TRIPURA UNIVERSITY
(A Central University)

Syllabus

for

Ph.D Course Work

In

Pharmacy

DEPARTMENT OF PHARMACY
SURYAMANINAGAR
2017

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

SYLLABUS OF PH.D. COURSEWORK IN PHARMACY-2017

Course Code	Name of Subjects	Marks	Credit Distribution (Subject wise)	Total Marks	Total Credit
PA-Z01	Research Methodology -I	100	4	400	16
PA-Z02	Research Methodology -II	100	4		
	Part-I: Review and critique of published research in the relevant field [2 Credits: 50 Marks]				
	Part-II: Analytical Research Methodology [2 Credits: 50 Marks]				
PA-Z03	Elective Paper	100	4		
PA-Z04	Seminar / Practical / Project and Assignment	100	4		

RESEARCH METHODOLOGY-I
Paper-I
[Code: PA-Z01]

Total Marks: 100 **Total Credits: 4**

The whole paper is divided into four units as follows:
Unit-1: Basic Computer Applications
Unit-2: Quantitative methods, Statistics and application of Computer in statistics
Unit-3: Research Ethics and IPR
Unit-4: Documentation and scientific writing

DETAILED SYLLABUS FOR EACH UNIT:

Unit-1: Basic Computer Applications

Basic computer knowledge, Features and applications related to presentation of text in suitable format and saving the data for future applications. Use of word processing, Practical knowledge of MS Word to type the script, insert tables, figures and graphs, plotting of graphs in excel, Preparation of power point presentations based on the topic of research. Insertion of figures, graphs, charts in presentation. Use of spreadsheet and database software, Preparation of scientific posters for presentations, Internet and its application: Email, WWW, Web browsing, acquiring technical skills, drawing inferences from data, Cloud computing.

Unit-2: Quantitative methods, Statistics and application of Computer in statistics

Measures of Central tendency and Dispersion. Probability distribution- Normal, Binomial and Poisson distribution. Parametric and Non-parametric statistics. Confidence interval, Errors.
Quantitative Techniques: Levels of significance, Regression and Correlation coefficient. Statistical analysis and fitting of data; Chi-Square Test, Association of Attributes t-Test Anova, Standard deviation, Co-efficient of variations. Open source software for quantitative and statistical analysis.

Unit-3: Research Ethics and IPR

Environmental impacts - Ethical issues - ethical committees - Commercialization – Copy right – royalty - Intellectual property rights and patent law – Trade Related aspects of Intellectual Property Rights– Reproduction of published material – Plagiarism - Citation and acknowledgement - Reproducibility and accountability.

Unit-4: Documentation and scientific writing:

Results and Conclusions, Preparation of manuscript for Publication of Research paper, Presenting a paper in scientific seminar, Thesis writing. Structure and Components of Research Report, Types of Report: research papers, thesis, Research proposal, Research Project Reports, Pictures and Graphs, citation styles, writing a review of paper, Bibliography.

Syllabus of Ph.D. Coursework in Pharmacy-2017

RESEARCH METHODOLOGY-II

Paper-II

[*Course Code: PA-Z02*]

Total Marks: 100 Total Credit: 04

I. Review and crtics of published research in relevant field. *2 Cradits: 50 Marks*

Rewiew of publuished research work from the following areas:

(i) Drug discovery & development
(ii) Analytical method development and impurity profiling.
(iii) Drug actions in the molecular level.
(iv) Drug toxicity.
(v) Natural product in the drug discovery and development.
(vi) Clinical development of drugs and drug like substances.
(vii) Metabolic study of drug.
(viii) Drug/drug intermidiatate synthesis and modification.
(ix) Computitational drug discovery.

Review work will cover *atleast* FIVE original research artiticles from journal of repute and subject relevancy (preferably last five years published articles).

[An outline proforma of the review work shall be provided to the students by the Department.]

II. Analytical methodology of Research: *2 Cradits: 50 Marks*

1. ***Ultraviolet and visible spectroscopy:*** Energy levels and selection rules, Woodward-Fisser and Fieser-Kuhn rules. Influence of substituent, ring size and strain on spectral characteristics; Solvent effect; Stereochemical effect; Non-conjugated interactions; Spectral correlation with structure.

2. ***Infrared spectroscopy (IR):*** Characteristic regions of the spectrum. Influence of substituent, ring size, hydrogen bonding, vibrational coupling and field effect on frequency. Determination of stereochemistry, Spectral interpretation with examples.

3. ***Nuclear magnetic resonance spectrometry (NMR):*** Magnetic nuclei, chemical shift and shielding, relaxation processes, chemical and magnetic non-equivalence, local diamagnetic shielding and magnetic anisotropy, spin-spin splitting, Pascal's triangle, coupling constant, mechanism of coupling, quadrupole broadening and decoupling, the effect of conformations and stereochemistry on the spectrum, diastereomeric protons, virtual coupling, long range coupling-epi, Peoria, bay effects. Shift reagents-mechanism of action, spin decoupling, and double resonance.

4. ***Mass spectrometry (MS):*** Molecular ion and metastable peak, fragmentation patterns, nitrogen and ring rules, McLafferty rearrangement, electron and chemical ionization modes, applications.

5. ***Chromatography:*** General principles, classification of chromatographic techniques, normal and reversed phase, bonded phase, separation mechanisms.

6. ***Column chromatography:*** Merits and demerits, short-column chromatography and flash chromatography, vacuum liquid chromatography (VLC), medium pressure liquid chromatography, high pressure liquid chromatography (HPLC) and HPTLC.

7. Gas chromatography, Introduction to GC-MS and LC-MS techniques.

8. ***Pharmacological Screening and Assays:*** General principles of screening, correlations between various animal models and human situations, animal ethics. Special emphasis on cell based assay, biochemical assay, radioligand binding assay, high through put screening.

Suggested readings:

1. Brown, T.A. (2010). Gene cloning and DNA analysis: An Introduction, Wiley-Blackwell; New York.
2. Goldsby, R. A., Kindt, T. J. and Osborne, B. A. (2008). Kuby Immunology. W. H. Freeman & Company, San Francisco.
3. Gupta, P. K. (2005). Elements of biotechnology, Rastogi Publications, Meerut.
4. Gupta, S. (2005). Research methodology and statistical techniques, Deep & Deep Publications (p) Ltd. New Delhi.
5. Kothari, C. R. (2008.) Research methodology(s), New Age International (p) Limited.New Delhi
6. Lewin, B. (2010). Genes X, CBS Publishers & Distributors. New Delhi.
7. Mangal, S. K. (2007). DNA Markers In Plant Improvement, Daya Publishing House, New Delhi.
8. Nelson, D. and Cox, M. M. (2009). Lehninger Principles of Biochemistry, W.H. Freeman and Company, New York.
9. Beckett and Stenlake, Practical Pharmaceutical Chemistry, CBS.
10. Instrumental Method of Chemical Analysis, B. K. Sharma.
11. Organic Spectroscopy-William Kemp. 3rd edition.
12. S. Lindsay, High Performance Liquid Chromatography, Analytical Chemistry by Open Learning (ACOL), Wiley, 1987.
13. Sethi and Charcgankar, Identification of Drugs in Pharmaceutical Formulations by TLC.
14. Sethi P.D., HPLC, Quantitative Analysis of Pharmaceutical Formulations, CBSPublishers, Delhi.
15. Sethi P.D., HPTLC, Quantitative Analysis of Pharmaceutical Formulations, CBSPublishers, Delhi
16. Sethi P.D., Quantitative Analysis of Pharmaceutical formulations, CBS Publishers, New Delhi.
17. Silverstein, Spectrometric identification of Organic compounds, Willy.
18. Skoog D.A., Heller F.J., Nieman T.A., Principles of Instrumental Analysis, WB saunders.
19. Spectroscopy of organic compounds by P.S. Kalsi.

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[Option-I]

ADVANCED PHARMACEUTICAL CHEMISTRY

Paper-III

[*Course Code: PA-Z03*]

Total Marks: 100 Total Credit: 04

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1. **Logics of Organic Synthesis:** Methods of determining reaction mechanisms (kinetic and non-kinetic methods); Energy profile diagrams, reaction intermediates, crossover experiments and isotopic labelling; Order of reactions, reversible, consecutive and parallel reactions, solvent, ionic strength and salt effects; Acid-base catalysis; Nucleophilic substitution reactions; Uni- and bimolecular reactions, attacking and leaving groups, steric and electronic effects; Neighbouring group participation; Formation and hydrolysis of esters, amides and acyl halides; Different mechanisms. Electrophilic substitution reactions; Aromatic electrophilic substitutions including Friedel-Crafts reactions; Addition and elimination reactions.

2. **Reaction of yields:** Phosphorus yields; Structure and reactivity, stabilized yields, effects of ligands on reactivity, Witting, Wittig-Horner and Wadsworth, Emmons reactions mechanistic realization; E/Z selectivity for olefin formation, Schlosser modification: Petersons olefin synthesis. Sulphur yields; Stabilized and non-stabilized yields: Thermodynamically and kinetically controlled reactions with carbonyl compounds, region and stereo-selective reactions.

3. **Principles of synthetic planning:** Logic-centered molecular synthesis; Dislocation, synthetic tree, synthons, logical imposition of boundary conditions, direct associated approach; Structure functionality relationships, functionality and unsaturation levels; Polar reactivity analysis; Control elements, consonant and dissonant circuits; Protocol for synthetic design.

4. **Alkylation:** Enolates; Regio- and stereo-selective enolate generation, "O" versus "C"- alkylation, effects of solvent, counter cation and electrophiles; Symbiotic effect; Thermodynamically and kinetically controlled enolate formations; Various transition-state models to explain stereoselective enolate formation; Enamines and metallo-enamines; Regioselectivity in generation, applications in controlling the selectivity of alkylation.

5. **Structure Activity Relationships in drug design:** Qualitative versus quantitative approaches, advantages and disadvantages; Random screening, nonrandom screening, drug metabolism studies, clinical observations, rational approaches to lead discovery; Homologation, chain branching, ringchain transformations, bioisosterism; Insights into molecular recognition phenomenon; Structure based drug design, ligand based drug design.

6. **Molecular Modeling:** Energy minimization, geometry optimization, conformational analysis, global conformational minima determination; Approaches and problems; Bioactive vs. global minimum conformations; Automated methods of conformational search; Advantages and limitations of available software; Molecular graphics; Computer methodologies behind molecular modeling including artificial intelligence methods.

7. **QSAR:** Electronic effects; Hammett equation, Lipophilicity effects; Hansch equation, Steric Effects; Taft Equation; Experimental and theoretical approaches for the determination of physico-chemical parameters, parameter inter-dependence; Case studies; Regression analysis, extrapolation versus interpolation, linearity versus non-linearity; The importance of biological data in the correct form; 2D QSAR; 3D-QSAR-examples CoMFA and CoMSIA.

8. **Molecular docking and dynamics:** Rigid docking, flexible docking, manual docking; Advantages and disadvantages of flex-X, flex-S, autodock and dock software's with successful examples; Monte Carlo simulations and molecular dynamics in performing conformational search, docking etc.

9. **Pharmacophore:** Concept, pharmacophore mapping, methods of conformational search used in pharmacophore mapping; Comparison between the popular pharmacophore methods like catalyst/HipHop, DiscoTech, GASP, etc. with practical examples.

Suggested readings:

1. Alfred Berger Biochemical Basis of Drug Design
2. Ariens. Drug design medicinal chemistry a series of monograph-volume 11- III, academic press, an imprint of Elsevier pub.
3. Berger's Medicinal Chemistry and Drug Design. 8th Edition.
4. Corwin , Hansen Comprehensive Medicinal Chemistry
5. Finar, I.L., (2012). Organic Chemistry Vol. 1& II, Pearson Education, 6th edition, UK.
6. Fleming (1999). Pericyclic Reactions, Oxford University Press, Oxford.
7. Fleming (2010). Molecular Orbitals and Organic Chemical Reactions, John Wiley & Sons.
8. Gyorgy Keri & Istdan Toth Molecular Pathomechanism and New Trends in Drug Research, Taylor & Francis Pub.
9. Jie Jack Li, (2009). Name Reactions: A collection of Detailed Reaction Mechanism, Publisher: Springer-verlag
10. Kalsi, P.S., (2010). Organic Reactions and Their Mechanisms, New Age International Pub., 3rd edition, New Delhi.
11. Kalsi, P.S., (2010). Stereochemistry: Conformation and Mechanism, New Age International (p) Ltd., New Delhi.
12. Lowry, T.H., Richardson K.S., (1998). Mechanism and Theory in Organic Chemistry, Addison-Wesley Longman Inc.
13. Mc Murry, J., Organic Chemistry, Asian Book Pvt Ltd, New Delhi
14. Reinhard Bruckner, (2001). Advanced organic chemistry: Reaction Mechanism, Academic Press.
15. Richard B. Silvermann, Org. Chemistry of Drug Design and drug Action.
16. Smith, M.B., March J., (2001). March's Advanced Organic Chemistry, John Wiley & Sons, New York.
17. Structure based Drug Design by Pandi Veerapandion
18. Testa B and Jenner P. Drug Metabolism Chemical & Biochemical Aspects, Marcel Dekker.

