Kumar Sharma | Internal Member | | <i>BK Sharma</i>
26/09/2018 |
| 8. Dr. Surajit Bhattacharjee | Internal Member | ..... |  |
| 9. Mr. Rajat Ghosh | Internal Member | | <i>[Signature]</i>
26/09/2018 |
| 10. Dr. Pratap Chandra Acharya | Internal Member | | <i>[Signature]</i>
26/09/18 |

The Chairperson of the Board of Post Graduate Studies of Department of Pharmacy welcomed all the members to the 4TH meeting of BPGS and thereafter initiated discussion on the business of the agenda.

Agendum-1: Confirmation of proceeding of 3rd BPGS meeting held on 12th May 2017.

Resolution: The proceedings of the 3rd BPGS meeting held on 12th May 2017 were confirmed

Agendum-2: Approval of list of external examiners, moderators & paper setters of M.Pharm course.

Resolution: The list of external examiners, moderators & paper setters were placed in the meeting and approved for onward transmission. The name of Prof. S. K. Sil, Department of Human Physiology and HOD, Department of Molecular Biology and Bioinformatics, TU was included as a moderator.

Agendum-3: Approval of Ph.D registration as per RAC recommendation.

Resolution: The recommendations of RAC dated 27/03/2018 for the registration of the Ph.D candidate Ms. Sarapynbiang Marwein was placed in the meeting and approved for onward transmission.

Agendum-4: Approval of Ph.D progress report as per RAC recommendation.

Resolution: The recommendations of RAC regarding 1st and 2nd Semester Ph.D progress report of the candidate Ms. Sarapynbiang Marwein as per the clause no 6. XI & XII of the "Tripura University Regulations for Doctor of Philosophy (Ph.D) - 2016" were placed in the meeting and approved for onward transmission.

Agendum-5: Revision of M.Pharm Pharmaceutical Chemistry syllabus as per PCI norms.

Resolution: The M.Pharm Pharmaceutical Chemistry syllabus as per PCI norms was placed in the meeting for discussion. The committee was requested to take necessary steps in this regard for future implementation of the syllabus as per PCI norms.

Agendum-6: Matter related to extension of AICTE approval.

Resolution: Deferred.

Agendum-7: Matter related to PCI approval.

Resolution: Deferred.

Agendum-8: Approval to start a new specialization "M.Pharm in Pharmaceutical Analysis".

Resolution: The matter with regards to start a new specialization "M.Pharm in Pharmaceutical Analysis" was placed in the meeting for discussion. The committee decided that the particular specialization "M.Pharm in Pharmaceutical Analysis" can be started with the existing facility. The committee also recommended to hire guest faculty to run the new specialization.

Agendum-9: Miscellaneous

Resolution: None


26.9.18

(Prof. Sukanta Banik)
Chairman, BPGS; Dean, Faculty of Science
& HOD, Department of Pharmacy

HOD
Department of Pharmacy
Tribhuvan University
Suryamaninagar-799027



NO.F.TU/Dean (Science)/BFS/10/16

Dated: 09.08.2019

**Proceedings of the 9th meeting of Board of Faculty of Studies (BFS), Science held on 3rd May, 2019
at 3.00 P.M. in the Council Hall, Tripura University.**

Members Present:

1. Professor S. Banik, Dean, Faculty of Sciences, Tripura University -Chairman
2. Professor Anjan Mukherjee, Department of Mathematics, Tripura University. -Member
3. Professor S.K. Sil, Department of Human Physiology, Tripura University -Member
4. Professor R.N. Dutta Purkayastha, Department of Chemistry, Tripura University -Member
5. Professor M.K. Singh, Department of Chemistry, Tripura University- -Member
6. Professor R.K. Nath, Department of Chemistry, Tripura University -Member
7. Professor B.K. Datta, Department of Botany, Tripura University -Member
8. Professor A.K. Saha, Department of Botany, Tripura University -Member
9. Professor R.K. Sinha, Department of Botany, Tripura University -Member
10. Professor D. Bhattacharjee, Department of Physics, Tripura University -Member
11. Professor P.S. Chaudhuri, Department of Zoology, Tripura University -Member
12. Professor Debasish Maiti, Department of Human Physiology, Tripura University- -Member
13. Dr. S. Chattopadhyaya, Department of Physics, Tripura University -Member
14. Dr. Y.V. Krishnaiah, Department of Geography & Disaster Management, Tripura University -Member
15. Dr. R.K. Mahapatra, Department of Library and Information Science, Tripura University -Member
16. Dr. Swanirbhar Majumder, Department of I.T, Tripura University -Member
17. Dr. Sabyasachi Das Gupta, Department of Forestry & Biodiversity, Tripura University - -Member
18. Dr. Shyamal Debnath, Department of Mathematics, Tripura University -Member
19. Dr. Bimal Debnath, Department of Forestry & Biodiversity, Tripura University -Member
20. Dr. Mousami Debbarma, Department of Geography & Disaster Management, Tripura University -Member
21. Dr. S.S. Singh, Department of Zoology, Tripura University -Member
22. Dr. Sudipta Pal, Department of Human Physiology, Tripura University -Member
23. Dr. P. Karuna Purnapa Rupa, Department of Material Science & Engineering, Tripura University -Member
24. Dr. B. Sanjay, Department of Library & Information Science, Tripura University -Member
25. Dr. M.K. Bhowmik, Department of CSE, Tripura University -Member
26. Dr. Dipayan Choudhuri, Department of Human Physiology, Tripura University -Member
27. Dr. Anirban Karmakar, Department of ECE, Tripura University -Member
28. Dr. Ashutosh Kumar, Department of Microbiology, Tripura University -Member
29. Dr. Bipin Kumar Sharma, Department of Microbiology, Tripura University -Member
30. Bishanka Brata Bhowmik, Department of ECE, Tripura University -Member
31. Sachin Bhaladhare, Department of Chemical & Polymer Engineering, Tripura University -Member
32. Alak Roy, Department of IT, Tripura University -Member
33. Sri Rajat Ghosh, Department of Pharmacy, Tripura University -Member
34. Ms. Sangita Das Biswas, Department of Electrical Engineering, Tripura University -Member

At the outset, Professor S. Banik, Dean, Faculty of Sciences & Chairman, Board of Faculty of Studies, Science extended welcome to all the members present in the meeting.

Then agenda wise discussion was initiated.

Agendum – 1/09/19: To confirm the proceedings of 8th meeting of BFS of Science dated 19.07.2018.

Resolution: Confirmed.

Agendum – 2/09/19: To report the action taken on the proceedings of 8th meeting of the BFS of Science held on 19.07.2018.

Resolution: Reported.

Agendum – 3/09/19: To report and recommend the names of outside expert, E-expert, names of adjudicator, etc. of the Research candidates under the Faculty of Sciences:

Resolution: The names of outside experts involved in Pre-Ph.D. Public Seminar and names of adjudicator of the following students (18 candidates) were reported.

Sl. No	Name of the Scholar	Department	Title of Ph. D. Thesis	Supervisor	Expert List
1.	Istak Ahmed	Geography & D/M	Sedimentation Problem of Regulated Rivers and its Impact on Geographical environment: A Case Study of the Gumti River, Tripura.	Dr. Nibedita Das (Pan), T.U.	Expert List is placed in file.
2.	Sanjit Sutradhar	Chemistry	Synthesis and Characterization of Complexes of Some Transition Metal ions with Some Dithiolate and Amine Ligands.	Prof. M.K. Singh, T.U.	-do-
3.	Usha Rani Gogoi	Computer Science & Engineering	Analysis of Infrared Breast Thermograms for Abnormality Detection.	Dr. M.K. Bhowmik, T.U, Supervisor & Prof. A.K. Ghosh, Hon'ble Ex-V.C, Co-Supervisor.	-do-
4.	Sumanta Saha	Mathematics	A study on Hybridized ICA, PCA, Rough Set model and its application in the field of Image Processing.	Prof. Anjan Mukherjee, T.U.(Supervisor) and Dr. S. Bhattacharya Halder, T.U (Co-Supervisor).	-do-
5.	Srijita Barman Roy	Mathematics	A Study on Image Processing Techniques Using Various Generalized forms of ICA and	Prof. Anjan Mukherjee, T.U.(Supervisor) and Dr. S.	-do-

			PCA.	Bhattacharya Halder, T.U (Co-Supervisor).	
6.	Utpal Pal	Mathematics	A Study on Bayesian Decision Theoretic Rough Set using R Package.	Dr. S. Bhattacharya (Halder), T.U.	-do-
7.	Kakali Das	Computer Science & Engineering	Prediction of Health Abnormality Using Thermal Images.	Dr. M.K. Bhowmik, Supervisor & Prof. B.K. De, Co-Supervisor	-do-
8.	Shawli Bardhan	Computer Science & Engineering	Analysis of IR Images For Detection of Inflammatory Knee Joint Diseases.	Dr. M.K. Bhowmik, T.U.	-do-
9.	Sudipta Sinha	Botany	Mycorrhizal association and its influence on growth of selected species of Bamboos of Tripura.	Prof. A.K. Saha, T.U.	-do-
10.	Sanchita Bhattacharya	Botany	Fungal community composition and bioactive potential of selected fungal endophytes isolated from Ananas comosus L. (Bromeliaceae) of Tripura.	Prof. A.K. Saha, T.U.	-do-
11.	H. Reshmi Singha	Botany	Genetic diversity and in vitro morphogenesis in two wild Solanum species of Tripura.	Prof. Rabindra Kumar Sinha (Supervisor) and Prof. Sangram Sinha (Co-Supervisor)	-do-
12.	Amal Debnath	Forestry & Biodiversity	Impact Assessment of Chromolaena odorata (L.) King & Robinson (Alien Invasive) on Diversity and Composition of Vegetation, Soil Properties and Litter Decomposition Rate in Atharamura Forest Range of Tripura State.	Dr. Bimal Debnath, T.U.	-do-
13.	Chandan Debnath	Physics	Characterizations of Hybrid Langmuir-Blodgett (LB) Films Prepared by Electrostatic	Prof. D. Bhattacharjee, T.U.	-do-

			Interactions.		
14.	Bapan Paul	Physics	Investigation on different solar and Geophysical Phenomena using GPS derived Total Electron Content (TEC) data over Equatorial Ionization Anomaly (EIA) crest region.	Dr. Anirban Guha, T.U.	-do-
15.	Somen Debnath	Mathematics	Generalization of fuzzy soft matrices and their applications.	Prof. Anjan Mukherjee, T.U.	-do-
16.	Dipanwita Banik	Zoology	Neurosecretory System and its Role in Regeneration and Reproduction of Epigeic, Endogic and anecic Species of Earthworms in Tripura (INDIA).	Prof. P.S. Choudhury, T.U.	-do-
17.	Aprajita Singh	Zoology	Biology and Aquaculture of Aar, <i>Aorichthys aor</i> (Hamilton, 1822) with reference to its Conservation.	Prof. S. Banik, T.U.	-do-
18.	Sourabh Chakraborty	Zoology	The Ecology of Earthworm Species in the Bamboo Stands of west Tripura, with special Reference to the Biology of two Dominant Species.	Prof. P. Choudhury, T.U.	-do-

Agendum – 4/09/19 : To report the name of Ph.D. Students who have been awarded Ph.D. Degree Provisionally in different subjects under the Faculty of Sciences.

Resolution: Reported.

Sl. No	Name of the Scholar	Department	Title of Ph. D. Thesis	Supervisor	Date of Award
1.	Ankita Chakraborty	Chemistry	Studies on the development of some greener protocols for the synthesis of highly functionalized heterocyclic molecules.	Prof. S. Majumder, T.U.	24.08.2018
2.	Abhijit Santra	Geography & Disaster	Changing Land Use Pattern of the Agartala City, Tripura: A	Dr. Saptarshi Mitra, T.U.	13.09.2018

		Management	Geographical Perspective.		
3.	Somnath Kar	Botany	Reproductive biology of some medicinal plants of Tripura.	Prof. B.K. Datta, T.U.	16.11.2018
4.	Debjani Rakshit	Mathematics	Studies on I- Statistically Convergent Sequences.	Dr. Shyamal Debnath, T.U.	16.11.2018
5.	Krishna Talapatra	Botany	Study of root fungal endophytes in selected invasive plants of Tripura, Northeast India.	Dr. Panna Das, T.U.	10.12.2018
6.	Kishan Saha	Botany	Cytological and Molecular Studies in some species of Zingiberaceae of Tripura.	Prof. Sangram Sinha, T.U.	10.12.2018
7.	Rajib Lal Deb Barma	Geography & Disaster Management	Evolution and Characteristics of Rural Settlements in South Tripura District, Tripura.	Dr. Saptarshi Mitra, T.U.	12.12.2018
8.	Sumit Sarkar	Physics	Synthesis of a few Anisotropic Noble Metal Nanocrystal with the Study of their optical Properties and their Suitable Applications.	Dr. Ratan Das, T.U.	27.12.2018
9.	Kanu Shil	Human Physiology	Alteration in Carbohydrate, Protein and Fat Metabolism in Liver, Kidney, Muscle and Brain Following Sub-Acute Chromium Exposure.	Dr. Sudipta Pal, T.U.	22.01.2019
10.	Singh Kwrak Santua Jamatia	Zoology	Earthworm Resource and its Community Characters in the areas of Tea Plantations in Tripura.	Prof. P.S. Choudhuri, T.U.	29.01.2019
11.	Pintu Debnath	Physics	Study of Molecular Aggregates of Cyanine Dyes in Ultra- Thin Films.	Dr. Syed Arshad Hussain, T.U.	14.02.2019
12.	Sima Majumdar	Geography & Disaster Management	Changes of Drainage Systems and their Impact on Landuse between Baramura and Atharamura Hill Ranges, Tripura.	Dr. N. Das(Pan), T.U.	27.03.2019
13.	Rahul Bhattacharjee	Physics	Theoretical studies of the electronic structure and different properties of some compounds and alloys employing Density	Dr. S. Chattopadhyaya, T.U.	27.03.2019

			Functional Theory.		
14.	Soma Banik	Physics	Adsorption of water soluble Ionic Molecules into the Template Langmuir Monolayer at the Air- water Interface and in Ultra Thin Films.	Prof. D. Bhattacharjee, T.U.	27.03.2019

Agendum – 5/09/19: To consider the syllabus of different subjects of Faculty of Sciences.

Resolution: Following syllabus was accepted.

1. Revised syllabus of M.Tech course and Ph.D. Course Work, Department of ECE.
2. P.G. and Ph.D. Course work syllabus of IT Department.
3. MLIS & Ph.D. Course work syllabus of Library & Information Science Department.
4. P.G. and Ph.D. Course work syllabus of Electronics & Communication Engineering Department.
5. Syllabus of Pharmacy Department.
6. Letter from Dept. of E.E.
7. P.G. and Ph.D. Course work syllabus of Geography & Disaster Management Department.
8. Modified syllabus of Department of Molecular Biology & Bioinformatics.

Agendum –6/09/19: To consider the names of Students to be enrolled for Ph.D. Registration.