[Option-II]

ADVANCED PHARMACEUTICS

Paper-III

[*Course Code: PA-Z03*]

Total Marks: 100 Total Credit: 04

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1. **Kinetics and drug stability:** Stability calculations, rate equation, complex order kinetics, kinetics of some decompositions, strategy of stability testing, method of stabilization, method of accelerated stability testing in dosage forms, Freeze Thaw methods, centrifugal methods, temperature and humidity control, physical stability testing of pharmaceutical products.

2. **Bioavailability and bioequivalence studies**: Designing of bioavailability and bioequivalence studies and interpretation of results. Physicochemical properties affecting bioavailability, pH-partition theory, dissolution, surface area adsorption, complexation, polymorphism and techniques of enhancing dissolution rate.

3. Formulation factors affecting bioavailability of drugs in dosage forms of tablets, capsules, parental, liquid orals and topical dosage forms.

4. **Basic concepts of pharmacokinetics:** compartment models: One, two and non-compartmental approaches to pharmacokinetics. Recent trends, merits and limitations of these approaches. Application of these models to determine the various pharmacokinetic parameters pertaining to
   a. Absorption: (wherever applicable) absorption rate constant, absorption half-life, lag time and extent of absorption, AUC.
   b. Distribution: Apparent volume of distribution and its determination.
   c. Metabolism: Metabolic rate constant
   d. Elimination: Over all apparent elimination rate constant, and half life.
   All the above under the following conditions:
      1. Intravenous bolus injection
      2. Intravenous infusion
      3. Single dose oral administration
      4. Multiple dose injections
      5. Multiple dosage oral administration

5. ***Concept of clearance:*** organ, total clearance, hepatic clearance, lung clearance and renal clearance. Fundamentals of controlled drug delivery systems, use of polymers in controlled drug delivery, pharmacokinetic and pharmacodynamic basis of controlled drug delivery. Pharmacodynamix study. Design, fabrication, evaluation and applications of the following controlled releasing systems

   (a) Controlled release oral drug delivery systems
   (b) Parental controlled release drug delivery systems
   (c) Implantable therapeutic systems
   (d) Transdermal delivery systems including iontophoresis

(e) Ocular and intrauterine delivery systems
(f) Bioadhesive drug delivery systems
(g) Proteins and peptide drug delivery

6. ***Biochemical and molecular biology approaches to Novel Drug Delivery Systems (NDDS) likes***: Liposomes, Niosomes, Microspheres, Nanoparticle and Resealed erythrocytes.
   1. Monoclonal antibodies
   2. Drug targeting to particular organs:
   (a) Problems of drug delivery to the brain and targeting to brain
   (b) Drug targeting in neoplastic diseases

Suggested readings:

1. Biopharmaceutics and Clinical Pharmacokinetics - An Introduction by Robert E. Notari.
2. Biopharmaceutics and Clinical Pharmacokinetics by Milo Gibaldi.
3. Biopharmaceutics and Clinical pharmacy by Robert E. Notari.
4. Bio-Pharmaceutics and Pharmacokinetics by D.M. Brah.
5. Controlled and Novel drug delivery systems by N. K. Jain.
6. Controlled Drug Deliver by Joseph R. Robinson and Vincent H. L. Lee.
7. Controlled Drug Deliver by N.K Jain.
8. Cooper and Gunn`s Dispensing for Pharmaceutical Students by S.J. Carter.
9. Cooper and Gunn`s Tutorial Pharmacy by S.J Carter.
10. Modern Pharmaceutics by Gilbert S. Banker and Christopher T. Rhodes.
11. Novel Drug Delivery System by Yie W. Chien.
12. Pharmaceutical Dosage forms by Howard. C. Ansel.
13. Physical Pharmacy by Alfred Martin.
14. Practical Physical Pharmacy (Vol-I and Vol-II) by Gaud and Gupta.
15. Targeted and Controlled Drug Delivery (Novel carrier systems) by S. P. Vyas and Khar.

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[Option-III]

ADVANCED PHARMACOLOGY

Paper-III

[*Course Code: PA-Z03*]

Total Marks: 100 Total Credit: 04

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1. Receptor Mechanisms: i) Molecular and chemical characterization of membrane receptors; Use of monoclonal antibodies in receptor characterization and purification; Immunopreciptation and eletrophoretic analysis of membrane proteins; Peptide mapping; Molecular weight determination by radiation inactivation; Solubilization of the receptors; Reconstitution of membrane receptors.

ii) Biochemical mechanisms of cell signaling; Plasma membrane and cytosolic receptor structure; Plasma membrane as a signal transduction element; Mechanisms of receptor mediated signaling; Ion gated channels; Ligand activated receptors with intrinsic enzyme activity; Amplification of transmembrane signals.

iii) Structure of G proteins, sub-classification of G proteins; Role of heterotrimeric G proteins in signaling; Generation of intracellular second messengers; Modulation of G protein activity.

iv) Calcium as second messenger, PIP2, IP3 receptors, calcium influx and efflux, intracellular sources of calcium and release, calcium oscillations; Intracellular calcium determinations in cell suspensions; Development of fluorescent indicators, fura-2, fluo-3, BAPTA; Digital ratio imaging in single cells.

v) Receptor dynamics and signaling; the mobile receptor paradigm; Receptor microclustering, patching, internalization, receptor mobility and cell activation; Homologous and heterologous regulation of receptors, sequestration, receptor turnover.

vi) Signal transduction of neurotransmitters and neuromodulators viz., norepinephrine

vii) HT, pathophysiological implications of neurotransmitter receptors.

viii) Introduction to mechanistic approach of drug design, receptor mapping, and computer aided drug design.

2. Stages of drug development: Drug laws, FDA, OECD, ICH, schedule Y; Design of preclinical toxicity studies and clinical development, clinical risk/ benefit analysis. Safety evaluation of medical devices and bio materials. Good Laboratory Practices (GLP), issues and implementation. Different methods in toxicity testing: Dose determination, response characterization, NOAEL, MTD and threshold limitations; Hormesis, lower dose extrapolation, in vitro and in vivo correlation, animal to human extrapolation; Flow chart.

3. Mechanism of toxicity: Evaluation across different models; Target organs, cell death, necrosis, apoptosis, oxidative stress, chromosome and DNA damage. Acute and chronic toxicity, genetic toxicity: Types of genetic toxicity testing; Principles of detection; Genotoxicity of marketed drugs, test batteries, Salmonella test, micronucleus test, chromosome aberration test, comet assay, new-bio assays.

4. Carcinogenicity, carcinogen identification: Carcinogenesis process, drug induced carcinogenicity, lifetime carcinogenicity bio assays, neonatal mouse models; Short and medium term bio assays, limitations and impacts.

5. Pharmacological Screening: Pharmacological screening models for therapeutic areas such as hypertension, cerebral ischaemia, pain, epilepsy, depression, Parkinson's disease, Alzheimer's disease, diabetis, leishmaniasis etc. Correlation between *in-vitro* and *in-vivo* screens; Special emphasis on cell based assay and specific use of reference drugs and interpretation of results.

Suggested readings:

1. Drug discovery and evaluation by H.G.Vogel and W.H.Vogel, Springerverlag, Berlin Heideleberg.
2. Essentials of Medical Pharmacology by K.D.Tripathi
3. Handbook of experimental pharmacology by S.K. Kulkarni, Vallabh Prakashan, Delhi.
4. Pharmacology and Pharmacotherapeutics by R.S Satoskar, S.D Bhandarkar and S.S Ainapure.
5. Pharmacology by H.P Rang M.M, Dale, J.M.Ritter & P.K.Moore
6. Principles of clinical research edited by Giovanna di ignazio, Di Giovanna and Haynes
7. Screening methods in Pharmacology, Vol.-1&2 by Robert .A. Turner and Peter Hebborn.
8. Textbook of clinical trials edited by David Machin, Simon Day and Sylvan green.
9. The Pharmacological basis of therapeutics by Joel G.Hardman. Lee E Limbird and Alfred Goodman Gilman.

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[Option-IV]

PHYTOCHEMISTRY AND ETHNOPHARMACOLOGY

Paper-III

[*Course Code: PA-Z03*]

Total Marks: 100 Total Credit: 04

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1. **Medicinal plants cultivation:** General aspects involved in the cultivation of medicinal plants: Conservation of medicinal plants, biodiversity law, WTO & TRIPS agreement. Factor involved in production of crude drug.

2. Approaches available for drug development, role of natural products in new drug development, plant derived drugs, bioactive compounds from natural sources. Bio-assay

3.Detailed phytochemical study of following class of phytoconstituents, including important drugs.

a) Phospholipids b) Terpenes and terpenoids c) Resins and related compounds d) Plant phenols
e) Alkaloids f) Glycosides g) Steroids

4. Study of information retrieval methods of natural plants and herbal databases. Screening and review of literature for the following:

a) Anti-hepatotoxics b) Anti-fertility agents c) Anti-microbials & Anti-Virals
d) Anti-cancer agents e) Hypolipidaemics f) Anti-obesity agents
g) Anti-diabetics h) Antiallergics h) Adaptogenics
i) Immunomodulators j) Cardio-vascular agents.

5. *Nutraceuticals:* Historical perspective, classification, scope & future prospects. Applied aspects of the Nutraceutical Science. Sources of Nutraceuticals. Glucosamine, Octacosanol, Lycopene, Carnitine, Melatonin and Ornithine alpha ketoglutarate. Use of proanthocyanidins. Nutraceutical remedies for common disorders like Arthritis, Bronchitis, circulatory problems, hypoglycemia, Nephrological disorders, Liver disorders, Osteoporosis, Psoriasis and Ulcers etc. Brief idea about some Nutraceutical rich supplements e.g. Bee pollen, Caffeine, Green tea, Lecithin, Mushroom extract, Chlorophyll, etc.

6. Biosynthetic studies on the following:
   a) Shikimic acid patway – Atropine and Morphine and Anthraquinone glycosides b) Acetate pathway – Cardiac glycosides

7. Structural elucidation of important phytoconstituents belonging to deffernt groups.
   a) Alkaloids – Nicotine, Atropine, Morphine, Caffeine. b) Glycosides–Amygdalin, strophanthidin.
   c) Steroids – Cholesterol d) Terpenes - Citral

8. *Marine Pharmacognosy:* Definition, present status, classification of important bioactive agents. General methods of isolation and purification. Study of important bioactive agents including chemistry& uses.

9. Complementary Alternative medicines including ethnomedicine Definition, principles and applications. Recent advances in phytochemical research.

Suggested readings:

1. An Introduction to Pharmacognosy by Smith Ely Jelliffe
2. Drugs of Natural Origin: A Treatise of Pharmacognosy by Gunnar Samuelsson, Lars Bohlin
3. Experimental pharmacognosy by Varro E. Tyler, Arthur Ernest Schwarting
4. Fundamentals of Pharmacognosy and Phytotherapy by Michael Heinrich, Joanne Barnes, Simon Gibbons
5. Marine Pharmacognosy: Trends and Applications by Se-Kwon Kim
6. Microscopic Pharmacognosy by William Mansfield
7. Molecular Pharmacognosy by Luqi Huang
8. Pharmacognosy and pharmacobiotechnology by James E. Robbers, Marilyn K. Speedie, Varro E. Tyler
9. Pytochemical methods by J.B.Haroborne
10. Text Book of Pharmacognosy by Titler, Brady & Robber
11. Text Book of Pharmacognosy by Trease & Evans
12. Textbook of Pharmacognosy and Phytochemistry by Biren Shah, Avinash Seth

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SEMINAR/PRACTICAL/PROJECT AND ASSIGNMENT

Paper-IV

[*Course Code: PA-Z04*]

Total Marks: 100 Total Credit: 04

The Ph.D scholars need to present a **relevant review work/seminar** or **assignment** of his/her own choice/area of research interest or as assigned by the faculty members of the department.

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त्रिपुरा विश्वविद्यालय
(केन्द्रीय विश्वविद्यालय)
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No.F.TU/REG/AC/20/2017

Date: 20th November, 2017

NOTIFICATION

In accordance with the resolution of the 20th Meeting of the Academic Council held on 18th August, 2017 (under agenda 8/20/2017), which was duly approved by the Executive Council in its 28th Meeting held on 20th September, 2017 (under agenda 04/28/2017), this is hereby notified for general information that the "Rules & Regulations for Doctor of Philosophy (Ph.D.)-2016" (as per the UGC Regulations [Minimum Standards and Procedure for Awards of M.Phil/Ph.D Degree], 2016) has been adopted in Tripura University.

The said Regulations shall be deemed to have come into effect from the academic session 2016-17.

(S. Debroy)
Registrar (i/c)
20.11.17

Copy to:

1. The Pro-Vice-Chancellor, T.U.
2. The Dean, Faculty of Arts & Commerce, T.U.
3. The Dean, Faculty of Science, T.U.
4. The Finance Officer, T.U.
5. The Controller of Examinations, T.U.
6. The Director, IQAC, T.U.
7. The HoD/HoD(i/c), Department of _____, T.U.
8. The Director, College Development Council, T.U.
9. The Joint Controller of Examinations, T.U.
10. The Deputy Registrar (Academic (i/c), T.U.
11. The Assistant Controller of Examinations, T.U.
12. P.S. to the Hon'ble Vice-Chancellor, T.U.

TRIPURA UNIVERSITY
(A Central University)
Suryamaninagar-799022

Rules & Regulations for Doctor of Philosophy (Ph.D.) -2016
Based on UGC-2016 Guidelines

[The Rules and Regulations have been drafted in connivance with the UGC (Minimum Standards and Procedure for Awards of M.Phil/Ph.D Degree) Regulations, 2016 on 5th May and as clarified on 25th July, 2016 (F.No 14-4/2016 (PS)].

1. Introduction:

I. These Regulations shall be called "The Tripura University Regulations for Doctor of Philosophy (Ph.D.) - 2016, in supersession of the earlier Rules & Regulations in this regard. And as and when any changes or amendment made by UGC or any such relevant authorities, such changes or amendment shall be the part of the Rules and Regulations after taking due approval from the Vice Chancellor, Tripura University.

II. These Regulations shall apply to every candidate applying for enrollment to the Programme, registration, conduct of research / study conferment of the Degree of Doctor of Philosophy (Ph.D.) of this University.

III. These Rules and Regulations shall come into effect fromAcademic year 2016- 17, and shall be applicable to the applicants,

a. Who have qualified in RET-2016 and intend to be enrolled in Ph.D. Programme in the Academic year 2016-17 and onwards.

b. And/or for the RET qualified candidates who qualified RET 2014/RET-2015 and were not allotted any supervisor and who have not gone through the Course Work.

2. Duration of the Programme:

I. Ph.D. Programmeshall be for a minimum duration of three years, including Course work and a maximum of six years from the date of admission to the Ph.D. Programme.

II. The women candidates and Persons with Disability (more than 40% disability) may be allowed a relaxation of two years for Ph.D. in the maximum duration.

III. Registration of a candidate of Ph.D. Program shall automatically be cancelled when maximum duration of the program is over. However, a candidate may be given chance to re-register to the program afresh on submission of fees. He/she has to pay the entire fees as stipulated to a fresh candidate in addition to re-registration fees. Such candidate shall get a period of three years time again to complete his remaining part of the Ph.D. Program

from the date of approval of re-registration. For re-registration a candidate has to apply to the authority showing his reason through his/her supervisor. The Vice Chancellor on recommendation of the Dean of concerned faculty may approve such re-registration which shall be reported to the Academic Council in its next meeting.

3. Procedure for Admission in Ph.D. Programme:

I. The University shall allow a candidate to get admission in the Ph.D. Program when he/ she qualifies in RET (Research Eligibility Test) conducted by the Tripura University. The RET shall be conducted through a Written Test followed by Viva-Voce Examinations.

II. There shall be an on-line application form of RET for Indian candidates.Admission portal shall remain open for a specified period as notified by the Tripura University from time to time. An applicant shall fill up the online form within the specified date and submit requisite feeof RET as per instruction given in the website.

III. There shall be a separate Online- admission form for international applicants and admission portal shall remain open for a specific period as notified by the Tripura University from time to time. An eligible international applicant has to fill up the online form and submit the same within the specified date. Requisite application fee is to be submitted as per instructions given along with application form.

IV. A candidate seekingAdmission in the Ph.D. Program of Tripura University shall have a Masters Degree or a Professional degree declared equivalent to the Masters Degree by the corresponding statutory regulatorybody, with at least 55% marks in aggregate or the equivalent grade 'B' in the UGC 7-point scale or an equivalent grade to a point scale wherever grading system is followed or an equivalent degree from a foreign educational institution accredited froman Assessments and Accreditations Agency which is approved, recognized or authorized by an authority, established or incorporated under a law in its home country or any other statutory authority in that country for the purpose of assessing,accrediting or assuring quality and standards of educational institutions.

V. A relaxation of 5% of marks, from 55% to 50%, or an equivalent relaxation of Grade, may be allowed for those belonging to SC/ST/OBC (Non Creamy layer) / Differently-Abled and other categories of candidates as per the decision of the Commission communicated from time to time, or for those who had obtained their Master's degree prior to 19th September 1991. The eligibility marks of 55% (or an equivalent grade in a point scale wherever grading system is followed) and the relaxation of 5% to the categories mentioned above are permissible based on the qualifying marksonly without including the grace mark procedures.

VI. The basic eligibility criteriafor appearing in RET shall be the successful completion of Post-Graduate Program (fulfilling the norms stated in sub clause 3.IV & 3.V of this Rules & Regulations) or a professional degree declared equivalent to the Masters' Degreeor a five year integrated master's degree by the corresponding statutory regulatory body recognized by UGC/AICTE/MCI/NCTE/INC/BCI.

VII. Tripura University shall decide on an annual basis through the DRC a predetermined and manageable number of Ph. D scholars to be admitted depending on the number of available Research Supervisors, and available academic and physical facilities, scholar-teacher ratio (as indicated in sub clause 8.Vof this Regulation), laboratory, library and such other facilities.

VIII. Notification of RET shall be made in Tripura University website and advertisement shall be made in at least 2 (two) national newspapers of which at least 1 (one) shall be in the regional language. The notification shall contain information about the number of available seats for admission, subject/discipline,criteria for admission, procedure for admission, examination centre(s) where entrance test(s) shall be conducted and all other relevant information for the benefit of the candidates.

IX. All Academic Departments of Tripura University offering Ph.D. Program shall intimate the Office of the Dean of the concerned faculty/assigned officer of the students' admission cell well in advance about the number of vacant seats available for admission to the Ph.D. Program in that year. If a Department has no vacancy for Ph.D. candidate in a particular academic year, such Department shallalso inform the concerned office mentioning the list of Registered Ph.D. candidates to every qualified Research supervisor of the department.

X. If there is no vacancy in a department, the department concern may not admit any student in a particular academic year(s).

XI. **Eligibility of an International Candidate for Ph.D. Program:**

a. An International Candidate possessing a Degree, considered equivalent to the M.Phil Degree of an Indian Institution, from a Foreign Educational Institution accredited by an Assessment and Accreditation Agency which is approved, recognized or authorized, by an authority,established or incorporated under a law in its home country or any other statutory authority in that country for the purpose of assessing, accreditingor assuring quality and standards of educational institutions, shall be eligible for admission to Ph.D. program.

b. A three member committee consisting of concerned Dean of the faculties and concerned Head of the Department and one senior Professor /Associated Professor of the department shall compare equivalence of the International Degree of the concerned candidate with that of M.Phil Program of Indian Universities. However, if an international candidate of his/her master's degree has completed at least 4 (four) credits in project work, 4 (four) credits in Research Methodology and his/her CGPA in master's degree was equivalent to 55% of marks, such candidate shall be treated as equivalent to M.Phil program of Indian Universities. If such candidate has not completed such courses in master's Degree but completed the equivalent requirement after completion of Master's Degree, that may also be accounted as equivalent to the M.Phil program by the Committee.

c. While applying, an international candidate shall attach three recommendations from responsible persons who have knowledge about the course work/research work/professional work of the applicant concerned. He/she shall clearly write the name, designation, mobile number and valid email account number of the referees. He/she shall also write anessay in 300 words mentioning why he/she is interested to do Ph.D in the Institution?

4. **Research Eligibility Test (RET) and Admission to the Ph.D. Program:**

I. The syllabus of RET shall consist of 50% of research methodology and 50% shall be subject specific. The RET shall be conducted at the Centre(s) notified by the university.Any change in examination centre(s) due to unforeseen reasons, shall also be notified accordingly by the university.

II. The questions of the written Test of the Subject Specific portion of the RET (as mentioned above)shall be held on the basis of Post-Graduates Syllabus of the concerned subject of Tripura University.The qualifying marks for the written test of RET shall be 50%.

III. A Candidate securing 50% or more marks in the written test of RET shall bequalified for appearing in Viva-Voce Examination of RET of 100 Marks before the DRCof the concerned Department.

IV. Candidates who have cleared UGC/CSIR NET/SLET/SET/GATE (Non- Engineering) shall be exempted from the written test of RET and they shall directly appear in Viva Voce Examination of RET.

V. The qualifying marks for Viva-Voce shall be 50 out of 100.

VI. A Viva-Voce/interviewshall be organized for the RET candidateswhere the candidates are required to discuss their research interest/area through a presentation before a duly constituted Departmental Research Committee (DRC).

VII. The Viva-voce/interview shall also consider the following aspects, viz. whether
   a. The candidates possess the competence for the proposed research.
   b. The research work can be suitably undertaken at the Institutions/College.
   c. The proposed area of research can contribute to new/additional knowledge.

VIII. The question papers for written part of RET in the respective subject shall be set by the faculty members of the concerned department and that shall be submitted by the Head of the Department to the office of the Controller of Examinations. The Board of Question Setters and Moderators shall be appointed by the Controller of Examinations with the approval of the Vice Chancellor. The moderated question paper shall be submitted to the Controller of Examination for further processing.

IX. **DRC:** There shall be a Departmental Research Committee (DRC) which shall consist of all the faculty members having Ph.D. (withat least three members). If a department having less than three faculty members with Ph.D. shall form a DRC incorporating required number of faculty member(s) having Ph.D. from the allied departments. If HOD is a Professor/Associate Professor, he/she shall be the chairperson of DRC. If HOD is not a Professor/Associate Professor, in that case concerned Dean shall be the Chairperson. The Chairperson of DRC shall notify the composition of RAC giving copy to the all concerned. The DRC chairman will report the findings to BPGS.

X. The subject wise Merit List shall be prepared by the concerned DRC on the basis of the performance of candidates in Viva-Voce Examinations and shall be submitted to COE/ Dean of the concerned faculty/Assigned officer of the students' admission cell. The concerned officer shall place the merit list of every department to the Dean's Committee of TU in its meeting for approval before publication of the result.

XI. Admission to the Ph.D. Programme shall be on the basis of subject-wise Merit List. RET qualified Candidates shall join at the respective departmentsfill up the necessary forms and submit requisite fees. During admission a candidate has to produce all Testimonials/Certificates in original. However, if any Certificates/testimonials appear to be fake / fabricated/ tempered, the candidature of the applicant shall be cancelled and the applicant shall beliable to punishment. If the number of RET qualified candidates are more than the existing vacant seats, in a department then the vacancy shall be filled up from the merit list in order of merit.

XII. The results of RET shall remain valid for two years from the date of its publication of result.

XIII. A Ph.D. Scholar (Indian & International both) after admission in 1st semester of Ph.D. Program shall enroll himself/herself in every semester (six month apart) on submission of requisite fees. If a scholar fails in a semester he/she also shall enroll in the same semester. No notification shall be made in this regards.

XIV. **RET for International Candidates:**If the number of international applicants for a department becomes less than 15% of total seats then such applicants need not appear in written test of RET, However they shall appear for oral test in the department. Only the successful candidate shall be eligible for admission in the Ph.D. program.

XV. **Selection Methodology for International Candidates:** The selection of an international candidate shall be made as mentioned below:

a. Academic section of the University shall send the documents of the International Candidate to the department concern for examination. The Equivalence Committee shall confirm whether the applicant is eligible or not to be admitted to the department for Ph.D program If eligible, his/her name shall be uploaded in the website so that International Candidate may appear in the RET- Viva Voce.

b. The successful International Candidate shall be allowed at least 15 days to be admitted in Ph.D program. But he/she shall pay the requisite fees as per norms set for International Candidates.

c. The admission officer shall inform the concerned candidate through email and shall instruct the candidate to get admitted by the specified date.

d. After admission, all other rules and regulations of the Ph.D. Program of International Candidate shall be the same, (if not otherwise stated).

XVI. Reservation rules of GOI shall be strictly followed during admission in Ph.D. Program for Indian students.

XVII. **Admission in Ph.D. Program for Indian students:**

a. A list of department-wise selected candidates for Ph.D. Program of the university shall be notified by the concerned officer in the TU website mentioning date and time of admission. This shall also be published in local dailies and in at least national newspaper.

b. The selected candidates shall be asked to report to the Head of the concerned department with all testimonials/certificates in original and some other documents as notified from time to time by the university.

c. The DRC of concerned department shall verify the original documents and if satisfied, shall allow the candidate concerned for submission of requisite fees.

d. The candidate shall be asked to fill two copies of admission form available in the TU website to complete the admission procedure. One copy of the admission form shall be sent to the admission authority by the concerned Chairperson of DRC within thirty working days. The admission authority/ concerned officer, after receiving the admission form(s) from the department shall upload the name of the candidates admitted for the year, along with the name of supervisor/co-supervisor and Research topic of the scholar concerned as per UGC norms.

e. All Scholars, within 15 days of their admission, shall have to submit 'Anti ragging affidavit' to the University, the formatof which is available in TU website. At the same time, such scholar also shall fill online 'Anti Ragging' affidavit every year. Online format is available in MHRD website.