Sl. No	Name of the Scholar	Department	Title of Ph. D. Thesis	Supervisor	Date of Registration	Ph.D. Mode	Category	Male/ Female	Ph.D. Rules
1.	Sarapynbing Marwein	Pharmacy	Synthesis and Antiproliferative Evaluation of Some Newer Spiroheterocyclic Derivatives.	Dr. P. Acharya, T.U.	27.03. 2018	Full time	ST	Female	2016
2.	Stabak Roy	Geography & Disaster Management	Infrastructural Attributes and Aspects of Railway Transport System in Tripura: A Geographical Analysis.	Dr. Saptarshi Mitra, T.U.	17.12. 2018	Full time	UR	Male	2014
3.	Parminder Kaur	Physics	Characterization of Atmospheric Aerosols and its Radiative Forcing	Dr. Anirban Guha,	06.11. 2018	Full time	UR	Female	2016

			over North-East India.	T.U.					
4.	Debankita Ghosh	Physics	First principle based theoretical investigation of physical properties of some chalcogenide ternary and quaternary alloys containing alkaline-earth and transition metal elements.	Dr. SuryaChat topadhyaya, T.U.	06.11.2018	Full time	OBC	Female	2016
5.	Manish Debbarma	Physics	Density functional theory (DFT) based calculations of physical properties of some mercury (Hg) doped transition metal chalcogenide ternary alloys.	Dr. SuryaChat topadhyaya, T.U.	06.11.2018	Full time	ST	Male	2016
6.	Sayantika Chanda	Physics	Theoretical investigation of physical properties of some chalcogenide ternary and quaternary alloys containing elements of transition metal group using density functional theory (DFT) based full-potential linearized augmented plane wave (FP-LAPW) approach.	Dr. SuryaChat topadhyaya, T.U.	06.11.2018	Full time	UR	Female	2016

7.	Utpal Sarkar	Physics	Calculations of physical properties of some alkaline-earth element doped transition metal chalcogenide ternary alloys using density functional theory (DFT) based full-potential linearized augmented plane wave (FP-LAPW) methodology.	Dr. SuryaChat topadhyaya, T.U.	06.11.2018	Part time	SC	Male	2016
8.	Tania Mondal	Chemistry	Studies on the Photophysical Properties of some Organic Molecules by Fabrication of Ultrathin Films.	Prof. R.K. Nath, T.U.	13.03.2018	Part time	UR	Female	2016
9.	Utsab Banerjee	Electronics & Communication Engineering	Study on Circularly Polarized Antenna's for Modern Wireless Communication Systems.	Dr. Anirban Karmakar, T.U(Supervisor) and Dr. Anuradha Saha, Dept.of AEIE, Netaji Subhash Engineering College, Kolkata, India (Co-Supervisor)	07.12.2018	Part time	UR	Male	2016
10.	Abhirup Bhawal	Electronics & Communication	Study on Vivaldi Antenna Systems with Improved	Dr. Anirban Karmakar,	29.01.2019	Part time	UR	Male	2016

		cation Engineeri ng	Radiation Characteristics for Wireless Communications Applications.	T.U(Super visor) and Dr. Anuradha Saha, Dept.of AEIE, Netaji Subhash Engineeri ng College, Kolkata, India (Co- Supervisor)					
11.	Debasish Datta	Mathemat ics	Studies on Double Sequences of Complex Uncertain Variables.	Prof. B.C. Tripathy, T.U.	24.09. 2018	Part time	OBC	Male	2016
12.	Rakhal Das	Mathemat ics	Studies on Topological Space, Ideals and Spatial topological Relation.	Prof. B.C. Tripathy, T.U.	24.09. 2018	Full time	SC	Male	2016
13.	Atrayee Dutta	Botany	Morphological and Molecular Characterization of some Wild Edible Mushrooms of Tripura and their Potent Biological Activities.	Prof. A.K. Saha (Superviso r) and Prof. S. Sinha (Co- Supervisor)	14.11. 2018	Full time	UR	Female	2016
14.	Biswajit Baishnab	Botany	Studies on Orchid Diversity of Tripura with Special Reference to Reproductive Biology of Selected Species.	Prof. B.K. Datta, T.U.	14.11. 2018	Full time	OBC	Male	2016
15.	Bibhash	Botany	Morphological, Biochemical and	Prof. R.K. Sinha	14.11.	Full	OBC	Male	2016

	Nath		tissue Culture Studies in Two Varieties of Musa Species of Tripura.	(Supervisor) and Prof. S. Sinha (Co-Supervisor)	2018	time			
16.	Biplab Banik	Botany	Mapping, Modelling of Metapopulation Dynamics and Habitat Suitability of Selected Threatened Taxa In Tripura, North East India.	Prof. B.K. Datta, T.U.	14.11. 2018	Full time	UR	Male	2016
17.	Dipan Sarma	Botany	Evaluation of Biological Activities Using Crude Extracts and Green Synthesis of Silver Nanoparticles From Selected Medicinal Plants of Tripura.	Prof. B.K. Datta (Supervisor) and Prof. A.K. Saha (Co-Supervisor)	14.11. 2018	Full time	UR	Male	2016
18.	Supriya Adhikari	Botany	Cytology, In-Vitro Clonal Propagation and Phytochemical Characterization of Stichoneuron Membranaceum Hook.F.	Prof. R.K. Sinha (Supervisor) and Prof. S. Sinha (Co-Supervisor)	14.11. 2018	Full time	UR	Male	2016
19.	Udipta Das	Botany	Characterization of Fungal Endophytes in Some Ethnomedicinal Plants and Their Role in Growth of Selected Cereals and Pulses.	Prof. A.K. Saha (Supervisor) and Dr. Panna Das (Co-Supervisor)	14.11. 2018	Full time	SC	Male	2016

20.	Parbati Dasgupta	Zoology	Reproductive Biology and Aquaculture of <i>Wallago attu</i> with reference to its Conservation in freshwater of Tripura, India.	Prof. S. Banik, T.U.	01.05. 2019	Part time	UR	Female	2014
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Resolution: Approved.

Agendum –7/09/19: Miscellaneous.

1. Reporting of Change of Ph.D. thesis title of the following candidates:

Sl. No.	Name	Department	Supervisor	Previous title	Modified title
1	Kartick Lal Bhowmik	Chemistry	Prof. R.K. Nath (Supervisor), and Dr. Biswajit Saha (Co-Supervisor).	Synthesis and Physical Characterization of Conducting Polymer Based Thin Films.	Synthesis, Characterization and Application of Conducting Polymer Based Films and Metal Oxide Nanocomposite.

Resolution: Resolved that the change of title be accepted.

2. Change of Ph.D. thesis title & Ph.D. Supervisor.

Sl. No.	Name	Department	Supervisor	Previous title	Modified title
1	Papri Das (Sengupta)	Zoology	Prof. S. Banik, T.U.	Neuro- Secretory Components of the Central Nervous system in Top-Soil Endogeic Earthworm, <i>Pontoscolex corethrurus</i> Under Natural and stress conditions.	Reproductive Physiology and ecology of <i>Ompok Pabda</i> of Tripura, India.

Resolution: Resolved that the change of title and supervisor be accepted.

3. Reporting of change of Ph.D. Supervisor and Co-Supervisor.

Sl. No.	Name	Department	Supervisor	Co-supervisor	Date of Registration
1	Kakali Das	Computer Science & Engineering	Dr. M.K. Bhowmik	Prof. B.K. De	08.11.2015

Resolution: Resolved that the change supervisor and co-supervisor be accepted.

4. To consider the names of external member of BPGS of different subjects of Faculty of Sciences:

Resolution: The names of the following external members of BPGS were approved.

S.I. No.	Department	External member
01.	Electronics & Communication Engineering	i) Prof. Nikhil Ranjan Das , Institute of Radio Physics and Electronics, Sisir Mitra Bhavan, University College of Science & Technology, 92, Acharya P.C. Road, Kolkata-700009, W.B, India. ii) Prof. Paramartha Dutta , Department of Computer & System Sciences, Siksha Bhavana, Visva Bharati, Santiniketan, W.B, India. iii) Dr. Rupaban Subadar , Associate Professor, Department of Electronics & Communication Engineering, North Eastern Hill University, Shillong- 793022, India.
02.	Chemical & Polymer Engineering	i) Prof. Niranjana Karak , Head, SAIC, Tezpur University, Tezpur- 784028, Assam, India. ii) Prof. Prabirkumar Saha , Ex-Head, Department of Chemical Engineering, IIT Guwahati, Assam, India. iii) Prof. Abanti Sahoo , Department of Chemical Engineering, National Institute of Technology Rourkela, Odisha, India.
03.	Material Science & Engineering	i) Prof. M. Ghanashyam Krishna , School of Engineering Sciences and Technology, University of Hyderabad, Hyderabad- 500046, India. ii) Prof. Karabi Das , Department of Metallurgical and Materials Engineering, IIT Kharagpur, Kharagpur- 721302, W.B, India. iii) Prof. Kalyan Mandal , Department of Condensed Matter Physics and Materials Science, S.N. Bose National Center for Basic Sciences, JD Block Sector-III, Salt Lake City, W.B, Kolkata.
04.	Library & Information science	i) Prof. R.K. Nigurtinkhuma , Department of Library & Information Science, Mizoram University, Aizwal, Mizoram, India. ii) Prof. Durga Sankar Rath , Department of Library & Information Science, Vidya Sagar University, Midinapore, W.B, India. iii) Prof. M. Madhusudan , Department of Library & Information Science, Delhi University, Delhi, India.

5. Letter of Prof. S.N. Karmakar, regarding RAC of Utsab Banerjee and Abhirup Bhawal.
Resolution: Approved.
6. Letter of Prof. S.K. Sil, regarding approval of the proposed name of Dr. Timir Tripathi, NEHU, and Prof. Sharmila Sengupta, Institute of Biomedical Genomics at Kalyani in West Bengal to work as Co-Supervisor in the Department of Human Physiology.
Resolution: Approved in principle.
7. Letter of Prof. K.K. Kundu, Principal, Agartala Govt. Medical College regarding change of P.G. Guide in the Department of Otorhinolaryngology, AGMC & GBPH.
Resolution: Approved.
8. Letter from Suman Paul, for introducing new course structure in Tripura University.
Resolution: Not Approved.
9. Letter of Department of Botany for approval of the name of other than RAC Expert.
Resolution: Approved.



(Professor S. Banik)
Chairman,
Board of Faculty of Studies
Tripura University

Copy to:

1. All Members of the Board of Faculty of Studies of Science. T.U.....
2. The Dean, Faculty of Arts & Commerce, T.U.
3. Office of Dean, Faculty of Sciences, T.U.
4. Registrar, T.U.
5. Director, IQAC, T.U.
6. Controller of Examinations, T.U.
7. Director, CDC, T.U.
8. Chairman, Annual Report Committee for 2018-2019
9. All HOD/Faculty of Science, T.U.
10. Deputy Registrar (Academic), T.U.
11. P.S.to V.C for kind information of Hon'ble Vice-Chancellor, T.U.
12. Ph.D. Section, T.U.



(Professor S. Banik)
Chairman,
Board of Faculty of Studies
Tripura University

भैषज विज्ञान विभाग

DEPARTMENT OF PHARMACY

त्रिपुरा विश्वविद्यालय

TRIPURA UNIVERSITY

(केन्द्रीय विश्वविद्यालय / A Central University)

सूर्यमणिनगर, अगरतला / Suryamaninagar, Agartala

त्रिपुरा(प.)/Tripura (W.), पिन/PIN – 799022, भारत/INDIA



दूरभाष / Phone : (+91) 381-2379402

(+91) 9485098468(M)

ई-मेल / E-Mail: hod_pharmacy@tripurauniv.in

वेबसाइट / Website : www.tripurauniv.in

INFORMATION

The Department of Pharmacy, Tripura University (A Central University), Suryamaninagar-799022, has adopted the M.Pharm syllabus as per the guidelines of **Pharmacy Council of India (PCI), New Delhi** vide Gazette notification named **“The Master of Pharmacy (M.Pharm) course Regulation-2014”** published in the Gazette of India dated **11th December 2014**.

New subject codes have been given for the course code which has not been given by PCI. Pages which are not relevant to our program have been omitted from the PCI syllabus.

The formats for the M.Pharm thesis has been attached in MS word file. Students are requested not to change any design, pattern, style and font size while writing the thesis.

2016

THE MASTER OF PHARMACY (M. PHARM.) COURSE REGULATION 2014

(BASED ON NOTIFICATION IN THE GAZETTE OF INDIA No. 362, DATED DECEMBER 11, 2014)

SCHEME AND SYLLABUS



PHARMACY COUNCIL OF INDIA
Combined Council's Building, Kotla Road,
Aiwan-E-Ghalib Marg, New Delhi-110 002.
Website : www.pci.nic.

विज्ञापन सं. 31004/99

RSGD NO. D. L. 31004/99



भारत का राजपत्र The Gazette of India

असाधारण

EXTRAORDINARY

भाग III—खण्ड 4

PART III—Section 4

प्रधिकार से प्रकाशित

PUBLISHED BY AUTHORITY

सं. 362] नई दिल्ली, बुधवार, दिसम्बर 11, 2014/अग्राहयण 20, 1936

No. 362] NEW DELHI, THURSDAY, DECEMBER 11, 2014/AGRAHAYANA 20, 1936

PHARMACY COUNCIL OF INDIA

NOTIFICATION

New Delhi, the 10th December, 2014

The Master of Pharmacy (M.Pharm) Course Regulations, 2014

No. 14-136/ 2014-PCI.—In exercise of the powers conferred by Sections 10 and 18 of the Pharmacy Act, 1948 (8 of 1948), the Pharmacy Council of India, with the approval of the Central Government hereby makes the following regulations; namely—

CHAPTER –I:REGULATIONS

1. Short Title and Commencement

These regulations shall be called as “The Revised Regulations for the Master of Pharmacy (M. Pharm.)Degree Program - Credit Based Semester System (CBSS) of the Pharmacy Council of India, New Delhi”. They shall come into effect from the Academic Year 2016-17. The regulations framed are subject to modifications from time to time by the authorities of the university.

2. Minimum qualification for admission

A Pass in the following examinations

a) B. Pharm Degree examination of an Indian university established by law in India from an institution approved by Pharmacy Council of India and has scored not less than 55 % of the maximum marks (aggregate of 4 years of B.Pharm.)

b) Every student, selected for admission to post graduate pharmacy program in any PCI approved institution should have obtained registration with the State Pharmacy Council or should obtain the same within one month from the date of his/her admission, failing which the admission of the candidate shall be cancelled.

Note: It is mandatory to submit a migration certificate obtained from the respective university where the candidate had passed his/her qualifying degree (B.Pharm.)

3. Duration of the program

The program of study for M.Pharm. shall extend over a period of four semesters (two academic years). The curricula and syllabi for the program shall be prescribed from time to time by Pharmacy Council of India, New Delhi.

4. Medium of instruction and examinations

Medium of instruction and examination shall be in English.

5. Working days in each semester

Each semester shall consist of not less than 100 working days. The odd semesters shall be conducted from the month of June/July to November/December and the even semesters shall be conducted from the month of December/January to May/June in every calendar year.

6. Attendance and progress

A candidate is required to put in at least 80% attendance in individual courses considering theory and practical separately. The candidate shall complete the prescribed course satisfactorily to be eligible to appear for the respective examinations.

7. Program/Course credit structure

As per the philosophy of Credit Based Semester System, certain quantum of academic work viz. theory classes, practical classes, seminars, assignments, etc. are measured in terms of credits. On satisfactory completion of the courses, a candidate earns credits. The amount of credit associated with a course is dependent upon the number of hours of instruction per week in that course. Similarly the credit associated with any of the other academic, co/extra-curricular activities is dependent upon the quantum of work expected to be put in for each of these activities per week/per activity.

7.1. Credit assignment

7.1.1. Theory and Laboratory courses

Courses are broadly classified as Theory and Practical. Theory courses consist of lecture (L) and Practical (P) courses consist of hours spent in the laboratory. Credits (C) for a course is dependent on the number of hours of instruction per week in that course, and is obtained by using a multiplier of one (1) for lecture and a multiplier of half (1/2) for practical (laboratory) hours. Thus, for example, a theory course having four lectures per week throughout the semester carries a credit of 4. Similarly, a practical having four laboratory hours per week throughout semester carries a credit of 2.

The contact hours of seminars, assignments and research work shall be treated as that of practical courses for the purpose of calculating credits. i.e., the contact hours shall be multiplied by 1/2. Similarly, the contact hours of journal club, research work presentations and discussions with the supervisor shall be considered as theory course and multiplied by 1.

7.2. Minimum credit requirements

The minimum credit points required for the award of M. Pharm. degree is 95. However based on the credit points earned by the students under the head of co-curricular activities, a student shall earn a maximum of 100 credit points. These credits are divided into Theory courses, Practical, Seminars, Assignments, Research work, Discussions with the supervisor, Journal club and Co-Curricular activities over the duration of four semesters. The credits

are distributed semester-wise as shown in Table 14. Courses generally progress in sequence, building competencies and their positioning indicates certain academic maturity on the part of the learners. Learners are expected to follow the semester-wise schedule of courses given in the syllabus.

8. Academic work

A regular record of attendance both in Theory, Practical, Seminar, Assignment, Journal club, Discussion with the supervisor, Research work presentation and Dissertation shall be maintained by the department / teaching staff of respective courses.