XVIII. **Admission for International Candidates:**

a. An International candidate on arrival in the Tripura University shall report to the Academic Section first for completing the 'formalities of an international student'.

b. **Documents required:**At the time of admission in Ph.D. Program in the University an international candidate shall produce the following documents in original and two sets of self attested photocopies of the said documents:

i. Filled in online application form.

ii. Receipt copy of email which was sent to the candidate concerned by Tripura University for admission in Ph.D. Program.

iii. Valid Passport and Visa.

iv. Two copies of filled up FORM A meant for 'international students', available in UGC website (www.ugc.ac.in).

v. Proof of adequate financial support / scholarship.

vi. Medical fitness certificate from the appropriate medical authorities not below the rank of District Medical Officer or equivalent medical officer.

vii. A certificate from local police station of his/her own country stating that he/she has no criminal record, no FIR was logged against him/her, he/she was not involved in any communal riot and any extremist activities etc.

viii. After observing the formalities the candidate concerned shall produce all the testimonials/certificates in original to the Chairperson DRC of the

concerned department. Then he/she shall submit the requisite fees prescribed for international candidate and complete other necessary formalities in the department for admission.

ix. On the day of admission the student concerned shall report to the Foreign Registration Officer (FRO) office, Agartala with necessary documents and shall obtain a permission for stay in India.

x. The Candidate who has registered enactment of the Rules & Regulations with be guided by the earlier Regulations.

XIX. **Cancellation of Admission:**

a. If any candidate, Indian/ International submits the fake/fabricated, certificate/ testimonial during admission procedure, or provide any wrong information, his/her admission to the program is liable to be cancelled. In such cases, final decision shall be taken by the Academic Council of the University.

b. If any candidate has any FIR against him/her, admission of such candidate shall remain suspendedtill his/her acquittal. And if such a candidate suppresses the fact of any FIR/Police case while filling in the admission form, and if such information reaches to the authority of Tripura University, the admitted candidate shall be asked to submit a clearance certificate from a policeofficer not below the rank of an Officer-in-Charge (OC) of the police station within 15 days. If the concerned candidate fails to produce such clearance certificate from the appropriate authority within this stipulated time, his/her admission shall stand cancelled.

c. During Ph.D. work if there is any kind of serious allegation against the scholar concerned, like harassment to women's, participation in social/ethnic violence, disobeying of the hostel rules or breaking of discipline at any level, copying in examination hall, involved in plagiarism in thesis, ragging and it is proved, then the admission of such candidate in Ph.D. Program of Tripura University shall stand cancelled.

d. If a Registered Ph.D. Scholar is found to be involved in any part time/full time/ contractual job in addition to grant of non – NET/ any other scholarship/any financial assistance from project, his/her Registration shall stand cancelled.

5. Eligibility of affiliated College/Institute of Tripura Universityfor offering Ph.D. Program:

I. The affiliated colleges of Tripura University having post graduate programme/ affiliated research institute/any industry having R&D programme (not less than 5 years), may offer Ph.D. Program under Tripura University.

II. Adequate academic, administrative and infrastructural facilitiesin the college/ Research Institute/ Industry are required for getting permission from Tripura University to offer Ph.D. Program. The procedure of giving recognition is as follows:

a. The intending institute shall write to the University authority for recognition to offer Ph. D. Program in a prescribed format.

b. Post-graduate Departments of Colleges, Research laboratories of Government of India/State Government with at least two Ph.D. qualified teachers/scientists/other academic staff in the Department concerned along with required infrastructure, supporting administrative and research promotion facilities as per these Regulations, stipulated under sub-clause 5.(II).h to 5.(II).j, shall be considered eligible to offer Ph.D. programs. Colleges shall additionally have the necessary recognition by the Institution under which they intend to offer Ph.D. program.

c. University shall form an inspection team to judge eligibility of the institute, comprising of three members, of which the Dean of the concerned faculty shall be the Chairperson. The other two members of the committee shall be nominated by Vice Chancellor. If needed, Vice Chancellor may appoint an external expert as a member in the team.

d. The intending institute shall pay a stipulated amount as inspection fee prior to inspection. No fee shall be required for the institution with which Tripura University having academic/research collaboration through Memorandum of Understanding (MoU).

e. The team shall submit a report to the Vice Chancellor after the visit about the infrastructure, academic and administrative ability of the institute. The Vice Chancellor with his comment shall refer the matter of inspection report to the Academic Council for consideration. After getting approval from Academic Council and Executive Council in this regard, the permission may be given to the institute for offering Ph.D. Program as per Rules &Regulations of PhD-2016 ofTU.

f. If an institute is not granted recognition for offering Ph.D. program in its first attempt, the institute may apply subsequently at a gap of one year for granting affiliation. Every timethe institute has to pay the inspection fee.

g. While visiting, the inspection team shall take care of all the issues mentioned in clause 5.(II).h to 5.(II).j of this Rules and Regulations.

h. In case of Science and Technology disciplines, research laboratories should be equipped with sophisticated instruments, provision for adequate space for each research scholar along with computer facilities and essential software, and uninterrupted power and water supply.

i. There should be library resources including latest editions of books, Indian and International journals, e-journals, extended working hours for all disciplines, adequate space for research scholars in the Department/ library for reading, writing and storing study and research materials.

j. Colleges/Institutes may also access the required facilities of the neighboring Institutions/Colleges, or of those Institutions/ Colleges/R&D laboratories/Organizations having the required facilities.

k. A college teacher (where Post Graduate Programs are not being offered) having Ph.D. Degree, may be allowed to guide the Ph.D. students provided that such teacher obtains a formal permission from the university. While offering such permission the following points shall be adhered to:

I. The college where the teacher is working, has required infrastructure, supporting administrative and research promotion facilities.

II. Such Ph.D. supervisor and Scholar is linked to a university department.

III. The said university department forms an RAC for the student concern.

IV. Such scholar has passed the Ph.D. Course Work Examinations.

V. Six month progress report of the scholar is to be submitted to the university department through the supervisor.

VI. For all the activities related to Ph.D. Program the scholar concerned is to present himself/herself in the University department.For the purpose no TA/DA shall be paid to the supervisor/scholar concerned. However, an eligible scholar may be given non-NET scholarship, provided thatthe scholar is not receiving/earning any money from any other source.

VII. If such supervisor is transferred from the college concerned/go for retirement/ voluntarily retired/leave the job, then the concerned university department shall try to accommodate the student if the P.HDtopics suits to any of the faculty member of the university department and if such teacher is willing to take the scholar under his/her guidance. In case, the scholar cannot be accommodated, the university shall not take any responsibility to accommodate the scholar. Before admission to the program both supervisor and student shall have to give a legal undertaking in this respect.

III. Notwithstanding anything contained in these Regulations or any other Rules or Regulations, for the time being in force, no university; institution, Deemed to be a University and College shall conduct Ph.D. Program through distance education mode.

IV. Part-time Ph.D program may be allowed with provision that all the conditions mentioned in the extant of Ph.D Regulations, are met. Conversion of a full time Scholar to Part Time Scholar andvice versa may be allowed by the university on valid reasons, only once in the entire period of research program.

6. **Credits, Credit Distribution and Semesters in Ph.D. Program:**

I. The Ph.D. Program shall spread over in semesters depending upon the duration of the program as specified in sub clause 2.I & 2.II of this Rules and Regulations.

II. Each six month duration shall comprise a semester. Usually Odd Semester shall be started w.e.f. 1st day of July every year and Even semester from 1st day of January every year.

III. There shall be allotment of Minimum number of Credits with each and every Semester of the Ph.D. Program as mentioned in table- B. A Research Scholar needs to earn these Minimum Credits to qualify in the particular Semester of the Program and also the other specified activities related to Ph.D. Program mentioned in Table - B. Total Minimum Credits of the Ph.D. Program is 100 (one hundred). If a Scholar fails to earn this Minimum Credit, he/she shall not be awarded the Doctor of Philosophy (Ph.D) from Tripura University. However, a scholar can earn more credits to complete his/her Ph.D. Program.

IV. A Scholar cannot proceed to next Semester/ activities of the Ph.D. Programuntil he/she qualifies in the previous Semester/ activities mentioned in table -B.

V. A Ph.D. Scholar can earn more number of Credits, in addition to the prescribed Minimum Credits in Course work as mentioned in sub-clause XIX (Table B).

VI. Evaluation shall be made on Six Months Progress Report, Synopsis, Summary etc by the RAC. On satisfaction, the RAC shall mention the performance of the candidate as 'Satisfactory/Unsatisfactory' and 'Full Credits/Zero Credits' respectively shall be awarded to the scholar concerned.

VII. Participation in teaching assistance and evaluation of answer scripts are mandatory for a research scholar. A scholar must have to earn at least 4 Credits over two semesters from teaching assistantship/ evaluation of answer scripts before submission of Ph.D. thesis. Maximum 2 Credits may be awarded to a scholar for teaching assistantship/evaluation of answer scripts in a semester. The assignment shall be given by the convener of the RAC of the concerned candidate in consultation with HOD. For assistantship/evaluation of scripts no remuneration shall be paid.

VIII. Teaching assistance means the concerned scholar shall assist the Course teacher to prepare course material/grading the assignment paper/ taking and grading the internal assessment paper/ laboratory classes. However, in exceptional cases few classes like tutorial classes may be assigned by course teacher to the scholar.

IX. Usually the Ph.D. Curriculum of Tripura University shall be of three years i,e, six semesters, each of six months duration. However, any extension of timein Program shall be guided by sub clause 2.I & 2.II of this Rules & Regulations.

X. Usually a Ph.D. Scholar shall complete his/her Ph.D. Course work in First Semester. However,in exceptional cases if a candidate fails to register in Course Work or become unsuccessful in Course Work examinations, he/she may be permitted by the RAC to complete the Course Work in appropriate semester. However, he/she shall be allowed to continue his work of Ph.D.An RAC may suggest additional course work (other than table C) to a scholar if his/her Ph.D. Program demands so. In that case it becomes mandatory for the scholar concerned to complete the said Course Work before submission of summary of result in 5000 words. If an RAC feels to offer a Course Work to a scholar even

from Post Graduate Courses of the University or from any other Institute, in that case scholar shall do that course at his/her own cost. The course work examination of such scholar may be conducted with post graduate students/authority of other Institute.

XI. A Scholar shall be required to submit half yearly progress reports starting from the 2nd semester in six copies to the Convener of RAC till the submission of summary of results for Public Seminar. However, a scholar who has earned 16 Credits in Course Work in 1st semester does not requireto submit a progress report separately. But if a scholar fails to register in course work in 1st semester he/she has to submit a progress report.

The progress report shall include the title of the Ph.D. thesis, Date of Registration/Enrollment Number, Name of the Scholar, Name of the Supervisor (Name of the Co- Supervisor if any) and Name of the Department, University / Institution and Year and duration on which the progress was made. The Progress report shall contain in detail the progress of research work being pursued. There shall be a presentation before the RAC, other faculty of the department.Other Research Scholar may remain present in the presentation.Duration of presentation may be half an hour or so. The convener of RAC shall have to provide a written evaluation of the progress reportalong with the advice or the necessary suggestion or correction, if any. The report should also be preserved in the department concerned in the file of the respective candidate.

XII. **Evaluation of six months Progress Report:** An RAC shall evaluate the six monthly progress report of a scholar in following procedures:

a. A progress report shall contain two parts, viz, written progress report and presentation of the report.

b. In the written progress report a scholar shall write about the methodologies/finding and real progress of work. RAC member shall read his/her report (the style of writing, content of writing, table/statistical interpretation etc). Presentation shall be made on work done in last six months. Considering the both parts as mentioned in 6.XII.a, if the RAC members are unanimously satisfied in the performance of the scholar, they shall write in their report as “satisfactory”, then full Credits shall be awarded to the scholar concerned. If not, “unsatisfactory “grade shall be awarded to the scholar. In that case zero credit shall be awarded to the scholar. In that case, the scholar shall register himself/herself afresh paying the requisite fees and shall repeat the whole work of six months.

c. The RAC shall prepare a report of the evaluation and all the members shall put their signature.RAC shall hand over a copy of the Evaluation Report to the scholar concerned

d. If the scholar earns 8 (eight) Credits in a semester he/she may enroll for next higher semester on submission of requisite fees. That part will be taken care of by the convener of RAC.

e. The result of the progress report shall be handed over to the Controller of Examinations. The Convener, RAC also shall preserve a copy of the same for future references. The whole matter requires to be reported to the BPGS and the concerned Dean. The BPGS shall check whether all the procedures have been followed properly.If found any procedural mistake,

the matter may be discussed in BPGS and necessary suggestion shall be given to Supervisor, who shall follow the said suggestion (s).

f. The Controller of Examinations shall prepare a Grade Card of the scholar concerned after Viva Voce of the Scholar as per Table B. Grade card shall be issued in every six months in the form of transcript in cumulative manner.

TABLE - A

Marks Range	Grade	Grade Point
Satisfactory	S	10
80.00 and above	O	10
75 - 79.99	A+	9
70 - 74.99	A	8
65 - 69.99	B+	7
60 - 64.99	B	6
55 - 59.99	C	5
50 - 54.99	P	4
Below 50	F	0
Unsatisfactory	U	0

XIII. To qualify a semester, a scholar shall have to earn specified minimum number of credits as mentioned in table - B.

XIV. The Convener of RAC shall clearly mention whether the particular scholar has qualified in the semester in his report.

XV. In order to qualify a semester (other than Course Work) a scholar shall earn at least 8(Eight) Credits.

XVI. If a Scholar fails to earn the Minimum number of Credits in a particular Semester of the Ph.D. Programme. He/she has to re-enroll in the Semester to earn the specified Minimum Credits. Such Scholar shall get two more chances to earn the minimum number of Credits (i.e., A scholar can utilize maximally three consecutive chances to qualify a semester subject to condition of 2.I & 2.II). If a Scholar fails to qualify the particular semester after availing the all three chances, his / her Registration to the Program shall be canceled. When a scholar misses his / her stipulated three chances, the Supervisor of the candidate shall immediately inform the matter to the members of RAC &Chairperson BPGS as well as the Dean of concerned faculty. In such caseseven if the candidate is already registered in the Ph.D. program, such registration shall be cancelled by the Academic Council. Otherwise, Chairman, DRC of the concerned department shall cancel the enrolment of the candidate concerned from the Ph.D. Program with the approval of the Vice Chancellor. The record shall be kept in writing in the department.

XVII. When a scholar has qualified in all the semesters but fails to submit his/her thesis in final form, he/she has to enroll in each and every semester till the award of the Degree.

XVIII. To submit the Summary of result, normally a student should have five “S” in Semester Progress Report. However, in exceptional cases, such as scholar has done excellent work and completed the work well ahead of time, the scholar can submit his/her summary of

results after obtaining four "S", taking permission from the Vice Chancellor. The application for permission shall be routed through the supervisor.

XIX.

Table - B
Minimum Credits to be Earned to qualify for next Semester/activities of Ph.D Program

Codes	Semester / Particulars	Minimum Credits Required to be qualified	Remark
	Passing of Course Work	**16**	
PHD-9005	Semester I (1st Progress report)	**8**	
PHD-9006	Semester II (2nd Progress report)	8	
PHD-9007	Semester III (3rdProgress report)	8	
PHD-9008	Semester IV (4th Progress report)	8	
PHD-9009	Semester V (5th Progress report)	8	
PHD-9010	Successful Submission of Synopsis	**8**	
PHD-9011	Successful Submission of Summary (5000 words)	**16**	
PHD-9012	Successful Submission of Thesis (positive Comments of all adjudicators)	**16**	
PHD-9014	Successful Defence of Thesis through Viva Voce Examination	**8**	
PHD-9015	Teaching Assistantship / Evaluation of Answer Scripts	**2+2=4**	
Total	**Minimum Credits required for Awarding Ph.D. Degree.**	**100**	

7. **Research Advisory Committee (RAC):**

I. There shall be a Research Advisory Committee, for Ph.D. scholar. The Research Supervisor of a scholar shall be the Convener of this Committee. This Committee shall have the following responsibilities:

a. To review the research proposal and finalize the topic of research.

b. To guide the research scholar to develop the study design and methodology of research and identify the course(s) that he/she may have to do.

c. To review the work periodically and assist in the progress of the research work of the research scholar.

d. To do the necessary work for evaluation of the scholar in each and every semester and handing over of the semester evaluation report to the scholar concerned as stipulated in this Rules & Regulations. And shall also submit the semester progress report to the appropriate authority. Concerned RAC shall evaluate the semester progress report.

e. To look into the matter of teaching assistantship/evaluation of answer scripts.

f. any other matter related to the scholar concerned.

II. All RAC members should have Ph.D Degree. An RAC shall consist of five (5) members including the Supervisor as Convener of the Committee. One faculty having Ph.D. in the relevant/allied subject and three full-time faculties from the department concerned including the Supervisor shall be members of the RAC. In case there is any Co-supervisor, he/she will be also a member of RAC In such cases there shall be two faculties from the department (Instead of three members).There shall be one external expert member of the concerned subject belonging to the university/industry/ research institute etc, other than TU. Three members shall constitute the quorum of the RAC meeting.

III. For a Department/Subject in which sufficient number of whole-time faculties is not available in the concerned Department of the University, the DRC concerned may constitute the RAC for that subject with requisite available members from the allied department.The table given below may be followed:

	Department having sufficient faculties with Ph.D.	**Department having insufficient faculties with Ph.D.**
Supervisor	Convener	Convener
Co supervisor (may be from university/same department/from other institute/Research Organization/Industry)	Member	Member
External Expert	Member	Member
Other Members	Three faculties where there is no Co-supervisor Two faculties where there is co-supervisor	Necessary faculties to make the total members five from allied department.

8. **Allocation of Research Supervisor:**

Eligibility criteria to become a Research Supervisor, Co-Supervisor, number of Ph.D. scholars admissible under a Supervisor, etc.

I. Any regular Professor of the Tripura University with at least five research publications in refereed journals and any regular Associate/Assistant Professor of the University with a Ph.D. degree and at least two research publications in refereed journals may be recognized as Research Supervisor. Provided that in areas/disciplines where there is no or only a limited number of refereed journals, the Institution may relax the above condition for recognition of a person as Research Supervisor with reasons recorded in writing.

II. Only a full time regular teacher of the Tripura University can act as a supervisor. The external supervisors are not allowed. However, Co-Supervisor can be allowed in inter-disciplinary areas from other departments of the same institute or from other related institutions/ Industry/ Research Institute, with the approval of the Research Advisory Committee.

III. The allocation of Research Supervisor for a selected research scholar shall be decided by the DRC concerned depending upon the number of scholars per Research Supervisor, the

available specialization among the Supervisors and research interests of the scholars as indicated by them at the time of interview/*viva voce.*

IV. In case of topics which are of inter-disciplinary nature where the DRC concerned feels that the expertise in the Department has to be supplemented from outside, the Department may appoint a Research Supervisor from the Department itself, who shall be known as the Research Supervisor, and a Co-Supervisor from outside the Department/ Faculty/College/Institution/Industry having R&D program/ Foreign Faculty/Eminent Professor of Hospital on such terms and conditions as may be specified and agreed upon by the consenting organizations.

V. A Research Supervisor/Co-supervisor who is a Professor, at any given point of time, cannot guide more than Eight (8) Ph.D. scholars. An Associate Professor as Research Supervisor can guide up to a maximum six (6) Ph.D. scholars and an Assistant Professor as Research Supervisor can guide up to a maximum of four (4) Ph.D. scholars.

VI. In case of relocation of a Ph.D. programof a woman scholar due to marriage or otherwise, the research data shall be allowed to be transferred to the University to which the scholar intends to relocate provided all the other conditions in these regulations are followed in letter and spirit and the research work does not pertain to the project secured by the parent institution/ supervisor from any funding agency. The scholar will, however, give due credit to the parent guide and the institution for the part of research already done.

VII. A supervisor at his/her last one (1) year of service shall not be allowed to register any new scholar for research guidance under him/her. However, such supervisor may act as co-supervisor to the other scholar concerned.

VIII. If a supervisor quit the job of Tripura University or go on lien to other Institute then he/she shall arrange a proper guide (s) for such scholar (s) before he/she goes to quit/lien, with the approval of DRC. If any such scholar is interested to quit the University, he/she is allowed to do so.

IX. If there is any unfortunate demise of a supervisor, then the concerned DRC shall do the needful so that the scholar (s) under such supervisor get a new supervisor from the department, within three months time and shall inform the appropriate authority accordingly.If the intake capacity of such supervisor is already filled up as per guidelines of UGC, he/she may supervise the scholar.It will be treated as special case. However, formal permission of the Vice Chancellor is required in such cases.

X. The college/institute teachers are also eligible to act as a Research Supervisor if the institute/college with PG courses.

XI. It may be noted that supervising one candidate is equivalent to co-supervising two students that is co-supervisor will earn 0.5 point.

9. **Ph.D. Course Work:**

Credit Requirements, number, duration, syllabus, minimum standards for completion, etc.

I. The credit assigned to the Ph.D. course work has been mentioned in table-A of this Rules and Regulations.

II. The Course Work shall be treated as prerequisite for Ph.D. program. Four Courses,each of 4 (Four) Credits have been assigned to Ph.D. Course Curriculum (as per Table B). Two Courses of Research Methodology (4 Credits each) shall cover areas such as, quantitative methods, computer applications, research ethics and review of published research in the relevant field, training, field work, etc. Other courses shall be advanced level courses preparing the students for Ph.D. degree.

III. The advance courses shall be developed by the concerned department and shall be taught by the departmental faculties.

TABLE - C

Course Code	Course Name	Course Contents	Credits
PHD-9001	Research Methodology I	Quantitative Methods, Computer Application and Research Ethics	**4**
PHD-9002	Research Methodology II	Review and Critique of Published Research in the relevant field, training, field work, Communication skill etc	**4**
PHD-9003	Advance area of research in the subject	To be decided according to need of the RAC.	**4**
PHD-9004	Seminar/Practical/ Project and Assignment etc	To be decided according to need of the RAC.	**4**

Notes:

1. The Dean of the concerned faculty on discussion with the groups of a departments shall decide the course content and working methodologies about the first two courses of Research Methodology, namely Research Methodology -I and Research Methodology-II.

2. The contents of the other two courses shall be decided by the offering departments. The DRC shall decide the content of the courses. It may be reported to the BPGS subsequently.

IV. A Ph.D. Scholar has to pass in all the above mentioned Courses to be successful in Ph.D. Course Work Examination to earn his/her required Credits. However, a Scholar can earn more than 16 Credits. He / she may earn extra Credits from other department/other institute/ MOOC approved by RAC in appropriate Semester. In that case he/she has to take written permission from the Convener of his/her RAC. The extra Credits will be reflected as well as in the final Grade Card ofPh.D Course Work.

V. All candidates admitted to the Ph.D. programs shall be required to complete the Course Work prescribed by the Department usually during the 1st semester of enrollment.

VI. A Ph.D. scholar has to obtain a minimum of 55% of marks or its equivalent Grade/CGPA in the Course Work in order to be eligible to continue in the program and submit the dissertation/thesis.

VII. To undertake the Ph.D. Course Work a candidate who is employed shall be required to submit the NOC by the employer allowing him/her to attend the Course Work classes.

VIII. To be eligible to appearto Ph.D. Course Work examination, each student shall have a minimum of 75% attendance in the classes. A student having attendance between 65% to 75% may be considered as eligible to appear as non-collegiate candidate and shall have to pay non-collegiate fee as per the rate of the post-graduate course. No student shall be allowed to appear in the examinations if attendance is less than 65%.

IX. All the Departmental faculties having Ph.D. Degree shall be involved in the process of Assessments and Evaluation of Paper-IV (i.e. Seminar/Practical Paper).

X. The duration of examination shall be of 3 hours for each theory paper of 100 marks.

XI. The fees for the examinations, Non- Collegiate Fees and other fee shall be determined by the University from time to time.

XII. Proposals containing the names of paper-setters / examiners etc. shall be submitted confidentially by the respective HODs to the Controller of Examinations, TU.

XIII. Paper setting, Moderation & Evaluation of answer scripts will be as per existing practice followed in the Post-Graduate Courses of the University.

10. **Registration:**

I. After successful completion of Course Work examination, a research scholar shall submit seven copies of the proposed research work in about 1000 words to the Ph.D. Supervisor within one year of publication of the result of Ph.D. Course Work Examination. The proposed research work shall be named as 'Synopsis'. The Synopsis will cover the following points.

a. Title of the proposed Ph.D. thesis
b. Introduction.
c. Literature survey.
d. Objectives
e. Proposed methodology
f. Significance of the work and
g. References.

II. **Synopsis:** The synopsis submitted to Ph.D. Supervisor shall be considered by the relevant Research Advisory Committee (RAC). The candidate shall be asked by the Supervisor to remain present in the meeting convened thereupon for a presentation & discussion on his/her synopsis.Evaluation of Synopsis shall be made by the RAC members. If the RAC is not satisfied with the synopsis and other documents submitted by the candidate, it shall advise the candidate, through the Supervisor, along with necessary suggestions to submit a revised synopsis for reconsideration.

III. After the approval of the Synopsis by the RAC the scholar concerned shall automatically earn 8 (eight) Credits.

IV. If the candidates fails to earn 8 (eight) Credits in synopsis, he/she shall be given necessary suggestions for correction and shall re-submit the corrected Synopsis within 30 days. Further evaluation shall be made.

V. The Supervisor shall give a performance report of synopsis to the candidate concerned in writing within three working days of synopsis seminar. A copy of the same to be preserved for future references. The report shall be placed to BPGS for formal approval.

VI. If BPGS approves the Synopsis, the date of Registration of the scholar concerned shall the date in which RAC approved the synopsis.