9. Course of study

The specializations in M.Pharm program is given in Table 1.

Table – 1: List of M.Pharm. Specializations and their Code

S. No.	Specialization	Code
1.	Pharmaceutics	MPH
2.	Industrial Pharmacy	MIP
3.	Pharmaceutical Chemistry	MPC
4.	Pharmaceutical Analysis	MPA
5.	Pharmaceutical Quality Assurance	MQA
6.	Pharmaceutical Regulatory Affairs	MRA
7.	Pharmaceutical Biotechnology	MPB
8.	Pharmacy Practice	MPP
9.	Pharmacology	MPL
10.	Pharmacognosy	MPG

The course of study for M.Pharm specializations shall include Semester wise Theory & Practical as given in Table – 2 to 11. The number of hours to be devoted to each theory and practical course in any semester shall not be less than that shown in Table – 2 to 11.

Table – 4: Course of study for M. Pharm. (Pharmaceutical Chemistry)

Course Code	Course	Credit Hours	Credit Points	Hrs./week	Marks
Semester I					
MPC101T	Modern Pharmaceutical Analytical Techniques	4	4	4	100
MPC1012T	Advanced Organic Chemistry -I	4	4	4	100
MPC103T	Advanced Medicinal chemistry	4	4	4	100
MPC104T	Chemistry of Natural Products	4	4	4	100
MPC105P	Pharmaceutical Chemistry Practical I	12	6	12	150
MPC106S	Seminar/Assignment	7	4	7	100
Total		35	26	35	650
Semester II					
MPC201T	Advanced Spectral Analysis	4	4	4	100
MPC202T	Advanced Organic Chemistry -II	4	4	4	100
MPC203T	Computer Aided Drug Design	4	4	4	100
MPC204T	Pharmaceutical Process Chemistry	4	4	4	100
MPC205P	Pharmaceutical Chemistry Practical II	12	6	12	150
MPC206S	Seminar/Assignment	7	4	7	100
Total		35	26	35	650

Table – 12: Course of study for M. Pharm. III Semester
(Common for All Specializations)

Course Code	Course	Credit Hours	Credit Points
MRM 301T	Research Methodology and Biostatistics*	4	4
MPC □02	Journal club	1	1
MPC □0□□	Discussion / Presentation (Proposal Presentation)	2	2
MPC□0□□	Research Work	28	14
Total		35	21

* Non University Exam

Table – 13: Course of study for M. Pharm. IV Semester
(Common for All Specializations)

Course Code	Course	Credit Hours	Credit Points
MPC □01	Journal Club	1	1
MPC □02□	Research Work	31	16
MPC □0□□	Discussion/Final Presentation	3	3
Total		35	20

Table – 14: Semester wise credits distribution

C□□□C□□	Semester	Credit Points
	I	26
	II	26
	III	21
	IV	20
MPC□0□C	Co-curricular Activities (Attending Conference, Scientific Presentations and Other Scholarly Activities)	Minimum=02 Maximum=07*
Total Credit Points		Minimum=95 Maximum=100*

*Credit Points for Co-curricular Activities

Table – 15: Guidelines for Awarding Credit Points for Co-curricular Activities

Name of the Activity	Maximum Credit Points Eligible / Activity
Participation in National Level Seminar/Conference/Workshop/Symposium/ Training Programs (related to the specialization of the student)	01
Participation in international Level Seminar/Conference/Workshop/Symposium/ Training Programs (related to the specialization of the student)	02
Academic Award/Research Award from State Level/National Agencies	01
Academic Award/Research Award from International Agencies	02
Research / Review Publication in National Journals (Indexed in Scopus / Web of Science)	01
Research / Review Publication in International Journals (Indexed in Scopus / Web of Science)	02

Note: International Conference: Held Outside India

International Journal: The Editorial Board Outside India

*The credit points assigned for extracurricular and or co-curricular activities shall be given by the Principals of the colleges and the same shall be submitted to the University. The criteria to acquire this credit point shall be defined by the colleges from time to time.

10. Program Committee

1. The M. Pharm. programme shall have a Programme Committee constituted by the Head of the institution in consultation with all the Heads of the departments.
2. The composition of the Programme Committee shall be as follows:
A teacher at the cadre of Professor shall be the Chairperson; One Teacher from each M.Pharm specialization and four student representatives (two from each academic year), nominated by the Head of the institution.
3. Duties of the Programme Committee:
 - i. Periodically reviewing the progress of the classes.
 - ii. Discussing the problems concerning curriculum, syllabus and the conduct of classes.
 - iii. Discussing with the course teachers on the nature and scope of assessment for the course and the same shall be announced to the students at the beginning of respective semesters.

- iv. Communicating its recommendation to the Head of the institution on academic matters.
- v. The Programme Committee shall meet at least twice in a semester preferably at the end of each sessionalexam and before the end semester exam.

11. Examinations/Assessments

The schemes for internal assessment and end semester examinations are given in Table – 16.

11.1. End semester examinations

The End Semester Examinations for each theory and practical course through semesters I to IV shall be conducted by the respective university except for the subject with asterix symbol (*) in table I and II for which examinations shall be conducted by the subject experts at college level and the marks/grades shall be submitted to the university.

(Pharmaceutical Chemistry-MPC)

Course Code	Course	Internal Assessment				End Semester Exams		Total Marks
		Continuos Mode	Sessional Exams		Total	Marks	Duration	
			Marks	Duration				
SEMESTER I								
MPC101T	Modern Pharmaceutical Analytical Techniques	10	15	1 Hr	25	75	3 Hrs	100
MPC102T	Advanced Organic Chemistry -I	10	15	1 Hr	25	75	3 Hrs	100
MPC103T	Advanced Medicinal chemistry	10	15	1 Hr	25	75	3 Hrs	100
MPC104T	Chemistry of Natural Products	10	15	1 Hr	25	75	3 Hrs	100
MPC105P	Pharmaceutical Chemistry Practical I	20	30	6 Hrs	50	100	6 Hrs	150
MPC106S	Seminar /Assignment	-	-	-	-	-	-	100
Total								650
SEMESTER II								
MPC201T	Advanced Spectral Analysis	10	15	1 Hr	25	75	3 Hrs	100
MPC202T	Advanced Organic Chemistry -II	10	15	1 Hr	25	75	3 Hrs	100
MPC203T	Computer Aided Drug Design	10	15	1 Hr	25	75	3 Hrs	100
MPC204T	Pharmaceutical Process Chemistry	10	15	1 Hr	25	75	3 Hrs	100
MPC205P	Pharmaceutical Chemistry Practical II	20	30	6 Hrs	50	100	6 Hrs	150
MPC206S	Seminar /Assignment	-	-	-	-	-	-	100
Total								650

Tables – 26: Schemes for internal assessments and end semester examinations
(Semester III& IV)

Course Code	Course	Internal Assessment				End Semester Exams		Total Marks
		Continuous Mode	Sessional Exams		Total	Marks	Duration	
			Marks	Duration				
SEMESTER III								
MRM301T	Research Methodology and Biostatistics*	10	15	1 Hr	25	75	3 Hrs	100
MPC020	Journal club	-	-	-	25	-	-	25
MPC000	Discussion / Presentation (Proposal Presentation)	-	-	-	50	-	-	50
MPC000	Research work*	-	-	-	-	350	1 Hr	350
Total								525
SEMESTER IV								
MPC010	Journal club	-	-	-	25	-	-	25
MPC000	Discussion / Presentation (Proposal Presentation)	-	-	-	75	-	-	75
MPC020	Research work and Colloquium	-	-	-	-	400	1 Hr	400
Total								500

*Non University Examination

11.2. Internal assessment: Continuous mode

The marks allocated for Continuous mode of Internal Assessment shall be awarded as per the scheme given below.

Table – 27: Scheme for awarding internal assessment: Continuous mode

Theory	
Criteria	Maximum Marks
Attendance (Refer Table – 28)	8
Student – Teacher interaction	2
Total	10
Practical	
Attendance (Refer Table – 28)	10
Based on Practical Records, Regular viva voce, etc.	10
Total	20

Table – 28: Guidelines for the allotment of marks for attendance

Percentage of Attendance	Theory	Practical
95 – 100	8	10
90 – 94	6	7.5
85 – 89	4	5
80 – 84	2	2.5
Less than 80	0	0

11.2.1. Sessional Exams

Two sessional exams shall be conducted for each theory / practical course as per the schedule fixed by the college(s). The scheme of question paper for theory and practical sessional examinations is given in the table. The average marks of two sessional exams shall be computed for internal assessment as per the requirements given in tables.

12. Promotion and award of grades

A student shall be declared PASS and eligible for getting grade in a course of M.Pharm.programme if he/she secures at least 50% marks in that particular course including internal assessment.

13. Carry forward of marks

In case a student fails to secure the minimum 50% in any Theory or Practical course as specified in 12, then he/she shall reappear for the end semester examination of that course. However his/her marks of the Internal Assessment shall be carried over and he/she shall be entitled for grade obtained by him/her on passing.

14. Improvement of internal assessment

A student shall have the opportunity to improve his/her performance only once in the sessional exam component of the internal assessment. The re-conduct of the sessional exam shall be completed before the commencement of next end semester theory examinations.

15. Reexamination of end semester examinations

Reexamination of end semester examination shall be conducted as per the schedule given in table 29. The exact dates of examinations shall be notified from time to time.

Table – 29: Tentative schedule of end semester examinations

Semester	For Regular Candidates	For Failed Candidates
I and III	November / December	May / June
II and IV	May / June	November / December

16. Allowed to keep terms (ATKT):

No student shall be admitted to any examination unless he/she fulfills the norms given in 6. ATKT rules are applicable as follows:

A student shall be eligible to carry forward all the courses of I and II semesters till the III semester examinations. However, he/she shall not be eligible to attend the courses of IV semester until all the courses of I, II and III semesters are successfully completed.

A student shall be eligible to get his/her CGPA upon successful completion of the courses of I to IV semesters within the stipulated time period as per the norms.

Note: Grade AB should be considered as failed and treated as one head for deciding ATKT. Such rules are also applicable for those students who fail to register for examination(s) of any course in any semester.

17. Grading of performances

17.1. Letter grades and grade points allocations:

Based on the performances, each student shall be awarded a final letter grade at the end of the semester for each course. The letter grades and their corresponding grade points are given in Table – 30.

Table – 30: Letter grades and grade points equivalent to Percentage of marks and performances

Percentage of Marks Obtained	Letter Grade	Grade Point	Performance
90.00 – 100	O	10	Outstanding
80.00 – 89.99	A	9	Excellent
70.00 – 79.99	B	8	Good
60.00 – 69.99	C	7	Fair
50.00 – 59.99	D	6	Average
Less than 50	F	0	Fail
Absent	AB	0	Fail

A learner who remains absent for any end semester examination shall be assigned a letter grade of AB and a corresponding grade point of zero. He/she should reappear for the said evaluation/examination in due course.

18. The Semester grade point average (SGPA)

The performance of a student in a semester is indicated by a number called 'Semester Grade Point Average' (SGPA). The SGPA is the weighted average of the grade points obtained in all the courses by the student during the semester. For example, if a student takes five courses (Theory/Practical) in a semester with credits C₁, C₂, C₃ and C₄ and the student's grade points in these courses are G₁, G₂, G₃ and G₄, respectively, and then students' SGPA is equal to:

$$SGPA = \frac{C_1G_1 + C_2G_2 + C_3G_3 + C_4G_4}{C_1 + C_2 + C_3 + C_4}$$

The SGPA is calculated to two decimal points. It should be noted that, the SGPA for any semester shall take into consideration the F and ABS grade awarded in that semester. For example if a learner has a F or ABS grade in course 4, the SGPA shall then be computed as:

$$SGPA = \frac{C_1G_1 + C_2G_2 + C_3G_3 + C_4 * ZERO}{C_1 + C_2 + C_3 + C_4}$$

19. Cumulative Grade Point Average (CGPA)

The CGPA is calculated with the SGPA of all the IV semesters to two decimal points and is indicated in final grade report card/final transcript showing the grades of all IV semesters and their courses. The CGPA shall reflect the failed status in case of F grade(s), till the course(s) is/are passed. When the course(s) is/are passed by obtaining a pass grade on subsequent examination(s) the CGPA

shall only reflect the new grade and not the fail grades earned earlier. The CGPA is calculated as:

$$\text{CGPA} = \frac{C_1S_1 + C_2S_2 + C_3S_3 + C_4S_4}{C_1 + C_2 + C_3 + C_4}$$

where C_1, C_2, C_3, \dots is the total number of credits for semester I, II, III, \dots and S_1, S_2, S_3, \dots is the SGPA of semester I, II, III, \dots .

20. Declaration of class

The class shall be awarded on the basis of CGPA as follows:

- First Class with Distinction = CGPA of 7.50 and above
- First Class = CGPA of 6.00 to 7.49
- Second Class = CGPA of 5.00 to 5.99

21. Project work

All the students shall undertake a project under the supervision of a teacher in Semester III to IV and submit a report. 4 copies of the project report shall be submitted (typed & bound copy not less than 75 pages).

The internal and external examiner appointed by the University shall evaluate the project at the time of the Practical examinations of other semester(s). The projects shall be evaluated as per the criteria given below.

Evaluation of Dissertation Book:

Objective(s) of the work done	50 Marks
Methodology adopted	150 Marks
Results and Discussions	250 Marks
Conclusions and Outcomes	50 Marks
Total	500 Marks

Evaluation of Presentation:

Presentation of work	100 Marks
Communication skills	50 Marks
Question and answer skills	100 Marks
Total	250 Marks

22. Award of Ranks

Ranks and Medals shall be awarded on the basis of final CGPA. However, candidates who fail in one or more courses during the M.Pharm program shall not be eligible for award of ranks. Moreover, the candidates should have completed the M. Pharm program in minimum prescribed number of years, (two years) for the award of Ranks.

23. Award of degree

Candidates who fulfill the requirements mentioned above shall be eligible for award of degree during the ensuing convocation.

24. Duration for completion of the program of study

The duration for the completion of the program shall be fixed as double the actual duration of the program and the students have to pass within the said period, otherwise they have to get fresh Registration.

25. Revaluation I Retotaling of answer papers

There is no provision for revaluation of the answer papers in any examination. However, the candidates can apply for retotaling by paying prescribed fee.

26. Re-admission after break of study

Candidate who seeks re-admission to the program after break of study has to get the approval from the university by paying a condonation fee.

PHARMACEUTICAL CHEMISTRY (MPC)

MODERN PHARMACEUTICAL ANALYTICAL TECHNIQUES (MPC 101T)

Scope

This subject deals with various advanced analytical instrumental techniques for identification, characterization and quantification of drugs. Instruments dealt are NMR, Mass spectrometer, IR, HPLC, GC etc.