VII. If BPGS refer back the Synopsis for correction, then as per suggestions of the BPGS the scholar shall do the needful and shall submit the same to the RAC. The RAC in its second meeting shall approve the Synopsis and shall place the corrected Synopsis to the BPGS again. If BPGS approves, the date of registration of the scholar concerned shall be second approval date of RAC. If BPGS does not approve even in second time, the scholar shall be advised to quit the program.

VIII. In all cases plan of works is to be made final before submission of Summary and due approval is to be taken. A scholar shall not be allowed to change his/her Plan of Work, once Summary is submitted.

IX. A candidate may be allowed to register for Ph.D. program in the subject in which he/she has obtained a Master's degree. However, a candidate having Master's degree in any of the allied subjects of a particular group may also carry out doctoral research in the subjects enlisted under each of the groups (as mentioned in annexure), subject to the condition that such candidates shall have individual Co-supervisors from their respective mother-subjects enabling the candidate to beendowed with Ph.D. degree belonging to his/her mother subject.

X. A part time research candidate pursuing research work shall meet the Supervisor every two weeks to update his/her research work.

XI. A candidate already possessing a Ph.D. degree of this university or any other University shall be eligible to be admitted to the Ph.D. program for an additional Ph.D. degree in a subject other than the subject in which he/she already possesses the Ph.D. degree. The admission of such a candidate will be at the discretion of the Vice-Chancellor, who on the basis of specific recommendation and full justification by the concerned committee and after considering certain relevant criteria such as the synopsis of the proposed topic, relevancies of the proposed study and its relationship with the topic of the previous Ph.D. etc. will take a final decision in this matter.

XII. A Ph.D. scholar cannot join any other Regular / Distance Mode course conducted by Tripura University or any other University. If inconsistencies are detected in this matter the research candidate may run the risk of losing the attainment of registration of Ph.D. in this University.

XIII. A part time scholar shall be guided by the same Rules & Regulations, Semester enrollment, submission of fees, Synopsis, and all other procedural matters as prescribed for regular candidates. However, there shall be no attendance bar for a Part time Scholar.

XIV. A Master's Degree in the Distance Mode may be accepted if it is recognized by the UGC. Off-campus Degree will not be considered.

XV. **Inter Disciplinary Works:** The inter-disciplinary research work may be allowed from among the subjects in the same group. For inter-disciplinary research work in between two subjects belonging to different groups, the supervisor shall seek permission from the Vice-Chancellor who will in turn seek recommendation in this regard from a committee to be constituted for the purpose comprising of the Dean of the concerned faculty and the other faculty members, if necessary. But following conditions may be considered:

A candidate may be allowed an allied subject as mentioned above if the resources in terms of guidance, laboratory, and library facilities are available in the concerned department.

A candidate who passed course work in Dept. A and found supervisor in Dept. B should have a Co-supervisor from Dept. A from which he/she will be awarded Ph.D. Degree.

XVI. **Conditions for Employed Candidate:**

a. Application of employed candidate shall be accompanied by No Objection Certificate (NOC) and the granting of the necessary leaves from the employer for carrying out the research work.

b. In case of laboratory based Science subjects, the employed registered candidates shall be required to do research work in the laboratory recognized by the University for at least 180 days (including vacations) during the entire period of the Ph.D. program.

c. Candidates not belonging to the state of Tripura, if registered for Ph.D. shall have to fulfill the essential stay requirement of 180 days during which the candidate shall make himself/herself available for various academic & research activities in the department. The supervisor and concerned Head of the Department shall have to certify to this effect.

11. **Attendance of Registered Students:**

A register shall be maintained by the HOD to monitor the attendance of Ph.D. Scholars. All the full paid Ph.D. Scholars undergoing the Course Work shall sign the register on every working day.

12. Public Seminar and submission of thesis:

I. The medium of Instruction in Ph.D. Program shall be English. So a Ph.D. candidate shall present his/her Public Seminar in English. The Ph.D. Thesis shall be written in English. However, medium of Instruction, Public Seminar, Viva Voce Examinations and writing of the thesis on language subjects other than English may be done either in English or in the language concerned.

In special cases the Vice Chancellor in consultation with the concerned Dean may bring changes in respect of languages of thesis where the adjudicators of the thesis written in that language is not available.

II. Ph.D. scholars must publish at least one (1) research paper in refereed journal/ preferably UGC listed journals and make two paper presentations in conferences/seminars before submission of the dissertation/thesis for adjudication, and produce evidence for the same in the form of presentation certificates and/or reprints.

III. The summary of result may be submitted after a minimum period of two years from the date of registration by a full time research scholar and after 2½ years by a part-time research scholar.

IV. The research candidate shall submit seven copies of the summary of results in about 5000 words along with a softcopy to the Supervisor/Convener of RAC. The summary of results should be submitted along with a statement of anti-plagiarism check by the candidate and duly certified by the supervisor.The extent of plagiarism part in thesis shall not exceed 40%. The amount of plagiarism part is subject tochange from time to time.

V. The Convener of RAC after receiving the summary of results shall distribute these to the members of the RAC at least 15 days prior to the Public Seminar. After receiving the reports, the Convener, RAC shall arrange for a public seminar in the department where the candidate shall have to present the complete work and defend the results in presence of the RAC members. At least three members of RAC shall form the quorum of RAC meeting for the public seminar. One of the external experts shall remain present in the public seminar (either RAC External member or e- copy external examiner).During the public seminar any member of the RAC or any member from the public may put forward specific suggestions on the work.

One e-copy shall be sent to another external expert other than RAC external expert and the e-report shall be brought.

a. Evaluation of Summary: The summary shall be evaluated by the RAC members and external expert. They have to clearly recommend whether the work of the candidate concerned was 'satisfactory' or 'not'. If a candidate is awarded 'Satisfactory' automatically the candidate concerned will earn full Credits. But if a candidate receive 'not satisfactory' he/she will be given no credits for this. If the 5000 words summary is not found satisfactory by the majority of the members, then the Committee shall suggest the candidate to revise the work on satisfactory level. A Scholar may do accordingly and may re-submit the summary within 3 months period. The supervisor RAC shall arrange for a second meeting of evaluation. If still the work of the scholar remains beyond the satisfactory level, such scholar shall get a third chance.If the third attempt is also unsatisfactory, the registration to the program of such candidate shall be cancelled.

b. A scholar shall earn 16 credits for successful submission of summary.

c. A panel of Adjudicators recommended by the RAC is to be submitted. And subsequently the list may be approved by the concerned BPGS. None of the Adjudicators shall be the external expert of BPGS /RAC.

VI. In all cases supervisor shall prepare a report of the evaluation and fill a prescribed format. He/she (Supervisor) shall report it to the BPGS for information. The result of the candidate is to be sent to the Controller of Examinations. The matter is to be reported to the concerned Dean along with copy of the summary within 30 days of Pre-Ph.D. Public Seminar. Copies of the all the papers is to be preserved by the supervisor concerned for future references after approval of BPGS.

VII. If a candidate successfully submits the summaryhe/she will earn 16 Credits.

VIII. After successful completion of the Pre-Ph.D. Seminar, the candidate is allowed to submit e-copy and spiral bound copy of the thesis to the supervisor for adjudication. Before that candidate shall incorporate the necessary changes as suggested in the Pre-Ph.D. Seminar (if any). And Supervisor shall give a Certificate in this respect.

IX. While submitting for evaluation of the thesis, a scholar shall produce an undertaking and a certificate from the Research Supervisor attesting to the originality of the work, vouching that there is no plagiarism and that the work has not been submitted for the award of any other degree/diploma of the same institution where the work was carried out, or to any other Institution.

X. Final printed copies of the thesis shall be prepared, bound and to be submitted by the scholar as per Tripura University guidelines after incorporation of suggestions made by the adjudicator(s) and Viva-Voce examiners after the Viva-Voce examination.

XI. If a scholar successfully submit final form of thesis he/she shall be awarded 12 Credits.

XII. A standard format (as prescribed) for the front cover, the spine and inner first page of the Ph.D. thesis should be strictly adhered to.

13. Evaluation of the thesisand Viva-Voce:

I. The Vice Chancellor shall appoint a board of three examiners, consisting of the supervisor and two (2) external experts from the panel of six experts submitted by the Supervisor concerned for adjudication of the thesis. This panel should be duly approved by BPGS.

II. After the thesis has been recommended for award of the Ph.D. Degree by all the three adjudicators, the candidate shall be asked to appear before Viva Voce to be conducted in this regard.

III. If the adjudicators has recommended for minor correction then the correction is to be made before viva voce examination. But if there is any ambiguity /conditionality/mistake pointed out in adjudications, then after correction, the portion of the thesis will be send to those adjudicators for further evaluation.

IV. If any two (2) of the three adjudicators recommended the thesis unambiguously and unconditionally, but the third adjudicator does not recommend, the thesis shall be sent to the external member of RAC for adjudication. After obtaining the report from the fourth examiner, the case shall be finally settled in accordance with the process as mentioned in the immediately preceding paragraphs.

V. One of the external adjudicators who has examined the thesis shall be the external examiner for the Open Public Viva Voce, which shall be conducted in the Department concerned in presence of the Board of the Examiners comprising the external adjudicator, Supervisor and the internal members of RAC. The Supervisors shall be the convener of the Viva-Voce.

VI. The examinersof Viva Voce shall examine the candidate in respect of the result of the thesis and the concerned subject area of the thesis to their satisfaction. The reports of the adjudicators of the thesis shall be provided to the Board of Examiners for conducting the Viva Voce and the candidate may be asked to explain and defend the points which might have been raised by the adjudicators, to the satisfaction of the examiners.

VII. Three members including the Supervisor and External adjudicator will form the quorum for Viva Voce.

14. Award of Degree :

I. All the reports of the adjudicators of the thesis and the report of the Viva Voce shall be placed before the concerned Board of Faculties or an approved body constituted by the Board of Faculties concerned preferably including the Dean of the Faculty concerned and one other senior Board of Faculty members for its consideration and recommendation for

the award of the degree. The name of the senior member shall approve by the Vice Chancellor.

II. The Vice-Chancellor shallrecommend/approve for the award of Ph.D. Degree to the candidate and shall report the same to the Academic Council duly for approval. A Provisional Certificate may be issued to the candidate by the University to the effect that the Degree has been awarded in accordance with the provisions of these UGC Regulations, 2016.

III. Following the successful completion of the evaluation process and before the announcement of the award of the Ph.D. degree(s), the University shall submit an electronic copy of the Ph.D. thesis to the INFLIBNET, for hosting the same so as to make it accessible to all Institutions/Colleges.

IV. Three (3) final, bounded copies (for central library, Supervisor & for Department concerned) of the thesis is to be submitted by the scholar concerned.

V. After the approval of the Vice Chancellor/Academic Council, a notification shall be issued by the University regarding the award of Ph.D. Degree to the candidate.

VI. The Ph.D. Degree under the seal of the University and signed by the Vice Chancellor shall be given to the candidate to the next convocation of the University.

15. Scholarship:

I. A candidate pursuing Ph.D. may apply for scholarship for which he/she is eligible. A part time scholar is not eligible for any kind of Scholarship.

II. Non-NET scholarship for Ph.D. Programshall be paid only to the regular Indian scholars who are not receiving any other kind of scholarship for pursuing his/her Ph.D. degree. Before issuing such scholarship, a scholar shall have to give a declaration that he/she is not earning from any other source.

III. If a non-NET scholarship receiving Ph.D. Scholar become eligible for any other kind of scholarship, his/her non-NET scholarship shall immediately be discontinued, i,e, a scholar shall not be receiving two scholarships at a time. Such scholar shall immediately inform his/her supervisor. The Supervisor shall request the authority in writing to discontinue the non-NET scholarship of such scholar.

IV. If once the non-NET scholarship is discontinued on the basis of the application of the scholar, such scholar shall not apply for non-NET scholarship once again, whatsoever the reasons may be.

V. If any scholar is receiving remuneration from any other source like project etc, such scholar shall not apply for non-NET scholarship. If his/her such remuneration is discontinued for any reason (other than punishment ground) such scholar after discontinuation of such scholarship (project remuneration etc) may apply for non-NET scholarship, through his/her supervisor. Supervisor shall write on recommendation why earlier scholarship / remuneration was discontinued.

VI. Retired Professors and the Foreign/NRI/Overseas students are not eligible to receive fellowship under the UGC Scheme of Non-NET fellowship to students, for pursuing Ph.D.Program.

16. **Rate of remuneration:**

Remuneration shall be paid to different examiner/adjudicators as per table below. However, the rate may vary from time to time, as decided by the appropriate authority.