Objectives

After completion of course student is able to know about chemicals and excipients

- The analysis of various drugs in single and combination dosage forms
- Theoretical and practical skills of the instruments

THEORY

60 Hrs

1. a. UV-Visible spectroscopy: Introduction, Theory, Laws, Instrumentation associated with UV-Visible spectroscopy, Choice of solvents and solvent effect and Applications of UV-Visible spectroscopy, Difference/ Derivative spectroscopy. 10 Hrs
b. IR spectroscopy: Theory, Modes of Molecular vibrations, Sample handling, Instrumentation of Dispersive and Fourier - Transform IR Spectrometer, Factors affecting vibrational frequencies and Applications of IR spectroscopy, Data Interpretation.
c. Spectrofluorimetry: Theory of Fluorescence, Factors affecting fluorescence (Characteristics of drugs that can be analysed by fluorimetry), Quenchers, Instrumentation and Applications of fluorescence spectrophotometer.
d. Flame emission spectroscopy and Atomic absorption spectroscopy: Principle, Instrumentation, Interferences and Applications.
2. NMR spectroscopy: Quantum numbers and their role in NMR, Principle, Instrumentation, Solvent requirement in NMR, Relaxation process, NMR signals in various compounds, Chemical shift, Factors influencing chemical shift, Spin-Spin coupling, Coupling constant, Nuclear magnetic double resonance, Brief outline of principles of FT-NMR and ¹³C NMR. Applications of NMR spectroscopy. 10 Hrs

- | | | |
|---|--|-----------|
| 3 | <p>Mass Spectroscopy: Principle, Theory, Instrumentation of Mass Spectroscopy, Different types of ionization like electron impact, chemical, field, FAB and MALDI, APCI, ESI, APPI Analyzers of Quadrupole and Time of Flight, Mass fragmentation and its rules, Meta stable ions, Isotopic peaks and Applications of Mass spectroscopy.</p> | 10
Hrs |
| 4 | <p>Chromatography: Principle, apparatus, instrumentation, chromatographic parameters, factors affecting resolution, isolation of drug from excipients, data interpretation and applications of the following:</p> <ul style="list-style-type: none"> a) Thin Layer chromatography b) High Performance Thin Layer Chromatography c) Ion exchange chromatography d) Column chromatography e) Gas chromatography f) High Performance Liquid chromatography g) Ultra High Performance Liquid chromatography h) Affinity chromatography i) Gel Chromatography | 10
Hrs |
| 5 | <p>a. Electrophoresis: Principle, Instrumentation, Working conditions, factors affecting separation and applications of the following:</p> <ul style="list-style-type: none"> a) Paper electrophoresis b) Gel electrophoresis c) Capillary electrophoresis d) Zone electrophoresis e) Moving boundary electrophoresis f) Iso electric focusing <p>b. X ray Crystallography: Production of X rays, Different X ray methods, Bragg's law, Rotating crystal technique, X ray powder technique, Types of crystals and applications of X-ray diffraction.</p> | 10
Hrs |
| 6 | <p>a. Potentiometry: Principle, working, Ion selective Electrodes and Application of potentiometry.</p> <p>b. Thermal Techniques: Principle, thermal transitions and Instrumentation (Heat flux and power-compensation and designs), Modulated DSC, Hyper DSC, experimental parameters (sample preparation, experimental conditions, calibration, heating and cooling rates, resolution, source of errors) and their influence, advantage and disadvantages, pharmaceutical applications. Differential Thermal Analysis (DTA): Principle, instrumentation</p> | 10
Hrs |

and advantage and disadvantages, pharmaceutical applications, derivative differential thermal analysis (DDTA). TGA: Principle, instrumentation, factors affecting results, advantage and disadvantages, pharmaceutical applications.

REFERENCES

1. Spectrometric Identification of Organic compounds - Robert M Silverstein, Sixth edition, John Wiley & Sons, 2004.
2. Principles of Instrumental Analysis - Douglas A Skoog, F. James Holler, Timothy A. Nieman, 5th edition, Eastern press, Bangalore, 1998.
3. Instrumental methods of analysis – Willards, 7th edition, CBS publishers.
4. Practical Pharmaceutical Chemistry – Beckett and Stenlake, Vol II, 4th edition, CBS Publishers, New Delhi, 1997.
5. Organic Spectroscopy - William Kemp, 3rd edition, ELBS, 1991.
6. Quantitative Analysis of Drugs in Pharmaceutical formulation - P D Sethi, 3rd Edition, CBS Publishers, New Delhi, 1997.
7. Pharmaceutical Analysis - Modern Methods – Part B - J W Munson, Vol 11, Marcel. Dekker Series
8. Spectroscopy of Organic Compounds, 2nd edn., P.S/Kalsi, Wiley eastern Ltd., Delhi.
9. Textbook of Pharmaceutical Analysis, KA.Connors, 3rd Edition, John Wiley & Sons, 1982.

ADVANCED ORGANIC CHEMISTRY - I
(MPC 102T)

Scope

The subject is designed to provide in-depth knowledge about advances in organic chemistry, different techniques of organic synthesis and their applications to process chemistry as well as drug discovery.

Objectives

Upon completion of course, the student shall be to understand

- The principles and applications of retrosynthesis
- The mechanism & applications of various named reactions
- The concept of disconnection to develop synthetic routes for small target molecule.
- The various catalysts used in organic reactions
- The chemistry of heterocyclic compounds

THEORY

60 Hrs

1. **Basic Aspects of Organic Chemistry:** 12 Hrs
 1. Organic intermediates: Carbocations, carbanions, free radicals, carbenes and nitrenes. Their method of formation, stability and synthetic applications.
 2. Types of reaction mechanisms and methods of determining them,
 3. Detailed knowledge regarding the reactions, mechanisms and their relative reactivity and orientations.
- Addition reactions**
 - a) Nucleophilic uni- and bimolecular reactions (SN1 and SN2)
 - b) Elimination reactions (E1 & E2; Hoffman & Saytzeff's rule)
 - c) Rearrangement reaction
2. Study of mechanism and synthetic applications of following named Reactions: 12 Hrs

Ugi reaction, Brook rearrangement, Ullmann coupling reactions, Dieckmann Reaction, Doebner-Miller Reaction, Sandmeyer Reaction, Mitsunobu reaction, Mannich reaction, Vilsmeier-Haack Reaction, Sharpless asymmetric epoxidation, Baeyer-Villiger oxidation, Shapiro & Suzuki reaction, Ozonolysis and Michael addition reaction

- 3 Synthetic Reagents & Applications: 12 Hrs
 Aluminiumisopropoxide, N-bromosuccinamide, diazomethane, dicyclohexylcarbodiimide, Wilkinson reagent, Wittig reagent. Osmium tetroxide, titanium chloride, diazopropane, diethyl azodicarboxylate, Triphenylphosphine, Benzotriazol-1-yloxy) tris (dimethylamino) phosphonium hexafluoro-phosphate (BOP).
- Protecting groups
- Role of protection in organic synthesis
 - Protection for the hydroxyl group, including 1,2-and 1,3-diols: ethers, esters, carbonates, cyclic acetals & ketals
 - Protection for the Carbonyl Group: Acetals and Ketals
 - Protection for the Carboxyl Group: amides and hydrazides, esters
 - Protection for the Amino Group and Amino acids: carbamates and amides
- 4 Heterocyclic Chemistry: 12 Hrs
 Organic Name reactions with their respective mechanism and application involved in synthesis of drugs containing five, six membered and fused heterocyclics such as Debus-Radziszewski imidazole synthesis, Knorr Pyrazole Synthesis Pinner Pyrimidine Synthesis, Combes Quinoline Synthesis, Berthsen Acridine Synthesis, Smiles rearrangement and Traube purine synthesis.
- Synthesis of few representative drugs containing these heterocyclic nucleus such as Ketoconazole, Metronidazole, Miconazole, celecoxib, antipyrin, Metamizole sodium, Terconazole, Alprazolam, Triamterene, Sulfamerazine, Trimethoprim, Hydroxychloroquine, Quinine, Chloroquine, Quinacrine, Amsacrine, Prochlorperazine, Promazine, Chlorpromazine, Theophylline, Mercaptopurine and Thioguanine.
- 5 Synthons approach and retrosynthesis applications 12 Hrs
- Basic principles, terminologies and advantages of retrosynthesis; guidelines for dissection of molecules. Functional group interconversion and addition (FGI and FGA)
 - C-X disconnections; C-C disconnections – alcohols and carbonyl compounds; 1,2-, 1,3-, 1,4-, 1,5-, 1,6-difunctionalized compounds
 - Strategies for synthesis of three, four, five and six-membered ring.

REFERENCES

1. "Advanced Organic chemistry, Reaction, Mechanisms and Structure", J March, John Wiley and Sons, New York.
2. "Mechanism and Structure in Organic Chemistry", ES Gould, Hold Rinchart and Winston, New York.
3. "Organic Chemistry" Clayden, Greeves, Warren and Wothers., Oxford University Press 2001.
4. "Organic Chemistry" Vol I and II. I.L. Finar. ELBS, Pearson Education Lts, Dorling Kindersley (India) Pvt. Ltd.,
5. A guide to mechanisms in Organic Chemistry, Peter Skyes (Orient Longman, New Delhi).
6. Reactive Intermediates in Organic Chemistry, Tandom and Gowel, Oxford & IBH Publishers.
7. Combinational Chemistry – Synthesis and applications – Stephen R Wilson & Anthony W Czarnik, Wiley – Blackwell.
8. Carey, Organic Chemistry, 5th Edition (Viva Books Pvt. Ltd.)
9. Organic Synthesis - The Disconnection Approach, S. Warren, Wily India
10. Principles of Organic Synthesis, ROC Norman and JM Coxan, Nelson Thorns.
11. Organic Synthesis - Special Techniques. VK Ahluwalia and R Agarwal, Narosa Publishers.
12. Organic Reaction Mechanisms IVth Edtn, VK Ahluwalia and RK Parashar, Narosa Publishers.

ADVANCED MEDICINAL CHEMISTRY
(MPC 103T)

Scope

The subject is designed to impart knowledge about recent advances in the field of medicinal chemistry at the molecular level including different techniques for the rational drug design.

Objectives

At completion of this course it is expected that students will be able to understand

- Different stages of drug discovery
- Role of medicinal chemistry in drug research
- Different techniques for drug discovery
- Various strategies to design and develop new drug like molecules for biological targets
- Peptidomimetics

THEORY

60 Hrs

1. Drug discovery: Stages of drug discovery, lead discovery; identification, validation and diversity of drug targets. 12 Hrs

Biological drug targets: Receptors, types, binding and activation, theories of drug receptor interaction, drug receptor interactions, agonists vs antagonists, artificial enzymes.

2. Prodrug Design and Analog design: 12 Hrs
- a) Prodrug design: Basic concept, Carrier linked prodrugs/ Bioprecursors, Prodrugs of functional group, Prodrugs to improve patient acceptability, Drug solubility, Drug absorption and distribution, site specific drug delivery and sustained drug action. Rationale of prodrug design and practical consideration of prodrug design.
 - b) Combating drug resistance: Causes for drug resistance, strategies to combat drug resistance in antibiotics and anticancer therapy, Genetic principles of drug resistance.
 - c) Analog Design: Introduction, Classical & Non classical, Bioisosteric replacement strategies, rigid analogs,

alteration of chain branching, changes in ring size, ring position isomers, design of stereo isomers and geometric isomers, fragments of a lead molecule, variation in inter atomic distance.

- 3 a) Medicinal chemistry aspects of the following class of drugs 12 Hrs
Systematic study, SAR, Mechanism of action and synthesis of new generation molecules of following class of drugs:
a) Anti-hypertensive drugs, Psychoactive drugs, Anticonvulsant drugs, H1 & H2 receptor antagonist, COX1 & COX2 inhibitors, Adrenergic & Cholinergic agents, Antineoplastic and Antiviral agents.
b) Stereochemistry and Drug action: Realization that stereo selectivity is a pre-requisite for evolution. Role of chirality in selective and specific therapeutic agents. Case studies, Enantio selectivity in drug adsorption, metabolism, distribution and elimination.
- 4 Rational Design of Enzyme Inhibitors 12 Hrs
Enzyme kinetics & Principles of Enzyme inhibitors, Enzyme inhibitors in medicine, Enzyme inhibitors in basic research, rational design of non-covalently and covalently binding enzyme inhibitors.
- 5 Peptidomimetics 12 Hrs
Therapeutic values of Peptidomimetics, design of peptidomimetics by manipulation of the amino acids, modification of the peptide backbone, incorporating conformational constraints locally or globally. Chemistry of prostaglandins, leukotrienes and thromboxones.

REFERENCES

1. Medicinal Chemistry by Burger, Vol I –VI.
2. Wilson and Gisvold's Text book of Organic Medicinal and Pharmaceutical Chemistry, 12th Edition, Lppincott Williams & Wilkins, Woltess Kluwer (India) Pvt.Ltd, New Delhi.
3. Comprehensive Medicinal Chemistry – Corwin and Hansch.
4. Computational and structural approaches to drug design edited by Robert M Stroud and Janet, F Moore

5. Introduction to Quantitative Drug Design by Y.C. Martin.
6. Principles of Medicinal Chemistry by William Foye, 7th Edition, Ippincott Williams & Wilkins, Wolters Kluwer (India) Pvt.Ltd, New Delhi.
7. Drug Design Volumes by Arienes, Academic Press, Elsevier Publishers, Noida, Uttar Pradesh..
8. Principles of Drug Design by Smith.
9. The Organic Chemistry of the Drug Design and Drug action by Richard B.Silverman, II Edition, Elsevier Publishers, New Delhi.
10. An Introduction to Medicinal Chemistry, Graham L.Patrick, III Edition, Oxford University Press, USA.
11. Biopharmaceutics and pharmacokinetics, DM,Brahmankar, Sunil B. Jaiswal II Edition, 2014, Vallabh Prakashan, New Delhi.
12. Peptidomimetics in Organic and Medicinal Chemistry by Antonio Guarna and Andrea Trabocchi, First edition, Wiley publishers.

CHEMISTRY OF NATURAL PRODUCTS
(MPC 104T)

Scope

The subject is designed to provide detail knowledge about chemistry of medicinal compounds from natural origin and general methods of structural elucidation of such compounds. It also emphasizes on isolation, purification and characterization of medicinal compounds from natural origin.

Objectives

At completion of this course it is expected that students will be able to understand-

- Different types of natural compounds and their chemistry and medicinal importance
- The importance of natural compounds as lead molecules for new drug discovery
- The concept of rDNA technology tool for new drug discovery
- General methods of structural elucidation of compounds of natural origin
- Isolation, purification and characterization of simple chemical constituents from natural source

THEORY	60 Hrs
1. Study of Natural products as leads for new pharmaceuticals for the following class of drugs	12 Hrs
a) Drugs Affecting the Central Nervous System: Morphine Alkaloids	
b) Anticancer Drugs: Paclitaxel and Docetaxel, Etoposide, and Teniposide	
c) Cardiovascular Drugs: Lovastatin, Teprotide and Dicoumarol	
d) Neuromuscular Blocking Drugs: Curare alkaloids	
e) Anti-malarial drugs and Analogues	
f) Chemistry of macrolid antibiotics (Erythromycin, Azithromycin, Roxithromycin, and Clarithromycin) and β - Lactam antibiotics (Cephalosporins and Carbapenem)	
2 a) Alkaloids	12 Hrs
General introduction, classification, isolation, purification, molecular modification and biological activity of alkaloids, general methods of structural determination of alkaloids, structural elucidation and stereochemistry of ephedrine, morphine, ergot, emetine and reserpine.	

b) Flavonoids

Introduction, isolation and purification of flavonoids, General methods of structural determination of flavonoids; Structural elucidation of quercetin.

c) Steroids

General introduction, chemistry of sterols, sapogenin and cardiac glycosides. Stereochemistry and nomenclature of steroids, chemistry of contraceptive agents male & female sex hormones (Testosterone, Estradiol, Progesterone), adrenocorticoids (Cortisone), contraceptive agents and steroids (Vit - D).

3 a) Terpenoids

12
Hrs

Classification, isolation, isoprene rule and general methods of structural elucidation of Terpenoids; Structural elucidation of drugs belonging to mono (citral, menthol, camphor), di (retinol, Phytol, taxol) and tri terpenoids (Squalene, Ginsenoside) carotinoids (β carotene).

b) Vitamins

Chemistry and Physiological significance of Vitamin A, B1, B2, B12, C, E, Folic acid and Niacin.

4 a). Recombinant DNA technology and drug discovery

12
Hrs

rDNA technology, hybridoma technology, New pharmaceuticals derived from biotechnology; Oligonucleotide therapy. Gene therapy: Introduction, Clinical application and recent advances in gene therapy, principles of RNA & DNA estimation

b). Active constituent of certain crude drugs used in Indigenous system Diabetic therapy - *Gymnema sylvestre*, *Salacia reticulata*, *Pterocarpus marsupium*, *Swertia chirata*, *Trigonella foenum graecum*; Liver dysfunction - *Phyllanthus niruri*; Antitumor - *Curcuma longa* Linn.

5 Structural Characterization of natural compounds

12
Hrs

Structural characterization of natural compounds using IR, ¹HNMR, ¹³CNMR and MS Spectroscopy of specific drugs e.g., Penicillin, Morphine, Camphor, Vit-D, Quercetin and Digitalis glycosides.