Fees structure for the Indian National pursuing Ph.D programme shall be as follows:
TABLE - III

Sl No	Particulars	Amount of Fees		Explanation
		Indian Student	International Student	
1	Enrollment Fees in each semester	Rs. 1000.00	US$ 200.00	
2	One time Caution Deposit (refundable after Degree)	Rs. 5000.00	US$ 100.00	
3	Semester Fees	Rs. 3000.00	US$ 250.00	Other than enrollment fees
4	Course work Examination fees For each 4 Credits or fraction	Rs. 500.00	US$ 20.00	
5	Back paper of 4 Credits/ Earning of 4 extra credit each	Rs. 300.00	US$ 20.00	
5	Non-Collegiate fees	Rs. 1000.00	US$ 75.00	
6	Library fees in each Semester	Rs. 100.00 /Semester	US$ 10.00	
7	Fine for Late enrollment in a semester	Rs. 500.00 up to 30 days. Above 30 days up to 89 days Rs. 1000.00	US$ 50.00 up to 30 days. Above 30 days up to 89 days US$ 100.00	Late enrollment fine shall not condone in short coming of attendance.

Note:

1. At the time of enrollment in a semester, a scholar shall pay: Enroll fees + Semester Fees + Library fees = Rs. 1000.00 + Rs. 3000.00 + Rs. 100.00 = Rs. 4100.00. If a scholar enroll in a semester in late. Late fine is also to be paid.

2. Caution Deposit Rs. 5000.00 to be paid in 1st enrollment of 1st semester only.

ANNEXURE –I

List of Inter-Departmental Allied Programme for Ph.D.

A. Group of Languages and Literature
Bengali
Hindi
Sanskrit
English
Linguistics
Tribal Languages, literature and Folk Studies
Pali
Comparative Literature
Any Foreign and Indian Language
Manuscript Studies
Kokborok

B. Group of Physical Science:
Physics
Chemistry
Medical Science/Nano Sciecne
Pharmacy
Geography and Disaster Management
Geology/Geophysics
Civil Engineering/Remote Sensing/GIS
All Engineering Branches

C. Group of Mathematical Science:
Mathematics
Statistics
Computer Applications
Physics
Computer Science
Bioinformatics
Information Technology
Microbiology, Molecular Biology &Bioinfromatics

D. Group of BioScience:
Botany
Zoology
Human Physiology
Microbiology
Molecular Biology&Bioinformatics
Biotechnology
Forestry & Biodiversity
Pharmacy
MD/MS
Agriculture
Veterinary and Animal Science
Environmental Science
Fishery
Horticulture

Nursing
Chemistry, Bio Chemistry
Mathematics
Computer Science &Engg.

E. Group of Social Science:
Economics
History
Political Science
Philosophy
Sociology
Psychology
Public Administration
Rural Management and Development
Education
Women Studies
Social Exclusion and Inclusive Policy
Defence and Strategic Studies
Culture Studies
Human Rights
Geography and Disaster Management
Social Work
Journalism & Mass Communication
Disabilities & Rehaibitional Studies
Anthropology
Musicology
Archeology
Law
Film & Video Production

F. Group of Commerce and Management Science:
Commerce, Finance & Taxation
Business Management
Law
Economics
Mass Communication
Psychology
Library and Information Science
Rural Management and Development
Disaster Management
Journalism
Sociology
Film & Video Production
Social Exclusion and Inclusive Policy

G. Group of Engineering
Electrical Engineering
Electronics &Communication
Chemical and Polymer Engineering
Rubber Technology
Computer Science and Engineering, Engineering Physics, Physical Science
Information Technology
Mathematics

Material Science & Engineering
Mechanical Engineering
Civil Engineering
Library & Information Science
Instrumentation
Linguistics (computational)
Medical Technology
Statistics

H. Group of Arts & Music:
Music
Dance
Fine Arts
Film and Video Production
Mass Communication
Graphic Arts
Cultural Studies

I. Group of Education:
Education
Physical Education
Psychology
Sports Medicine
Disabilities and Rehabition Studies

The above mentioned list of subjects is indicative. The number and names of allied subjects may vary on recommendation of the Board of Faculty of Studies with the approval of Academic Council.

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Attach a Recent Passport Size Photograph

PhD Form I

To be filled for Joining the Course-Work after Qualifying in the Research Eligibility Test in the Year 2.....

1. Name of Student: .....

2. Department/Centre: .....

3. Local Address of Student: .....

4. Permanent Address of Student: .....

5. Mobile Phone no. of Student: ..... 6. Email ID of Student: .....

7. Name of Father of Student: .....

8. Name of Mother of Student: .....

9. Mobile Phone no. of one Parent: ..... 10. Email ID of a Parent: .....

11.Category: Unreserved/ SC/ ST/ OBC (circle one only) 12. Sex: Male/Female/Transgender (circle one only)

13. Marital Status: Unmarried/ Married/ Divorced/ Widowed (circle one only)

14. If Married: a. Name of Spouse: .....

b. Mobile Phone no. of Spouse: .....

15. Special Ability Status (if any): .....

16. PhD will be done FULL TIME/ PART TIME (circle one only)

17. If Full Time: Fellowship Type: Inspire/ JRF/ Non NET/ Other (circle one only). Attach appropriate certificates.

18. If Part Time: a. Name of Employer: .....

b. Full Address of Employer: .....

c. Phone No. of Employer: .....

d. Email ID of Employer: .....

e. No Objection Certificate from Employer Attached? yes/no (If "no" joining is not allowed.)

f. Leave for attending Course Work classes granted? yes/no (If "no" joining is not allowed.)

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19. Area of Interest for PhD Research: .....

20. Bachelors Degree of Student:

a. Year .....

b. Degree .....

c. University/Institute .....

d. Final % of Marks or CGPA .....

21. Masters Degree of Student:

a. Year .....

b. Degree .....

c. University/Institute .....

d. Final % of Marks or CGPA .....
(Attach a self-attested copy of final transcript)

e. Migration Certificate Attached? yes/no (If "no" joining is not allowed.)

22. I, Shri/Smt ....., son/daughter of Shri .....
..... state that all the information given above are true. I have read the latest PhD Regulations of Tripura University and understood the Regulations. I will abide by these Regulations and other rules and regulations of Tripura University while pursuing my PhD studies in Tripura University. I also understand that joining the course-work classes conducted in Tripura University does not guarantee me finding a supervisor in the Department/Centre and/or performing research in my area of interest.

Signature of Student: ..... Place: .....

Date: .....

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21. Verified and Admitted for Course Work/ Rejected

Signature of HOD/Dept. Coordinator: ..... Date:.....

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22. Recorded in the register.

Unique Enrollment No. Assigned to Student: .....

Signature of the Dealing Clerk in PhD Section .....Date:.....

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23. Signature of Dean ..... Date:.....

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PhD Form II

To be filled by DRC for Allocation of Supervisor/Co-Supervisor

1. Name of Student: ..... 2. Enrollment No.....

3. Department/Centre: .....

4. Area of Interest of the Student for PhD Research .....

5. Name of Supervisor for the Student .....

6. Name of Co-Supervisor for the Student (if needed).....

I, Dr. ..... agree to serve as the Supervisor of the student named above.

Signature ..... Date:.....

I, Dr. ..... agree to serve as the Co-Supervisor of the student named above.

Signature ..... Date:.....

We certify that the Supervisor and Co-Supervisor selected satisfy the latest PhD Regulations of Tripura University for being a Supervisor or Co-Supervisor of a PhD student of the Department.

Signatures of DRC members:

a. Chair Name: ..... Signature:..... Date:.....

b. Member Name: ..... Signature:..... Date:.....

c. Member Name: ..... Signature:..... Date:.....

d. Member Name: ..... Signature:..... Date:.....

e. Member Name: ..... Signature:..... Date:.....

Signature of Dean ..... Date:.....

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PhD Form III

To be filled by DRC for the Course-Work in the Year 2.....

1. Name of Student: ..... 2. Enrollment No.....

3. Department/Centre: .....

4. Area of Interest of the Student for PhD Research .....

5. Possible Supervisor/Co-Supervisor for the Student .....

6. Course Work Courses Recommended for the Student:

i. ..... (semester Odd/Even Year: -)

ii. ..... (semester Odd/Even Year: -)

iii..... (semester Odd/Even Year: -)

iv..... (semester Odd/Even Year: -)

Signatures of DRC members:

a. Name: ..... Signature:..... Date:.....

b. Name: ..... Signature:..... Date:.....

c. Name: ..... Signature:..... Date:.....

d. Name: ..... Signature:..... Date:.....

e. Name: ..... Signature:..... Date:.....

Signature of HOD/Dept. Coordinator: ..... Date:.....

Signature of Dean ..... Date:.....

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PhD Form IV

To be filled by A Supervisor for the Formation of R.A.C.

1. Name of Student: ..... 2. Enrollment No.....

3. Department/Centre: .....

4. Area of Interest of the Student for PhD Research .....

5. The RAC of this student consists of the following members:

(i) Supervisor: Name ....Initials .....

(ii) Co-Supervisor: Name .....Initials .....

(iii) Member: Name..... Dept.....Initials .....

(iv) Member: Name..... Dept.....Initials .....

(v) External Member: Name .....

Organization .....

Department .....

Signature .....

(Consent of the External Member may be obtained via Email. Attach a print-out of the Email.)

R.A.C. formation is Approved/Not Approved (circle one choice)

Signature of Chairperson of BPGS: ..... Date:.....

Signature of Chairperson of BFS..... Date:.....

Signature of Vice Chancellor: ..... Date:.....

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PhD Form V

To be filled by RAC for Approval of the Synopsis

1. Name of Student: ..... 2. Enrollment No.....

3. Department/Centre: .....

4. Date of Completion of Approved Course Work: .....

5. Area of Interest of the Student .....

6. Title of the Proposed Thesis .....

7. Date of Submission of Written Synopsis .....

8. Date of Presentation/Examination of the Synopsis by RAC .....

The synopsis is SATISFACTORY/ Not Satisfactory (circle one only).
If not satisfactory write the reasons in detail and attach.

(i) Supervisor: Name ....Signature:..... .....Date:.....

(ii) Member/Co-Supervisor: Name .... Signature:..... .....Date:.....

(iii) Member: Name ....Signature:..... .....Date:.....

(iv) Member: Name .... .Signature:..... .....Date:.....

(v) External Member: Name ....Signature:..... .....Date:.....

Attach extra sheets with detailed comments (if any) by RAC members.

Recommendation of RAC is Accepted/Not Accepted (circle one choice). If not accepted write the reasons in detail and attach.

Signature of Chairperson of BPGS: ..... Date:.....

The Date of Registration as a PhD Scholar: .....

The Registration number ..... Initials of dealing clerk .....

Signature of Chairperson of BFS..... Date:.....

Signature of Vice Chancellor: ..... Date:.....

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PhD Form VI

To be filled by RAC for Research Progress

1. Name of Student: ..... 2. Enrollment No.....

3. Department/Centre: .....

4. Date of Completion of Approved Course Work: .....

5. Date of Registration ..... 6. Registration No.....

7. Title of the Proposed Thesis .....

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8. Progress Report No. 1/ 2/ 3/ 4/ 5 (circle one only)

9. Date of Submission of Progress Report .....

10. Date of Presentation/Examination of Progress Report by RAC .....

The Progress Report is SATISFACTORY/ Not Satisfactory (circle one only).
If not satisfactory write the reasons in detail and attach.

(i) Supervisor: Name ....Signature:..... .....Date:.....

(ii) Member/Co-Supervisor: Name .... Signature:..... .....Date:.....

(iii) Member: Name ....Signature:..... .....Date:.....

(iv) Member: Name .... .Signature:..... .....Date:.....

(v) External Member: Name ....Signature:..... .....Date:.....

Attach extra sheets with detailed comments (if any) by RAC members.

Initials of dealing clerk .....

Signature of Dean:..... Date:.....

Tripura University
Suryamaninagar 799022
Tripura, India

PhD Form VII

To be filled by Student for Change of Thesis Title

1. Name of Student: ..... 2. Enrollment No.....

3. Department/Centre: .....

4. Date of Completion of Approved Course Work: .....

5. Date of Registration ..... 6. Registration No.....

7. Old Title of the Thesis: .....

8. New Title of the Proposed Thesis.....

Attach sheets explaining the need for the change.

Signature of Student:..... Date:.....

The proposed change is APPROVED/ Not Approved (circle one only).
If not approved write the reasons in detail and attach.

(i) Supervisor: Name ....Signature:..... .....Date:.....

(ii) Member/Co-Supervisor: Name .... .Signature:..... .....Date:.....

(iii) Member: Name ....Signature:..... .....Date:.....

(iv) Member: Name .... .Signature:..... .....Date:.....

(v) External Member: Name ....Signature:..... .....Date:.....

Attach extra sheets with detailed comments (if any) by RAC members.

The Change in the Thesis title is Approved/ Not Approved (circle one only).
If not approved write the reasons in detail and attach.

Signature of Chairperson of BPGS:..... Date:.....

Initials of dealing clerk .....

Signature of Chairperson of BFS..... Date:.....

Signature of Vice Chancellor: ..... Date:.....

Tripura University
Suryamaninagar 799022
Tripura, India

PhD Form VIII

To be filled by Student for Change of Status from Part-time to Full-time and vice versa

1. Name of Student: ..... 2. Enrollment No.....

3. Department/Centre: .....

4. Date of Completion of Approved Course Work: .....

5. Date of Registration ..... 6. Registration No.....

I want change my status from Part-time to Full-time/ Full-time to Part-time (circle one choice only).