REFERENCES

1. Modern Methods of Plant Analysis, Peech and M.V.Tracey, Springer – Verlag, Berlin, Heidelberg.
2. Phytochemistry Vol. I and II by Miller, Jan Nostrant Rein Hld.
3. Recent advances in Phytochemistry Vol. I to IV – Scikel Runeckles, Springer Science & Business Media.
4. Chemistry of natural products Vol I onwards IWPAC.
5. Natural Product Chemistry Nakanishi Gggolo, University Science Books, California.
6. Natural Product Chemistry "A laboratory guide" – Rapheal Khan.
7. The Alkaloid Chemistry and Physiology by RHF Manske, Academic Press.
8. Introduction to molecular Phytochemistry – CHJ Wells, Chapmanstall.
9. Organic Chemistry of Natural Products Vol I and II by Gurdeep and Chatwall, Himalaya Publishing House.
10. Organic Chemistry of Natural Products Vol I and II by O.P. Agarwal, Krishan Prakashan.
11. Organic Chemistry Vol I and II by I.L. Finar, Pearson education.
12. Elements of Biotechnology by P.K. Gupta, Rastogi Publishers.
13. Pharmaceutical Biotechnology by S.P.Vyas and V.K.Dixit, CBS Publishers.
14. Biotechnology by Purohit and Mathur, Agro-Bios, 13th edition.
15. Phytochemical methods of Harborne, Springer, Netherlands.
16. Burger's Medicinal Chemistry.

PHARMACEUTICAL CHEMISTRY PRACTICAL - I
(MPC 105P)

1. Analysis of Pharmacopoeial compounds and their formulations by UV Vis spectrophotometer, RNA & DNA estimation
2. Simultaneous estimation of multi component containing formulations by UV spectrophotometry
3. Experiments based on Column chromatography
4. Experiments based on HPLC
5. Experiments based on Gas Chromatography
6. Estimation of riboflavin/quinine sulphate by fluorimetry
7. Estimation of sodium/potassium by flame photometry

To perform the following reactions of synthetic importance

1. Purification of organic solvents, column chromatography
2. Claisen-schmidt reaction.
3. Benzyllic acid rearrangement.
4. Beckmann rearrangement.
5. Hoffmann rearrangement
6. Mannich reaction
7. Synthesis of medicinally important compounds involving more than one step along with purification and Characterization using TLC, melting point and IR spectroscopy (4 experiments)
8. Estimation of elements and functional groups in organic natural compounds
9. Isolation, characterization like melting point, mixed melting point, molecular weight determination, functional group analysis, co-chromatographic technique for identification of isolated compounds and interpretation of UV and IR data.
10. Some typical degradation reactions to be carried on selected plant constituents

ADVANCED SPECTRAL ANALYSIS
(MPC 201T)

Scope

This subject deals with various hyphenated analytical instrumental techniques for identification, characterization and quantification of drugs. Instruments dealt are LC-MS, GC-MS, ATR-IR, DSC etc.

Objectives

At completion of this course it is expected that students will be able to understand-

- Interpretation of the NMR, Mass and IR spectra of various organic compounds
- Theoretical and practical skills of the hyphenated instruments
- Identification of organic compounds

THEORY

60Hrs

- | | | |
|----|--|-----------|
| 1. | UV and IR spectroscopy:
Wood ward – Fieser rule for 1,3- butadienes, cyclic dienes and α , β -carbonyl compounds and interpretation compounds of enones.
ATR-IR, IR Interpretation of organic compounds. | 12
Hrs |
| 2 | NMR spectroscopy:
1-D and 2-D NMR, NOESY and COSY, HECTOR, INADEQUATE techniques, Interpretation of organic compounds. | 12
Hrs |
| 3 | Mass Spectroscopy

Mass fragmentation and its rules, Fragmentation of important functional groups like alcohols, amines, carbonyl groups and alkanes, Meta stable ions, Mc Lafferty rearrangement, Ring rule, Isotopic peaks, Interpretation of organic compounds. | 12
Hrs |
| 4 | Chromatography:
Principle, Instrumentation and Applications of the following :
a) GC-MS b) GC-AAS c) LC-MS d) LC-FTIR e) LC-NMR f) CE-MS g) High Performance Thin Layer chromatography h) Super critical fluid chromatography i) Ion Chromatography j) I-EC (Ion-Exclusion Chromatography) k) Flash chromatography | 12
Hrs |

- 5 a). Thermal methods of analysis 12
Introduction, principle, instrumentation and application of DSC, Hrs
DTA and TGA.
- b). Raman Spectroscopy
Introduction, Principle, Instrumentation and Applications.
- c). Radio immuno assay
Biological standardization , bioassay, ELISA, Radioimmuno
assay of digitalis and insulin.

REFERENCES

1. Spectrometric Identification of Organic compounds - Robert M Silverstein, Sixth edition, John Wiley & Sons, 2004.
2. Principles of Instrumental Analysis - Douglas A Skoog, F. James Holler, Timothy A. Nieman, 5th edition, Eastern press, Bangalore, 1998.
3. Instrumental methods of analysis – Willards, 7th edition, CBS publishers.
4. Organic Spectroscopy -William Kemp, 3rd edition, ELBS, 1991.
5. Quantitative analysis of Pharmaceutical formulations by HPTLC - P D Sethi, CBS Publishers, New Delhi.
6. Quantitative Analysis of Drugs in Pharmaceutical formulation - P D Sethi, 3rd Edition, CBS Publishers, New Delhi, 1997.
7. Pharmaceutical Analysis- Modern methods – Part B - J W Munson, Volume 11, Marcel Dekker Series

ADVANCED ORGANIC CHEMISTRY - II
(MPC 202T)

Scope

The subject is designed to provide in-depth knowledge about advances in organic chemistry, different techniques of organic synthesis and their applications to process chemistry as well as drug discovery.

Objectives

Upon completion of course, the student shall be able to understand

- The principles and applications of Green chemistry
- The concept of peptide chemistry.
- The various catalysts used in organic reactions
- The concept of stereochemistry and asymmetric synthesis.

THEORY

60 Hrs

- | | |
|---|--------|
| 1. Green Chemistry: | 12 Hrs |
| a. Introduction, principles of green chemistry | |
| b. Microwave assisted reactions: Merit and demerits of its use, increased reaction rates, mechanism, superheating effects of microwave, effects of solvents in microwave assisted synthesis, microwave technology in process optimization, its applications in various organic reactions and heterocycles synthesis | |
| c. Ultrasound assisted reactions: Types of sonochemical reactions, homogenous, heterogeneous liquid-liquid and liquid-solid reactions, synthetic applications | |
| d. Continuous flow reactors: Working principle, advantages and synthetic applications. | |
| 2. Chemistry of peptides | 12 Hrs |
| a. Coupling reactions in peptide synthesis | |
| b. Principles of solid phase peptide synthesis, t-BOC and Fmoc protocols, various solid supports and linkers: Activation procedures, peptide bond formation, deprotection and cleavage from resin, low and high HF cleavage protocols, formation of free peptides and peptide amides, purification and case studies, site-specific chemical modifications of peptides | |
| c. Segment and sequential strategies for solution phase peptide synthesis with any two case studies | |
| d. Side reactions in peptide synthesis: Deletion peptides, side | |

reactions initiated by proton abstraction, protonation, over-activation and side reactions of individual amino acids.

- 3 Photochemical Reactions 12 Hrs
Basic principles of photochemical reactions. Photo-oxidation, photo-addition and photo-fragmentation.

Pericyclic reactions

Mechanism, Types of pericyclic reactions such as cyclo addition, electrocyclic reaction and sigmatropic rearrangement reactions with examples

- 4 Catalysis: 12 Hrs
- a. Types of catalysis, heterogeneous and homogenous catalysis, advantages and disadvantages
 - b. Heterogeneous catalysis - preparation, characterization, kinetics, supported catalysts, catalyst deactivation and regeneration, some examples of heterogeneous catalysis used in synthesis of drugs.
 - c. Homogenous catalysis, hydrogenation, hydroformylation, hydrocyanation, Wilkinson catalysts, chiral ligands and chiral induction, Ziegler-Natta catalysts, some examples of homogenous catalysis used in synthesis of drugs
 - d. Transition-metal and Organo-catalysis in organic synthesis: Metal-catalyzed reactions
 - e. Biocatalysis: Use of enzymes in organic synthesis, immobilized enzymes/cells in organic reaction.
 - f. Phase transfer catalysis - theory and applications

- 5 Stereochemistry & Asymmetric Synthesis 12 Hrs
- a. Basic concepts in stereochemistry - optical activity, specific rotation, racemates and resolution of racemates, the Cahn, Ingold, Prelog (CIP) sequence rule, meso compounds, pseudo asymmetric centres, axes of symmetry, Fischers D and L notation, cis-trans isomerism, E and Z notation.
 - b. Methods of asymmetric synthesis using chiral pool, chiral auxiliaries and catalytic asymmetric synthesis, enantiopure separation and Stereo selective synthesis with examples.

REFERENCES

1. "Advanced Organic chemistry, Reaction, mechanisms and structure", J March, John Wiley and sons, New York.
2. "Mechanism and structure in organic chemistry", ES Gould, Hold Rinchart and Winston, New York.
3. "Organic Chemistry" Clayden, Greeves, Warren and Wothers., Oxford University Press 2001.
4. "Organic Chemistry" Vol I and II. I.L. Finar. ELBS, Sixth ed., 1995.
5. Carey, Organic chemistry, 5th edition (Viva Books Pvt. Ltd.)
6. Organic synthesis-the disconnection approach, S. Warren, Wily India
7. Principles of organic synthesis, ROC Norman and JMCoxan, Nelson thorns
8. Organic synthesis- Special techniques VK Ahluwalia and R Aggarwal, Narosa Publishers.
9. Organic reaction mechanisms IV edtn, VK Ahluwalia and RK Parashar, Narosa Publishers.

**COMPUTER AIDED DRUG DESIGN
(MPC 203T)**

Scope

The subject is designed to impart knowledge on the current state of the art techniques involved in computer assisted drug design.

Objectives

At completion of this course it is expected that students will be able to understand

- Role of CADD in drug discovery
- Different CADD techniques and their applications
- Various strategies to design and develop new drug like molecules.
- Working with molecular modeling softwares to design new drug molecules
- The in silico virtual screening protocols

Theory

60 Hrs

1. Introduction to Computer Aided Drug Design (CADD)

12
Hrs

History, different techniques and applications.

Quantitative Structure Activity Relationships: Basics

History and development of QSAR: Physicochemical parameters and methods to calculate physicochemical parameters: Hammett equation and electronic parameters (σ), lipophilicity effects and parameters ($\log P$, π -substituent constant), steric effects (Taft steric and MR parameters) Experimental and theoretical approaches for the determination of these physicochemical parameters.

2 Quantitative Structure Activity Relationships: Applications

12
Hrs

Hansch analysis, Free Wilson analysis and relationship between them, Advantages and disadvantages; Deriving 2D-QSAR equations.

3D-QSAR approaches and contour map analysis.

Statistical methods used in QSAR analysis and importance of statistical parameters.

3 Molecular Modeling and Docking

12
Hrs

a) Molecular and Quantum Mechanics in drug design.

b) Energy Minimization Methods: comparison between global

minimum conformation and bioactive conformation
c) Molecular docking and drug receptor interactions: Rigid docking, flexible docking and extra-precision docking. Agents acting on enzymes such as DHFR, HMG-CoA reductase and HIV protease, choline esterase (AChE & BchE)

- 4 Molecular Properties and Drug Design 12 Hrs
a) Prediction and analysis of ADMET properties of new molecules and its importance in drug design.
b) De novo drug design: Receptor/enzyme-interaction and its analysis, Receptor/enzyme cavity size prediction, predicting the functional components of cavities, Fragment based drug design.
c) Homology modeling and generation of 3D-structure of protein.
- 5 Pharmacophore Mapping and Virtual Screening 12 Hrs
Concept of pharmacophore, pharmacophore mapping, identification of Pharmacophore features and Pharmacophore modeling; Conformational search used in pharmacophore mapping.

In Silico Drug Design and Virtual Screening Techniques
Similarity based methods and Pharmacophore based screening, structure based In-silico virtual screening protocols.

REFERENCES

1. Computational and structural approaches to drug discovery, Robert M Stroud and Janet. F Moore, RCS Publishers.
2. Introduction to Quantitative Drug Design by Y.C. Martin, CRC Press, Taylor & Francis group..
3. Drug Design by Ariens Volume 1 to 10, Academic Press, 1975, Elsevier Publishers.
4. Principles of Drug Design by Smith and Williams, CRC Press, Taylor & Francis.
5. The Organic Chemistry of the Drug Design and Drug action by Richard B. Silverman, Elsevier Publishers.
6. Medicinal Chemistry by Burger, Wiley Publishing Co.

7. An Introduction to Medicinal Chemistry –Graham L. Patrick, Oxford University Press.
8. Wilson and Gisvold's Text book of Organic Medicinal and Pharmaceutical Chemistry, Ippincott Williams & Wilkins.
9. Comprehensive Medicinal Chemistry – Corwin and Hansch, Pergamon Publishers.
10. Computational and structural approaches to drug design edited by Robert M Stroud and Janet, F Moore

PHARMACEUTICAL PROCESS CHEMISTRY
(MPC 204T)

Scope

Process chemistry is often described as scale up reactions, taking them from small quantities created in the research lab to the larger quantities that are needed for further testing and then to even larger quantities required for commercial production. The goal of a process chemist is to develop synthetic routes that are safe, cost-effective, environmentally friendly, and efficient. The subject is designed to impart knowledge on the development and optimization of a synthetic route/s and the pilot plant procedure for the manufacture of Active Pharmaceutical Ingredients (APIs) and new chemical entities (NCEs) for the drug development phase.

Objectives

At completion of this course it is expected that students will be able to understand

- The strategies of scale up process of APIs and intermediates
- The various unit operations and various reactions in process chemistry

THEORY	60 Hrs
1. Process chemistry	12
Introduction, Synthetic strategy	Hrs
Stages of scale up process: Bench, pilot and large scale process.	
In-process control and validation of large scale process.	
Case studies of some scale up process of APIs.	
Impurities in API, types and their sources including genotoxic impurities	
2. Unit operations	12
a) Extraction: Liquid equilibria, extraction with reflux, extraction with agitation, counter current extraction.	Hrs
b) Filtration: Theory of filtration, pressure and vacuum filtration, centrifugal filtration,	
c) Distillation: azeotropic and steam distillation	
d) Evaporation: Types of evaporators, factors affecting evaporation.	
e) Crystallization: Crystallization from aqueous, non-aqueous solutions factors affecting crystallization, nucleation. Principle and general methods of Preparation of polymorphs, hydrates, solvates and amorphous APIs.	

- | | | |
|---|--|-----------|
| 3 | Unit Processes - I
a) Nitration: Nitrating agents, Aromatic nitration, kinetics and mechanism of aromatic nitration, process equipment for technical nitration, mixed acid for nitration,
b) Halogenation: Kinetics of halogenations, types of halogenations, catalytic halogenations. Case study on industrial halogenation process.
c) Oxidation: Introduction, types of oxidative reactions, Liquid phase oxidation with oxidizing agents. Nonmetallic Oxidizing agents such as H ₂ O ₂ , sodium hypochlorite, Oxygen gas, ozonolysis. | 12
Hrs |
| 4 | Unit Processes - II
a) Reduction: Catalytic hydrogenation, Heterogeneous and homogeneous catalyst; Hydrogen transfer reactions, Metal hydrides. Case study on industrial reduction process.
b) Fermentation: Aerobic and anaerobic fermentation. Production of
i. Antibiotics; Penicillin and Streptomycin,
ii. Vitamins: B2 and B12
iii. Statins: Lovastatin, Simvastatin
c) Reaction progress kinetic analysis
i. Streamlining reaction steps, route selection,
ii. Characteristics of expedient routes, characteristics of cost-effective routes, reagent selection, families of reagents useful for scale-up. | 12
Hrs |
| 5 | Industrial Safety
a) MSDS (Material Safety Data Sheet), hazard labels of chemicals and Personal Protection Equipment (PPE)
b) Fire hazards, types of fire & fire extinguishers
c) Occupational Health & Safety Assessment Series 1800 (OHSAS-1800) and ISO-14001 (Environmental Management System), Effluents and its management | 12
Hrs |

REFERENCES

1. Process Chemistry in the Pharmaceutical Industry: Challenges in an Ever-Changing Climate-An Overview; K. Gadamasetti, CRC Press.
2. Pharmaceutical Manufacturing Encyclopedia, 3rd edition, Volume 2.
3. Medicinal Chemistry by Burger, 6th edition, Volume 1-8.
4. W.L. McCabe, J.C Smith, Peter Harriott. Unit operations of chemical engineering, 7th edition, McGraw Hill
5. Polymorphism in Pharmaceutical Solids .Dekker Series Volume 95 Ed: H G Brittain (1999)
6. Regina M. Murphy: Introduction to Chemical Processes: Principles, Analysis, Synthesis
7. Peter J. Harrington: Pharmaceutical Process Chemistry for Synthesis: Rethinking the Routes to Scale-Up
8. P.H.Groggins: Unit processes in organic synthesis (MGH)
9. F.A.Henglein: Chemical Technology (Pergamon)
10. M.Gopal: Dryden's Outlines of Chemical Technology, WEP East-West Press
11. Clausen, Mattson: Principle of Industrial Chemistry, Wiley Publishing Co.,
12. Lowenheim & M.K. Moran: Industrial Chemicals
13. S.D. Shukla & G.N. Pandey: A text book of Chemical Technology Vol. II, Vikas Publishing House
14. J.K. Stille: Industrial Organic Chemistry (PH)
15. Shreve: Chemical Process, Mc Grawhill.
16. B.K.Sharma: Industrial Chemistry, Goel Publishing House
17. ICH Guidelines
18. United States Food and Drug Administration official website www.fda.gov

PHARMACEUTICAL CHEMISTRY PRACTICALS – II
(MPC 205P)

1. Synthesis of organic compounds by adapting different approaches involving (3 experiments)
 - a) Oxidation
 - b) Reduction/hydrogenation
 - c) Nitration
2. Comparative study of synthesis of APIs/intermediates by different synthetic routes (2 experiments)
3. Assignments on regulatory requirements in API (2 experiments)
4. Comparison of absorption spectra by UV and Wood ward – Fieser rule
5. Interpretation of organic compounds by FT-IR
6. Interpretation of organic compounds by NMR
7. Interpretation of organic compounds by MS
8. Determination of purity by DSC in pharmaceuticals
9. Identification of organic compounds using FT-IR, NMR, CNMR and Mass spectra
10. To carry out the preparation of following organic compounds
11. Preparation of 4-chlorobenzhydrylpiperazine. (an intermediate for cetirizine HCl).
12. Preparation of 4-iodotoluene from p-toluidine.
13. NaBH₄ reduction of vanillin to vanillyl alcohol
14. Preparation of umbelliferone by Pechhman reaction
15. Preparation of triphenyl imidazole
16. To perform the Microwave irradiated reactions of synthetic importance (Any two)
17. Determination of log P, MR, hydrogen bond donors and acceptors of selected drugs using softwares
18. Calculation of ADMET properties of drug molecules and its analysis using softwares
Pharmacophore modeling
19. 2D-QSAR based experiments
20. 3D-QSAR based experiments
21. Docking study based experiment
22. Virtual screening based experiment

Semester III
MRM 301T - Research Methodology & Biostatistics

UNIT – I

General Research Methodology: Research, objective, requirements, practical difficulties, review of literature, study design, types of studies, strategies to eliminate errors/bias, controls, randomization, crossover design, placebo, blinding techniques.

UNIT – II

Biostatistics: Definition, application, sample size, importance of sample size, factors influencing sample size, dropouts, statistical tests of significance, type of significance tests, parametric tests (students “t” test, ANOVA, Correlation coefficient, regression), non-parametric tests (wilcoxon rank tests, analysis of variance, correlation, chi square test), null hypothesis, P values, degree of freedom, interpretation of P values.

UNIT – III

Medical Research: History, values in medical ethics, autonomy, beneficence, non-maleficence, double effect, conflicts between autonomy and beneficence/non-maleficence, euthanasia, informed consent, confidentiality, criticisms of orthodox medical ethics, importance of communication, control resolution, guidelines, ethics committees, cultural concerns, truth telling, online business practices, conflicts of interest, referral, vendor relationships, treatment of family members, sexual relationships, fatality.

UNIT – IV

CPCSEA guidelines for laboratory animal facility: Goals, veterinary care, quarantine, surveillance, diagnosis, treatment and control of disease, personal hygiene, location of animal facilities to laboratories, anesthesia, euthanasia, physical facilities, environment, animal husbandry, record keeping, SOPs, personnel and training, transport of lab animals.

UNIT – V

Declaration of Helsinki: History, introduction, basic principles for all medical research, and additional principles for medical research combined with medical care.



PHARMACY COUNCIL OF INDIA

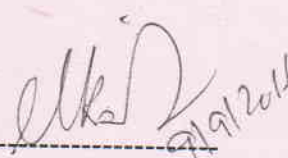

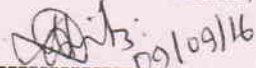
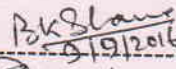
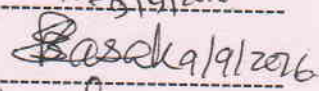
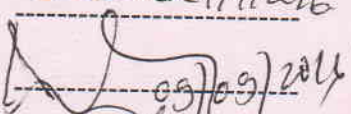
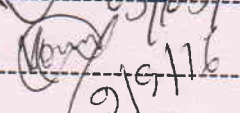
Combined Council's Building, Kotta Road,
Aiwan-E-Ghalib Marg, New Delhi-110 002.
Website : www.pci.nic.

DEPARTMENT OF PHARMACY

Tripura University
(A Central University)
Suryamaninagar - 799022

The proceeding of the 2nd meeting of Board of Post Graduate Studies of Department of Pharmacy held on 9th September, 2016 (Friday) at 11:00AM in the chamber of HOD.

Members Present:

1. Prof. M. K. Singh	Chairperson	
2. Prof. S.K. Ghosh	External Member	_____
3. Prof. D. Sriram	External Member	_____
4. Dr. Sunil Kumar	External Member	_____
5. Prof. R. N. Dutta Purkayastha	Internal Member	
6. Dr. Debasish Maiti	Internal Member	
7. Dr. Bipin Kr. Sharma	Internal Member	
8. Dr. Surajit Basak	Internal Member	
9. Mr. Rajat Ghosh	Internal Member	
10. Dr. Kuntal Manna	Internal Member	

The chairperson of the Board of Post Graduate Studies (BPGS) of Department of Pharmacy extended a warm welcome to all the members.

Agenda-1: Confirmation of Proceeding of 1st meeting of BPGS, Dated: 14th Aug. 2015.

Resolution:

The Proceeding of 1st meeting of BPGS, Dated: 14th Aug. 2015 were confirmed with the following modifications:

a) The members of the committee discussed in detail syllabus of M.Pharm under CBCS, the course code of various subjects in different semesters were modified in conformity with CBCS rules of university. Modification as follows:

Semester-I

Previous Course Code

MPHA-904(P)C

MPHA-905(P)C

MPHA-906DE

MPHA-908CEC



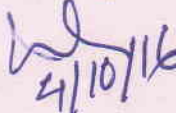
Modified course code

MPHA-904C

MPHA-905C

MPHA-906E

MPHA-908CF

 4/10/16
 4.10.16
 4/10/16

 6/10/16
 6/10/16

Semester-II

MPHA-1004(P)C

MPHA-1004C

MPHA – 1005(P)C

MPHA-1005C

MPHA-1006DE

MPHA-1006E

Semester-III

MPHA-1103DE

MPHA-1103E

Semester-IV

MPHA-1203DE

MPHA – 1203E

b) Committee discussed in detail the credit of Course Code- MPHA-907E, Subject Name: Optional Elective-I from outside the department for the AY-2015-2016 onward and resolved that, a student may opt any Optional Elective-I (MPHA-907E) from outside the department. The credit for MPHA-907E shall be awarded only '2' (Two) even a student goes for '4' (four) credit course for the Elective Paper and the total credit should not be exceed 24 (maximum) as per CBCS Rules of University.

Agenda-2: For recommendation of List of Examiners including paper setters and moderators for the M.Pharm of 1st and 3rd Semester and Ph.D. coursework.

Resolution:

The lists of Examiner, Paper Setters and Moderators were placed in the meeting and were approved for onward transmission.

Agenda-3: Reporting of recommendation of RAC of Ph.D. Scholars for approval of Ph.D. registration.

Resolution: The recommendations of RAC for registration of Shri Manik Das and Miss Sanchari Goswami were placed in the meeting and approved for onward transmission.

Agenda-4: Reporting of formation of Departmental Research Committee (DRC) for newly admitted Ph.D. student.

Resolution:

Agendum was withdrawn.

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Agenda-5: For the Constitution/approval of RAC (Research Advisory Committee) for Ph.D. candidates.

Resolution:

Proposal for RAC(s) members for the following candidates were placed in the meeting and approved.

Sl. No.	Name of Candidate	Name of Supervisor	RAC Members
1.	Mr. Waikhom Somraj Singh	Dr. Kuntal Manna	<p>i. Prof. Sudam Chandra Si (External Expert) Professor Cum Dean School of Pharmaceutical Sciences, SOA University, Kalinganagar, Ghatikia Bhubaneswar – 03</p> <p>ii. Prof. S. Majumder (Member) Professor Department of Chemistry, TU</p> <p>iii. Dr. Shiv Sankar Singh (Member) Assistant Professor Department of Zoology, TU</p> <p>iv. Dr. Pratap Ch. Acharya (Member) Assistant Professor Department of Pharmacy, TU</p> <p>v. Dr. Kuntal Manna (Supervisor cum Convener) Assistant Professor Department of Pharmacy, TU</p>
2.	Mr. Bikash Debnath	Dr. Kuntal Manna	<p>i. Dr. Pallab Kanti Halder (External Expert) Associate Professor, Department of Pharmaceutical Technology, Fulorhat Bidyargalli, Sonarpur, Kolkata: 700150</p> <p>ii. Dr. Shubhamoy Chowdhury (Member) Assistant Professor Department of Chemistry, TU</p> <p>iii. Dr. Debasish Maiti (Member) Associate Professor Department of Human Physiology, TU</p> <p>iv. Dr. Pratap Ch. Acharya (Member) Assistant Professor Department of Pharmacy, TU</p> <p>v. Dr. Kuntal Manna (Supervisor cum Convener) Assistant Professor Department of Pharmacy, TU</p>

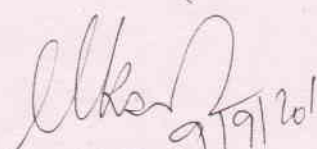
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3.	Sarapynbiang Marwein	Dr. Pratap Chandra Acharya	<p>i. Dr. Senthil Raja A (External Expert) Associate Professor, Department of Pharmaceutics, IIT (BHU), Varanasi-221005 Mob.: 09453313140</p> <p>ii. Dr. Utpal Chandra De (Member) Assistant Professor Department of Chemistry, TU</p> <p>iii. Dr. Surajit Bhattacharjee (Member) Assistant Professor, Department of Molecular Biology and Bioinformatics, TU</p> <p>iv. Dr. Kuntal Manna (Member) Assistant Professor Department of Pharmacy, TU</p> <p>v. Dr. P. Ch. Acharya (Supervisor cum Convener) Assistant Professor Department of Pharmacy, TU</p>
4.	Rajat Ghosh	Dr. Pratap Chandra Acharya	<p>i. Prof. S. K. Ghosh (External Expert) Department of Pharmaceutical Sciences, Dibrugarh University, Dibrugarh-786004, Assam, Mob.: 094353330771</p> <p>ii. Dr. Swapan Majumdar (Member) Associate Professor Department of Chemistry, TU</p> <p>iii. Dr. Surajit Bhattacharjee (Member) Assistant Professor, Department of Molecular Biology and Bioinformatics, TU</p> <p>iv. Dr. Kuntal Manna (Member) Assistant Professor Department of Pharmacy, TU</p> <p>v. Dr. P. Ch. Acharya (Supervisor cum Convener) Assistant Professor Department of Pharmacy, TU</p>

Agenda-6: Miscellaneous (If any)

Resolution:

It was withdrawn.


(Prof. M. K. Singh)

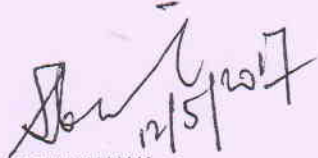
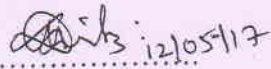
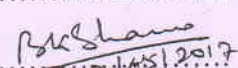
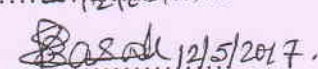
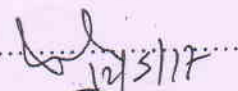

Chairman, BPGS & HOD, Department of Pharmacy



DEPARTMENT OF PHARMACY
TRIPURA UNIVERSITY (A CENTRAL UNIVERSITY)
SURYAMANINAGAR, TRIPURA-799022

Proceedings of the 3rd meeting of Board of Post Graduate Studies of Department of Pharmacy held on 12TH May 2017 (Friday) at 11:00 AM in the chamber of HOD.

Members Present:

1. Prof. Sukanta Banik, Dean, Faculty of Science	Chairperson	.....	12/5/2017
2. Prof. S. K. Ghosh	External Member	.....	—
3. Prof. D. Sriram	External Member	.....	—
4. Dr. Sunil Kumar	External Member	.....	—
5. Prof. R. N. Dutta Purkayastha	Internal Member	.....	—
6. Dr. Debasish Maiti	Internal Member	.....	12/05/17
7. Dr. Bipin Kumar Sharma	Internal Member	.....	12/5/2017
8. Dr. Surajit Basak	Internal Member	.....	12/5/2017
9. Mr. Rajat Ghosh	Internal Member	.....	12/5/17
10. Dr. Kuntal Manna	Internal Member	.....	12/5/17

The Chairperson of the Board of Post Graduate Studies of Department of Pharmacy welcomed all the members to the 3rd meeting of BPGS and thereafter initiated discussion on the business of the agenda.

Agendum-1: Confirmation of proceeding of 2nd BPGS meeting held on 9th September 2016.

Resolution: The proceedings of 2nd meeting of BPGS held on 9th September 2016 were confirmed.

Agendum-2: For approval of Ph.D. registration as per the RAC recommendation reports of Ph.D scholars.

Resolution: The recommendations of RAC for registration of Mr. Waikhom Somraj Singh, Mr. Bikash Debnath and Mr. Rajat Ghosh were placed in the meeting and approved for onward transmission.

Agendum-3: For confirmation of paper code of M.Pharm CBCS syllabus.

Resolution: With regard to using a code "PA" instead of "MPHA" which was being used since inception of the Department of Pharmacy. The committee recommended for using initial "PA" instead of "MPHA".

Agendum-4: Approval of Pre-PhD course work syllabus.


Resolution: The syllabus was placed in the meeting and approved for onward transmission.

Agendum-5: For recommendation of List of Examiners including paper setters and moderators for the M.Pharm and Ph.D. course work.

Resolution: The list of examiners, paper setters and moderators were placed in the meeting and approved for onward transmission.

Agendum-6: Miscellaneous (If any).

Resolution: The department proposed to get approval from Pharmacy Council of India (PCI), New Delhi. The committee discussed regarding its merit at length. So, the committee resolved that an application from the department will be submitted to PCI for their approval, through office of Do


12.5.2017

(Prof. Sukanta Banik)
Chairman, BPGS; Dean, Faculty of Science
& HOD, Department of Pharmacy

HOD
Department of Pharmacy
Tripura Central University
Suryamaninagar-789001



DEPARTMENT OF PHARMACY
Tripura University (A Central University)
Suryamaninagar– 799022, West Tripura, INDIA

**SUBJECT DISTRIBUTION IN MASTER OF PHARMACY (M.PHARM) IN PHARMACEUTICAL CHEMISTRY
IN CBCS SYSTEM**

1ST SEMESTER

Course Code	Name of Subjects		Credits	Total Credits
PA-901C	Pharmaceutical Chemistry-I (Drug Design)	Departmental Core Subjects	4	24
PA-902C	Pharmaceutical Analysis-I (Basic Instrumentation Methods)		4	
PA-903C	Pharmaceutical Chemistry-II (Natural Products)		4	
PA-904 C	Pharmaceutical Chemistry - Practical		2	
PA-905 C	Pharmaceutical Analysis -Practical		2	
PA-906 E	Research Methodology for Biochemical Sciences	Departmental Elective	2	
PA-908CF	Computer Skill-II	Core Foundation Course	4	
PA-907 E	Optional Elective-I	Outside the Department	2	

2ND SEMESTER

Course Code	Name of Subjects		Credits	Total Credits
PA-1001C	Pharmaceutical Analysis-II (Advanced Instrumental Methods)	Departmental Core Subjects	4	20
PA-1002C	Pharmaceutical Chemistry-III (Medicinal Chemistry)		4	
PA-1003C	Pharmaceutical Chemistry-IV (Principles of Organic Synthetic Planning)		4	
PA-1004 C	Instrumental Methods -Practical		2	
PA-1005 C	Medicinal Chemistry -Practical		2	
PA-1006 E	Review works/Summer Tanning for Project and Presentation	Departmental Elective	2	
PA-1007 E	Optional Elective-II	Outside the Department	2	

3RD SEMESTER

Course Code	Name of Subjects		Credits	Total Credits
PA-1101C	Dissertation works (Part –I)	Departmental Core Subjects	6	14
PA-1102C	Viva-Voce on Dissertation work Reports (Part –I)		4	
PA-1103 E	Seminar and Journal Club	Departmental Elective	2	
PA-1104 EF	Online course/ MOOC / SWAYAM/ Distance Learning/English communication/Yoga, Etc.	Outside the Department	2	

4TH SEMESTER

Course Code	Name of Subjects		Credits	Total Credits
PA-1201C	Dissertation works (Part –II)	Departmental Core Subjects	6	14
PA-1202C	Viva-Voce on Dissertation Report (Part –II)		4	
PA-1203 E	Seminar and Journal Club	Departmental Elective	2	
PA-1204 EF	Online course/ MOOC / SWAYAM/ Distance Learning/English communication/Yoga, Etc.	Outside the Department	2	

PHARMACEUTICAL CHEMISTRY-I
(Drug Design)

Total Marks: 100

Total Lectures: 45

GROUP - A

- 1) Drug Discovery- Identification of Target to Clinical Trials:** *Conventional methods of drug design:* Lead, discovery of lead, lead optimization, objective of lead optimization, pharmacophoric identification and analog approach of drug designing. Lead discovery - Random screening and non random or targeted screening, rational approaches to lead discovery. Strategies of lead modification.
- 2) Structure Activity Relationships in Drug Design:** Physicochemical Properties in Relation to Biological Action. parameters - Lipophilicity, electronic, Steric factors. Quantitative Model-Hansch analysis, Free Wilson Analysis, Mixed approach and Other QSAR Approaches. Applications of Hansch Analysis, Free Wilson Analysis.
- 3) Recombinant Technology and Gene- Based Drug Design:** Detailed structure of nucleic acids and protein-nucleic acid interactions; Nucleic acid and small molecule interactions; DNA damage and repair. Nucleic acids (NA) as targets for drug action; NA-interactive agents; Classes of drugs that interact with nucleic acids; Intercalation, NA-alkylation, NA-strand breaking and their importance in drug action. Introduction to protein and peptide based drugs.

GROUP - B

- 4) Design of Enzyme Inhibitors:** Reversible enzyme inhibitors – simple competitive inhibition, Transition state analogs and multi-substrate analogs, Slow and tight binding inhibitors and Irreversible enzyme inhibition – affinity labels and mechanism based. Current development with respect to the inhibition of the following enzymes – reverse transcriptase, HMG Co A reductase inhibitors, Protein Kinase.
- 5) Drug Receptor Theory and Interactions:** Drug-Receptor Interaction, Basic ligand concept, agonist, antagonist, partial agonist, inverse agonist, Receptor Theories - Occupancy, Rate & Activation Theories. Topological and stereochemical consideration. Receptor occupation and response relationship, Receptor Binding Assays, Determination of B_{max} and K_d by transforming data with Hill plot and Scatcherd plot.
- 6) Design and Application of Prodrugs:** chemistry and design of prodrugs- Bioprecursor & Carrier Linked Prodrugs, hard and soft drugs. Prodrugs of various functional groups like carbonyl, hydroxyl, Amide, amines, *Application of Prodrug approach to:* Improvement of bioavailability,

Prevent first pass metabolism, Reduction of side effects, Prolong duration of action, Site specific delivery.

Suggested Readings:

1. Alan L. Harney - Advanced in drug discovery techniques.
2. Alfred Burger – Text Book of medicinal chemistry Vol. 1 & Vol. 2.
3. Carowari Hansch and Albert Leo, ACS, Washington DC – 1995.
4. E.J. Ariens; Drug Design, Academic Press, New York.
5. Ellis & Wert – Progress in Medicinal Chemistry – Academic Press, New York.
6. Exploring QSAR: Vol. I Fundamentals and application in chemistry and Biology by C Hansch. A Leo and D Hockman ACS Book Catalog.
7. P C Jurs, Computer Software Application in Chemistry, John Wiley & Sons, New York
8. Paul's charifson – Practical application of computer Aided drug design – Marcel Dekker 1997.
9. Principles and Practice, Vth Ed, John Wiely& Sons.
10. Progress in Medicinal Chemistry, Series by Ellis & Wert.
11. Receptor based drug design, by P. Leff, Marcel Dekker, New York, 1998.
12. The Organic Chemistry of Drug design and Drug Action - R.B.Silverman Academic, Press –1992.
13. William O. Foye – Principles of Medicinal Chemistry Varghese Publishing House.
14. Wilson &Gisvolds – Text book of organic medicinal and pharmaceutical chemistry, 10th Edition, 1998.
15. Y. C.Martin, Quantitative Drug Design – A Critical Introduction (Medicinal Research Monograph, Vol. 8) Marce; Dekker. Inc. New York

[Latest editions of all the suggested books are recommended. Additional references as required will be provided by the faculty members during classes]

PHARMACEUTICAL ANALYSIS-I
(Basic Instrumentation Methods)

Total Marks: 100

Total Lectures: 45

GROUP – A

1) UV-Visible Spectrophotometry: Brief review of electromagnetic spectrum, UV-Visible range, energy, wave length and color relationships. Interaction of electromagnetic radiation (UV-Visible) with matter and its effects. Chromophores and their interaction 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) Chromatography: i) Classification of chromatographic methods based on mechanism of separation. Principles of separation and application of column, paper and Thin layer chromatography. ii) *Gas Chromatography:* Instrumentation, packed and open tubular column, column efficiency parameters, the van Deemter equation, Resolution, liquid stationary phases, derivatization methods of GC including acylation, perfluoroacylation, alkylation and esterification. Detectors: FID, ECD, TCD, NPDA critical comparison of sensitivity, selectivity and field of applications of these detectors. Applications of G.C. in pharmaceutical analysis.

3) Electrophoresis:- Theory and principles, classifications, instrumentation, moving boundary electrophoresis, zone electrophoresis, Isotachopheresis, Isoelectric focusing and immune-electrophoresis, continuous electrophoresis(preparative), applications.

GROUP – B

4) 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.

5) Impurity Profiling: Impurities, drug master files, profiling of impurities, official guidelines for impurities.

6) Stability Testing: Stability indicating assays, methods, protocols and parameters for physical stability testing programs, stabilization, shelf life determination, equipment, ICH guidelines.

Suggested Readings:

- 1) Beckett and Stenlake, Practical Pharmaceutical Chemistry, CBS.
- 2) D. L. Pavia, G. M. Lampman and G. S. Kris, Introduction to Spectroscopy- A guide for students of Organic chemistry, Harcourt college publishers.(latest edition)
- 3) Instrumental Method of Chemical Analysis, B. K. Sharma.
- 4) Organic Spectroscopy by L.D.S. Yadav.
- 5) Organic Spectroscopy-William Kemp. 3rd edition.
- 6) S. Lindsay, High Performance Liquid Chromatography, Analytical Chemistry by Open Learning (ACOL), Wiley, 1987.
- 7) Sethi and Charegankar, Identification of Drugs in Pharmaceutical Formulations by TLC.
- 8) Sethi P.D., HPLC, Quantitative Analysis of Pharmaceutical Formulations, CBSPublishers,Delhi.
- 9) Sethi P.D., HPTLC, Quantitative Analysis of Pharmaceutical Formulations, CBSPublishers,Delhi
- 10) Sethi P.D., Quantitative Analysis of Pharmaceutical formulations, CBS Publishers, New Delhi.
- 11) Silverstein, Spectrometric identification of Organic compounds, Willy.
- 12) Skoog D.A., Heller F.J., Nieman T.A., Principles of Instrumental Analysis, WB saunders.
- 13) Spectroscopy of organic compounds by P.S. Kalsi.
- 14) Willard H.H., Merrit L. L.,Dean J.A., Settle P.A., Instrumental Methods of Analysis, Van Nostrand.

[Latest editions of all the suggested books are recommended. Additional references as required will be provided by the faculty members during classes]

PHARMACEUTICAL CHEMISTRY-II
(Natural Products)

Total Marks: 100

Total Lectures: 45

GROUP – A

- 1) Basic principles and general methods for extraction of phytoconstituents, isolation methods, characterization and therapeutic uses of the following classes: Alkaloids, Glycosides, Flavonoids, Terpenoids, Phytosterols and others.
- 2) Herbal Formulations: Types of herbal formulations, recent trends in poly herbal formulations, various Ayurvedic dosage forms, GMP for herbal drug formulations, Potential herb- drug interaction and adverse effects of some herbal medicines.
- 3) Discovery of new chemical entities from herbal origin in the following therapeutic areas: Anti-asthmatic, Anti-oxidant, Anti-hepatotoxic, Anti-inflammatory, Anti-cancer, Anti-infective agents, Immunomodulators and immunosuppressants.

GROUP – B

- 4) The metabolism of purines and pyrimidines, allopurinol and xanthine oxidase and associated disorders.
- 5) Early penicillin and cephalosporins, amido Penicillins, Beta lactamase stable cephalosporins, Antipseudomonal penicillin and cephalosporins.
- 6) Other beta lactam agents: Nocardins and monobactams, Clavulanic acid analogs, Carbapenams.
- 7) Aminoglycosides, Tetracyclines, Macrolides, Polyene & Polypeptide antibiotics

Suggested Readings:

1. Encyclopedia of Indian Medicinal Plants: Rational Western Therapy, Ayurvedic and Other Traditional Usage, Botany; Ed. by C.P. Khare, Berlin: Springer-Verlag, 2004
2. Herbs, Spices and Medicinal Plants: Recent Advances in Botany, Horticulture and Pharmacology: Vol. 1 ; Ed. by Lyle E. Craker, James E. Simon, CBS Publishers & Distributors, Delhi, 2002
3. Cultivation of Medicinal and Aromatic Crops; by Azhar Ali Farooqi and B.S. Sreeramu, Universities Press (India) Ltd., Hyderabad, 2001
4. Indian Spices and Condiments as Natural Healers; by H.K. Bakhru, Jaico Publishing House, New Delhi, 2004

5. Pharmacognosy , Phytochemistry of Medicinal Plants; by Jean Bruneton, Lavoisier Publishing, France, 2nd ed 2001
6. Herbal Drugs Industry: A Practical Approach to Industrial Pharmacognosy; Ed. by R. D. Chaudhri, Eastern Publishers, New Delhi: 1999
7. Biologically Active Natural Products: Pharmaceuticals; Ed. by Stephen J. Cutler and Horace G. Cutler, CRC Press London, 2000
8. Pharmacodynamic Basic of Herbal Medicine; by M. Ebadi, CRC Press, New York , 2002
9. Compendium of Indian Medicinal Plants: Vol. 1-4; Ed by Ram P. Rastogi, CSIR, New Delhi, 2002
10. Medicinal Plants of the World: Chemical Constituents Traditional and Modern Medicinal Uses, Vol. 2 ; by Ivan A. Ross, Humana Press, New Jersey , 2001
11. Textbook of Natural Medicine - Vol. I & II; Ed. by Joseph E. Pizzorno and Michael T. Murray, Churchill Livngsone, London, 2nd Ed., 2000
12. Indian Herbal Pharmacopoeia: Vol. I & II, by Indain drug Manufacturers Assocation and Regional Research Laboratory, Jammu Tawi: Regional Research Laboratory, 1998
13. Quality Standard of Indian Medicinal Plants; Vol. 1 ; by A.K. Gupta, Indian Council of Medical Research, New Delhi , 2003
14. The Wealth of India: A Dictionary of Indian Raw Materials and Industrial Products; Raw Materials by Publication and Information Directorate; CSIR, New Delhi: Publications & Information Directorate, CSIR, 1988

[Latest editions of all the suggested books are recommended. Additional references as required will be provided by the faculty members during classes]

PHARMACEUTICAL CHEMISTRY - PRACTICAL

Total Marks: 100

Total Practical: 20

GROUP – A

- 1) Hands on Training: Various solvents distillation, recrystallization, column purification.
- 2) Chemical spotting of various organic substances and their chemical identification. Separation and extraction of analyses based on chemical principles.
- 3) Workshops: Building, viewing and cleaning small molecules using Chemoffice, ACD ChemSketch, etc. Calculation of various properties of the molecules, visualization and interpretation-Bond lengths, Bond angles, Torsion angles, Dipole moments, Calculation of Heat of formation, Clog P and partial charges. Training in softwares like pKa database, log P database.
- 4) Workshop on preparation of stereo models of selected drugs by plastic models or computer software.

GROUP – B

- 5) Hands on Training on: Refinement and identification of active sites, bimolecular crystallographic identification, brief exercise on design of a novel molecule using the various modules with references to the following Anti-HIV agents, Anti-neoplastics, Anti-diabetics, Anti-inflammatory, etc.
- 6) Preparation and evaluation of prodrugs.
- 7) Synthesis: Drug intermediates, one and multi steps drug synthesis and purification. Multi step synthesis of drugs and intermediates used in the synthesis of various drugs employing micro TLC and qualitative analysis.

Note: Additional experiments may be added or deleted or may be modified according to availability of instruments/reagents and as per theory syllabus

Suggested Readings:

1. L. Finar, Organic Chemistry, Vol. I & II, ELBS/ Longman, London.
2. Mann & Saunderson, Practical Organic Chemistry, Orient Longman, London.
3. Shriner, Hermann, Morrill, Curtin & Fuson, The Systematic Identification of Organic Compounds, John Wiley & Sons. USA.
4. Vogel's Text book of Practical Organic Chemistry, ELBS/ Longman, London
5. Y. C. Martin, Quantitative Drug Design – A Critical Introduction (Medicinal Research Monograph, Vol. 8) Marce: Dekker. Inc. New York.
6. Young D. Computational Chemistry: A Practical Guide for Applying Techniques to Real World Problems. New York: Wiley; 2001.

[Latest editions of all the suggested books are recommended. Additional references as required will be provided by the faculty members during practical classes]

PHARMACEUTICAL ANALYSIS –PRACTICAL

Total Marks: 100

Total Practical: 20

GROUP - A

- 1) Analysis of drugs and raw materials using official pharmacopoeial methods based on UV-Visible or other Chromatographic techniques. Workshop on Spectral interpretation and calculation (Woodward – Fischer rules).
- 2) Separation of an impurity in a sample using basic preparative analytical methods. Extraction and analysis of active ingredients from dosage forms and natural products.
- 3) Qualitative and quantitative estimation of pharmaceutical substances by Paper chromatography and TLC.

GROUP - B

- 4) Dissolution studies of various pharmaceutical formulations. Stability studies: Degradation kinetic study of drugs and shelf-life determination, Accelerated stability studies of a formulation.
- 5) Gel electrophoresis studies for separation of protein and molecular weight determination.
- 6) Development and optimization of assays using spectroscopic and chromatographic methods.

Note: Additional experiments may be added or deleted or may be modified according to availability of instruments/reagents and as per theory syllabus.

Suggested Readings:

1. L. Finar, Organic Chemistry, Vol. I & II, ELBS/ Longman, London.
2. Mann & Saunder, Practical Organic Chemistry, Orient Longman, London.
3. R. M. Silverstein, G. Claytron Bassel's, T. C. Movvill, Spectrometric identification of Organic compounds, John Wiley & Sons, USA.
4. Shriner, Hermann, Morrill, Curtin & Fuson, The Syntematic Identification of Organic Compounds, John Wiley & Sons. USA.
5. Vogel's Text book of Practical Organic Chemistry, ELBS/ Longman, London

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RESEARCH METHODOLOGY FOR BIOCHEMICAL SCIENCES

Total Marks: 50

Total Lectures: 20

1) Pharmaceutical Research: Aim objective & purpose and need for Research, Types of Research, Selecting a problem and preparing a research proposal, Methods and Tools used in research, Literature Survey, Printing & Secondary Sources of Information, E-Resources.

2) Research Documentation: How, techniques, importance and uses of computers, the research Report/Paper writing/thesis writing, Patent Search and Reading of Patents, Ethics in Research & Publication, The Research Report Paper writing/ thesis writing.

3) Data Handling in Pharmaceutical Research: Accuracy & precision, ways of expressing accuracy, significant figures, types of errors, determinate & indeterminate errors, propagations of errors, quality control charts, Variability and variables, statistics of sampling, samples and population, bias.

4) Research Grants & Experimental Data: Presentation of Experimental Data, Procurement of Research Grants from various agencies, International Agencies, Government bodies and Private bodies, Industry - Institute Interaction & Interaction with Research Organization.

5) Presentation: Importance, types different skills, contained, format of model, introduction & ending, Poster, Gestures, eye contact, facial, expressions, stage, fright, volume- pitch, speed, pause & language, Visual aids & seating, Questionnaire.

Suggested Readings:

1. A practical Introduction to copyright- GravinMcfarlane
2. Presentation Skills- Michael Halton- Indian Society for Institute Education
3. Quality Assurance of Pharmaceuticals, Pharma Book Syndicate, Hyderabad
4. Pharmaceutical Statistics, Practicals& Clinical Application by S. Bolton, Marcel Dekker , Inc., New York
5. Methods in Biostatistics by Mahajan.
6. Understanding ISO 9000 and Implementing the basics to Quality – D. H. Stamatis, Marcel Dekker , Inc., New York
7. Guidelines for Laboratory Quality Auditing – Donald C. Singer, Ronald P. Upton, Marcel Dekker, Inc., New York
8. Good Manufacturing Practices for Pharmaceuticals : A plan for total quality control – Sidney H Willing, James R. Stoker, Marcel Dekker, Inc., New York
9. Research In education: John V. Best, James V. Kahn
10. Scientists in legal System- Ann Labor Science
11. Thesis and Assignment Writing- Jonathan Anderson
12. Thesis Projects in science and Engineering, Richard M. Davis

[Latest editions of all the suggested books are recommended. Additional References as required will be provided by the faculty members during classes]

PHARMACEUTICAL ANALYSIS-II
(Advanced Instrumental Methods)

Total Marks: 100

Total Lectures: 45

GROUP - A

1) Infra-Red Spectrophotometer: Nature of infra-red radiation. Interaction of IR radiation with organic molecules and effects on bonds. Molecular Infrared spectra. Brief outline of classical IR instrumentation and particle details of obtaining spectra, including sample preparation for spectroscopy, qualitative interpretation of IR spectroscopy including FT-IR.

2) Nuclear Magnetic Resonance 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 term used in describing spectra and their interpretation (Signal No., Position, Intensity). Brief outline of instrumentation arrangement 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. Decoupling and shift reagent methods. Brief outline of principles of FT-NMR with reference to ^{13}C -NMR: Spin-spin and spin-lattice relaxation phenomenon. Free induction decay (FID) proton noise de-coupling signal, average time domain and frequency domain signals nuclear over Hauser enhancement ^{13}C -NMR 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 2D-NMR techniques.

3) Hyphenated Techniques: Interfaces used in and applications of LC-MS, GC-MS, LC-MS-MS. Detectors. Data interpretation.

GROUP – B

4) Thermal Analysis: Pharmaceutical applications of thermo gravimetric analysis (TGA), differential thermal analysis (DTA), differential scanning calorimetry (DSC) and microcalorimetry: different types of calorimeters and micro calorimeters, advantages of microcalorimetry over DSC.

5) 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 spectrometry. Fast atom bombardment mass spectrometry.

6) X-ray Diffraction Methods: Introduction, Generation of X-rays, Elementary crystallography, Miller Indices, X-ray diffraction, Bragg's law, X-ray powder diffractometer, obtaining and interpretation of X-ray powder diffraction data.

Suggested Readings:

1. D. A. Skoog, E. J. Holler and T. A. Nieman, Principles of Instrumental Analysis, Harcourt Asia Pvt. Ltd, 2001.
2. D. L. Pavia, G. M. Lampman and G. S. Kris, Introduction to Spectroscopy- A guide for students of Organic chemistry, Harcourt college publishers.(latest edition).
3. Instrumental Method of Chemical Analysis, B. K. Sharma.
4. J R. M. Silverstein, G. C. Bassler and T. C. Morrill, Spectrometric Identification of Organic Compounds, 6th edn, John Wiley, New York, 1998.
5. Organic Spectroscopy by L.D.S. Yadav.
6. Organic Spectroscopy-William Kemp. 3rd edition.
7. P. S. Kalsi, Spectroscopy of Organic Compounds, New Age Publication, 2002.
8. Spectroscopy of organic compounds by P.S. Kalsi.
9. Willard H.H., Merrit L. L., Dean J.A., Settle P.A. Instrumental Methods of Analysis, Van Nostrand.

[Latest editions of all the suggested books are recommended. Additional references as required will be provided by the faculty members during classes]

PHARMACEUTICAL CHEMISTRY-III
(Medicinal Chemistry)

Total Marks: 100

Total Lectures: 45

GROUP - A

- 1) Pharmacophore:** Historical Perspective and Viewpoint of Pharmacophore, Functional Groups Considered as Pharmacophores, Ehrlich's "Magic Bullet", Fischer's "Lock and Key", Two-dimensional Pharmacophores, Three-dimensional Approach of Pharmacophores, Criteria for Pharmacophore Model, Pharmacophores for Human ADME/Tox-related Proteins.
- 2) Molecular Modeling & Drug Design:** Introduction to Molecular Geometry, Coordinate Space for Optimization of Algorithm of Molecular Geometry, Z-Matrix, Molecular Vibrations, Electrostatic Charges. Introduction to Molecular Dynamics, Density Functional Theory, Linear Scaling Techniques, *Ab-initio* Methods. Introduction to molecular docking, Rigid docking, Flexible docking, manual docking. Virtual Screening, Ligand-Based Virtual Screening, Structure-Based Virtual Screening.
- 3) Chemoinformatics:** Introduction to chemoinformatics, Molecular file formats and their conversions: smiles, smirks & smarts, Database search: sub structure search and similarity search.

GROUP – B

- 4) Cardiovascular Agents and Anti-hyperlipidemics:** Structure Based Design of Thrombin inhibitors, Design of Antithrombotic agents directed at Factor Xa, Polypeptide Modulators of Na⁺ channel function as a basis for the development of novel cardiac stimulants, Renin Inhibitors.
- 5) Anti-viral agents, Anti-HIV drugs, Anti-fungal agents, Anti-neoplastic agents, Anti-malarial, Anti-mycobacterials, Fluoroquinolones and Chloramphenicol.**
- 6) Drugs Acting on Central Nervous System:** Opioid analgesics, Anticonvulsants, Anti-parkinsonism drugs, CNS stimulants, Neuroleptics, Antidepressants.
- 7) Drugs Acting on Autonomic Nervous System:** Cholinergics, Anticholinergics and Anticholinesterases, Adrenergics, Sympatholytics, Neuromuscular junction blocking agents.

Suggested Readings:

1. A Collection of General Chemistry Experiments. Anil J Elias, Universities Press
2. A Textbook of Drug Design and Development 2nd Edition edited by PovlKrogsgaard.

3. Advanced Computer Assisted Techniques in Drug Discovery by Han VandeWaterbeemd.
4. B. N. LaDu, H. G. Mandel and E L Way., Fundamental of Drug Metabolism and Disposition, William and Wilkins Co., Baltimore
5. Burger's Medicinal Chemistry & Drug Discovery – Vol. I-VI, Edited by D. J. Abraham, Wiley Interscience.
6. C Hansch, Comprehensive Medicinal Chemistry. Vol. IV, Quantitative Drug Design, Perogmon Press. Oxford
7. Medicinal Chemistry – An Introduction, Gareth Thomas. John Wiley & Sons.
8. Organic Synthesis: Strategy and Control, Paul Wyatt and Stuart Warren, John Wiley & Sons Ltd.
9. Organic Synthesis: The Disconnection Approach, Stuart Warren and Paul Wyatt, Wiley published the second edition.
10. Retrosynthesis by E. J. Corey
11. Synthone Approach by Prabhu and Iyer
12. The Logic of Chemical Synthesis, E. J. Corey and Xue-min Chelg, John Wiley & Sons.

[Latest editions of all the suggested books are recommended. Additional references as required will be provided by the faculty members during classes]

PHARMACEUTICAL CHEMISTRY-IV
(Principles of Organic Synthetic Planning)

Total Marks: 100

Total Lectures: 45

GROUP - A

- 1) **Transient Reaction Intermediates:** *Carbocations:* Formation, structure, stability, reactions involving carbocations, rearrangement reactions. *Carbanions:* Formation, structure, stability, reactions involving carbanions. *Free Radicals:* Formation, Structure, stability, detection, reaction involving free radicals. *Carbenes:* Formation, structure, stability, reactions involving carbenes. *Nitrenes:* Formation, structure, stability, reactions involving nitrenes.
- 2) **Substitution, Addition and Elimination Reactions:** Mechanism, Orientation, Reactivity, Stereochemistry and Name reactions will be discussed for the following and related reactions.
 - Nucleophilic Substitution (Aliphatic and Aromatic)
 - Electrophilic Substitution (Aliphatic and Aromatic)
 - Elimination Reactions
- 3) **Catalysis:** Introduction, homogenous, heterogenous catalysis, enzyme catalysed reactions in the manufacture of drugs; Phase Transfer catalysis, use of PTC in anhydride, epoxide, ester, nitrile and sulfide formation in ester hydrolysis and reduction reactions.
- 4) **Pericyclic Reactions:** Definition and classification of Pericyclic reactions, electrocyclic reactions, cyclo addition reactions, Sigmatropic rearrangements, group transfer reactions.

GROUP - B

- 5) **Stereochemistry of Organic Compounds:** Introduction to Constitution, Configuration, Conformation, Symmetry Elements, Chirality, Optical Activity, Stereoisomers, Enantiomers, Diastereomers, Racemic Mixture, Resolution.
- 6) **Retrosynthesis:** Synthetic methodologies of obtaining drugs, Disconnection approach, synthons for carbon- carbon bond formation, bifunctional compounds, selective functional group interconversions (FGI) retrosynthetic analysis, synthetic approaches for attaching heterocyclic ring systems in drug molecules having five member & six member heteroaromatic rings, protection and deprotection of various groups, Transforms and Retrons, Types of Transforms.
- 7) **Combinatorial Chemistry:** Introduction & Principle of Combinatorial Chemistry, synthetic methodologies including solid-phase synthesis (SPS) and solution phase chemistry, Library Purification Methodology, parallel synthesis, mixed combinatorial synthesis, anchor or linker, solid supports, identification of structures from mixed combinatorial synthesis, combinatorial synthesis of heterocycles, identification of structures from a combinatorial synthesis, planning a combinatorial

syntheses, automation and devices for combinatorial chemistry and parallel organic synthesis, high-throughput screening for lead discovery.

Suggested Readings:

1. Burger's Medicinal Chemistry & Drug Discovery – Vol. I-VI, Edited by D. J. Abraham, Wiley Interscience.
2. A Collection of General Chemistry Experiments. Anil J Elias, Universities Press
3. A Textbook of Drug Design and Development 2nd Edition edited by PovlKrogasgaard.
4. Advanced Computer Assisted Techniques in Drug Discovery by Han VandeWaterbeemd.
5. B. N. LaDu, H. G. Mandel and E L Way., Fundamental of Drug Metabolism and Disposition, William and Wilkins Co., Baltimore
6. C. Hansch, Comprehensive Medicinal Chemistry. Vol. IV, Quantitative Drug Design, Perogmon Press. Oxford
7. Medicinal Chemistry – An Introduction, Gareth Thomas. John Wiley & Sons.
8. Organic Synthesis: Strategy and Control, Paul Wyatt and Stuart Warren, John Wiley & Sons Ltd.
9. Organic Synthesis: The Disconnection Approach, Stuart Warren and Paul Wyatt, Wiley published the second edition.
10. Retrosynthesis by E. J. Corey
11. Synthone Approach by Prabhu and Iyer
12. The Logic of Chemical Synthesis, E. J. Corey and Xue-min Chelg, John Wiley & Sons.

[Latest editions of all the suggested books are recommended. Additional references as required will be provided by the faculty members during classes]

INSTRUMENTAL METHODS-PRACTICAL

Total Marks: 100

Total Practical: 20

- 1) Analysis of drugs and raw materials using official pharmacopoeial methods based on UV-Visible or other Chromatographic techniques.
- 2) Hands on training of sample handling, maintenance, estimation of drug samples in infrared spectroscopy. Spectral interpretation and application of vibrational group frequencies of given known and unknown organic drug samples.
- 3) Interpretation of organic small and macro molecules in Mass Spectra, workshop in fragmentation pattern of given drug molecules.
- 4) Estimation of drugs in biological or simulated fluids.
- 5) Identification of drugs and natural products using hyphenated analytical techniques
- 6) ^1H - NMR and ^{13}C -NMR interpretation of certain organic molecules.

Note: Additional experiments may be added or existing ones may be modified according to availability of instruments/reagents and as per theory syllabus

Suggested Readings:

1. D. L. Pavia, G. M. Lampman and G. S. Kris, Introduction to Spectroscopy- A guide for students of Organic chemistry, Harcourt college publishers.(latest edition).
2. Instrumental Method of Chemical Analysis, B. K. Sharma.
3. J R. M. Silversterin, G. C. Bassler and T. C. Morrihl, Spectrometric Identification of Organic Compounds, 6th edn, John Wiley, New York, 1998.
4. Organic Spectroscopy by L.D.S. Yadav.
5. Organic Spectroscopy-William Kemp. 3rd edition.
6. P. S. Kalsi, Spectroscopy of Organic Compounds, New Age Publication, 2002.
7. Spectroscopy of organic compounds by P.S. Kalsi.

[Latest editions of all the suggested books are recommended. Additional references as required will be provided by the faculty members during classes]

MEDICINAL CHEMISTRY - PRACTICAL

Total Marks: 100

Total Practical: 20

- 1) Organic spotting of binary mixtures, identification of the type of mixture, micro-scale chemical separation, identification of the individual components, establishment of the identity of the separated components with the help of derivative preparation and TLC.
- 2) Experiments based on physicochemical properties of drugs (e.g. partition coefficient, degree of ionization, solubility).
- 3) Isolation and characterization of Natural Products.
- 4) Workshop on calculation of electron density, electrostatic potential, HOMO and LUMO. Energy minimization of small molecules and proteins. Brief exercise on protein structures, protein loops.
- 6) Workshop on molecular modeling, pharmacophore modeling, molecular docking. Solving problems based on QSAR & QSPR.

Note: Additional experiments may be added or existing ones may be modified according to availability of instruments/reagents and as per theory syllabus

Suggested Readings:

1. L. Finar, Organic Chemistry, Vol. I & II, ELBS/ Longman, London.
2. Mann & Saunderson, Practical Organic Chemistry, Orient Longman, London.
3. Shriner, Hermann, Morrill, Curtin & Fuson, The Systematic Identification of Organic Compounds, John Wiley & Sons. USA.
4. Vogel's Text book of Practical Organic Chemistry, ELBS/ Longman, London
5. Y. C. Martin, Quantitative Drug Design – A Critical Introduction (Medicinal Research Monograph, Vol. 8) Marce: Dekker. Inc. New York.
6. Young D. Computational Chemistry: A Practical Guide for Applying Techniques to Real World Problems. New York: Wiley; 2001.

[Latest editions of all the suggested books are recommended. Additional references as required will be provided by the faculty members during classes]