Attach sheets explaining the need for the change. Attach NOC and leave documents from employer if becoming part-time. Attach scholarship documents or prayers for non-NET if becoming full-time.

Signature of Student:..... Date:.....

The proposed change is APPROVED/ Not Approved (circle one only).
If not approved write the reasons in detail and attach.

(i) Supervisor: Name ....Signature:..... .....Date:.....

(ii) Member/Co-Supervisor: Name .... .Signature:..... .....Date:.....

(iii) Member: Name ....Signature:..... .....Date:.....

(iv) Member: Name .... .Signature:..... .....Date:.....

(v) External Member: Name ....Signature:..... .....Date:.....

Attach extra sheets with detailed comments (if any) by RAC members.

The Change in the Status is Approved/ Not Approved (circle one only).
If not approved write the reasons in detail and attach.

Signature of Dean:..... Date:.....

Approved/ Not Approved (circle one only).

Signature of Vice Chancellor: ..... Date:.....

Tripura University
Suryamaninagar 799022
Tripura, India

PhD Form IX

To be filled by Student for Public Seminar

1. Name of Student: ..... 2. Enrollment No.....

3. Department/Centre: .....

4. Date of Completion of Approved Course Work: .....

5. Date of Registration ..... 6. Registration No.....

7. a. Date of Satisfactory Progress Report Exam 1.....

b. Date of Satisfactory Progress Report Exam 2.....

c. Date of Satisfactory Progress Report Exam 3.....

d. Date of Satisfactory Progress Report Exam 4.....

e. Date of Satisfactory Progress Report Exam 5.....

8. Publications Record (attach a sheet with details as mentioned below. Mention all publications/conference presentations):

a. Conference Publication/ Presentation 1 (Authors, title of paper, Name of Conference, venue, dates, oral/poster presentation. If published then write title of proceedings, publisher, page numbers from-to):.....

b. Conference Publication/ Presentation 2 (Authors, title of paper, Name of Conference, venue, dates, oral/poster presentation. If published then write title of proceedings, publisher, page numbers from-to):.....

c. Refereed Journal paper 1 (Authors, title of paper, Name of journal, volume no., page numbers from –to, month, ISSN no., publisher name, under review/ accepted):.....

9. *I want to deliver my Public Seminar. A 5000-word summary of my thesis and a report on lack of plagiarism are attached.*

Signature of Student:..... Date:.....

Public seminar is APPROVED/ Not Approved (circle one only). If not approved write the reasons in detail and attach.

The second external expert for checking the e-copy of the 5000-word summary:

Name:..... Affiliation: .....

Email ID:.....

(i) Supervisor: Name ....Signature:..... .....Date:.....

(ii) Co-Supervisor: Name .... .Signature:..... .....Date:.....

Signature of Dean:..... Date:.....

Tripura University
Suryamaninagar 799022
Tripura, India

PhD Form X

To be filled by RAC for Public Seminar and 5000-word Summary

1. Name of Student: ..... 2. Enrollment No.....

3. Department/Centre: .....

4. Date of Completion of Approved Course Work: .....

5. Date of Registration ..... 6. Registration No.....

7. Title of the Thesis .....

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8. Date of Submission of 5000-word Summary .....

9. Date and Time of Public Seminar.....

10. Venue of Public Seminar: .....

11. Public Seminar has been attended by approximately ..... persons.

The Public Seminar is SATISFACTORY/ Not Satisfactory (circle one only). If not satisfactory write the reasons in detail and attach.

The 5000-word summary is SATISFACTORY/ Not Satisfactory (circle one only). If not satisfactory write the reasons in detail and attach.

(i) Supervisor: Name ....Signature:..... .....Date:.....

(ii) Member/Co-Supervisor: Name .... Signature:..... .....Date:.....

(iii) Member: Name ....Signature:..... .....Date:.....

(iv) Member: Name .... .Signature:..... .....Date:.....

(v) External Member: Name ....Signature:..... .....Date:.....

(vi) Attach Email comments of the 2nd external expert on the 5000-word summary

Attach extra sheets with detailed comments (if any) by RAC members.

Noted

Signature of Chairperson of BPGS..... Date.....

Initials of dealing clerk .....

Signature of Dean:..... Date:.....

Tripura University
Suryamaninagar 799022
Tripura, India

PhD Form XI

To be filled by Student for Submitting PhD Thesis

1. Name of Student: ..... 2. Enrollment No.....

3. Department/Centre: .....

4. Date of Completion of Approved Course Work: .....

5. Date of Registration ..... 6. Registration No.....

7. a. Date of Satisfactory Progress Report Exam 1.....

b. Date of Satisfactory Progress Report Exam 2.....

c. Date of Satisfactory Progress Report Exam 3.....

d. Date of Satisfactory Progress Report Exam 4.....

e. Date of Satisfactory Progress Report Exam 5.....

8. Date of Successful Public Seminar and examination of 5000 word Summary.....

9. Publications Record (attach a sheet with details as mentioned below. Mention all publications/conference presentations):

a. Conference Publication/ Presentation 1 (Authors, title of paper, Name of Conference, venue, dates, oral/poster presentation. If published then write title of proceedings, publisher, page numbers from-to):.....

b. Conference Publication/ Presentation 2 (Authors, title of paper, Name of Conference, venue, dates, oral/poster presentation. If published then write title of proceedings, publisher, page numbers from-to):.....

c. Refereed Journal paper 1 (Authors, title of paper, Name of journal, volume no., page numbers from –to, month, ISSN no., publisher name, under review/ accepted):.....

10. *I want to submit an electronic (.pdf) and a printed version of my thesis for examination. A report on lack of plagiarism is attached. I understand that I may need to modify/correct the thesis according to comments of adjudicators/ viva-voce examiners before final submission.*

Signature of Student:..... Date:.....

Submission of thesis is APPROVED/ Not Approved (circle one only). If not approved write the reasons in detail and attach.

(i) Supervisor: Name ....Signature:..... .....Date:.....

(ii) Co-Supervisor: Name ....Signature:..... .....Date:.....

Signature of Dean:..... Date:.....

Tripura University
Suryamaninagar 799022
Tripura, India

PhD Form XII

To be filled by Supervisor/Co-Supervisors for submitting names of Thesis Adjudicators

1. Name of Student: ..... 2. Enrollment No.....

3. Department/Centre: .....

4. Date of Completion of Approved Course Work: .....

5. Date of Registration ..... 6. Registration No.....

7. Date of Successful Public Seminar and examination of 5000 word Summary.....

8. Title of Thesis:.....

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9. Names and Current Addresses of six possible Adjudicators:

(i) Name:.....

Affiliation:.....

Address:.....

Email ID: ..... Mobile Phone no.....

(ii) Name:.....

Affiliation:.....

Address:.....

Email ID: ..... Mobile Phone no.....

(iii) Name:.....

Affiliation:.....

Address:.....

Email ID: ..... Mobile Phone no.....

(iv) Name:.....

Affiliation:.....

Address:.....

Email ID: ..... Mobile Phone no.....

(v) Name:.....

Affiliation:.....

Address:.....

Email ID: ..... Mobile Phone no.....

(vi) Name:.....

Affiliation:.....

Address:.....

Email ID: ..... Mobile Phone no.....

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9. I/We certify that none of the suggested experts are/were members of BPGS/BUGH/BFS/ RAC external expert of the particular candidate. All the experts are PhD degree holders.

(i) Supervisor: Name ....Signature:..... .....Date:.....

(ii) Co-Supervisor: Name ....Signature:..... .....Date:.....

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10. In the BPGS meeting held on .....the names of six possible adjudicators given above are APPROVED/ not Approved (circle one only). If not approved write a detailed explanation on a sheet of paper and attach.

Signature of Chairperson of BPGS:..... Date:.....

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11. Let the list of names be kept in the file of the student and placed before the Vice Chancellor for final selection of two adjudicators out of the six given names.

Signature of Dean:..... Date:.....

Tripura University
Suryamaninagar 799022
Tripura, India

PhD Form XIV

To be filled by An Adjudicator of A PhD Thesis Summarizing His/Her Opinions

1. Name of Candidate: .....

2. Title of the Thesis:.....

Please note that this Form XIV should be accompanied by a report (preferably in English) commenting on the strengths and weaknesses as well as specific suggestions for the improvement of the thesis as per the guidelines in the covering letter. This recommendation form is to mainly facilitate the Authorities of Tripura University in deciding appropriate action for the thesis. Please staple the report to this form.

In the Table below please put a check mark (√) in the last box in one row only.

Category A	The thesis is worthy of a PhD degree. The suggestions made by me in the report are minor.	
Category B	The thesis becomes worthy of a PhD degree after the suggested modifications/corrections have been done and the modifications verified by the Supervisor(s).	
Category C	The thesis requires major modifications as suggested in the report, and the thesis must be sent to me/other examiners after the changes have been incorporated.	
Category F	The thesis is not worthy of a PhD degree.	

Signature of the Adjudicator:..... Date:.....

Adjudicator's Name:.....

Affiliation:.....

Address:.....

Email ID: ..... Mobile Phone no.....

The report is received on date ..... Signature of the Dealing Clerk .....

Tripura University
Suryamaninagar 799022
Tripura, India

PhD Form XV

To be filled by Student for Re-submitting PhD Thesis

1. Name of Student: ..... 2. Enrollment No.....

3. Department/Centre: .....

4. Date of Completion of Approved Course Work: .....

5. Date of Registration ..... 6. Registration No.....

7. a. Date of Satisfactory Progress Report Exam 1.....

   b. Date of Satisfactory Progress Report Exam 2.....

   c. Date of Satisfactory Progress Report Exam 3.....

   d. Date of Satisfactory Progress Report Exam 4.....

   e. Date of Satisfactory Progress Report Exam 5.....

8. Date of Successful Public Seminar and examination of 5000 word Summary.....

9. Publications Record (attach a sheet with details as mentioned below. Mention all publications/conference presentations):

a. Conference Publication/ Presentation 1 (Authors, title of paper, Name of Conference, venue, dates, oral/poster presentation. If published then write title of proceedings, publisher, page numbers from-to):.....

b. Conference Publication/ Presentation 2 (Authors, title of paper, Name of Conference, venue, dates, oral/poster presentation. If published then write title of proceedings, publisher, page numbers from-to):.....

c. Refereed Journal paper 1 (Authors, title of paper, Name of journal, volume no., page numbers from –to, month, ISSN no., publisher name, under review/ accepted):.....

10. *I want to submit again an electronic (.pdf) and a printed version of my thesis for examination. A report on lack of plagiarism is again attached. I made modifications/ corrections in the draft thesis according to the comments of adjudicators. I understand that I may need to modify/correct the thesis again according to comments of viva-voce examiners before final submission.*

Signature of Student:..... Date:.....

I/We certify that all modifications / corrections suggested by adjudicator(s) have been incorporated in the thesis being submitted.
Re-submission of thesis is APPROVED/ Not Approved (circle one only). If not approved write the reasons in detail and attach.

(i) Supervisor: Name ....Signature:..... .....Date:.....

(ii) Co-Supervisor: Name ....Signature:..... .....Date:.....

Signature of Dean:..... Date:.....

Tripura University
Suryamaninagar 799022
Tripura, India

PhD Form XVI

To be filled by Examiners of PhD Viva Voce

1. Name of Candidate: .....

2. Department/Centre: .....

3. Title of the Thesis:.....

4. Date of Viva:..... 5. Venue: .....

Please note that this Form XVI should be accompanied by a report (preferably in English) commenting on the strengths as well as specific suggestions (if any) for further improvement of the research work and the thesis. This recommendation form is to mainly facilitate the Authorities of Tripura University in deciding appropriate action. Please staple the report to this form.

In the Table below please put a check mark (√) in the last box in one row only.

Category A	The work is worthy of a PhD degree. The suggestions made by us in the report are minor.	
Category B	The work becomes worthy of a PhD degree after the suggested modifications/corrections have been done.	

Signature of the Supervisor:..... Date:.....

Signature of the Co-Supervisor: ..... Date:.....

Signature of the Examiner: .....Date:.....

Examiner's Name:.....

Affiliation:.....

Address:.....

Email ID: ..... Mobile Phone no.....

The report is received on date ..... Signature of the Dealing Clerk .....

Tripura University
Suryamaninagar 799022
Tripura, India

PhD Form XVII

To be filled by Student for Submitting Final Version of PhD Thesis

1. Name of Student: ..... 2. Enrollment No.....

3. Department/Centre: .....

4. Date of Completion of Approved Course Work: .....

5. Date of Registration ..... 6. Registration No.....

7. a. Date of Satisfactory Progress Report Exam 1.....

b. Date of Satisfactory Progress Report Exam 2.....

c. Date of Satisfactory Progress Report Exam 3.....

d. Date of Satisfactory Progress Report Exam 4.....

e. Date of Satisfactory Progress Report Exam 5.....

8. Date of Successful Public Seminar and examination of 5000 word Summary.....

9. Date of Submission of the First Draft of the Thesis.....

10. Date of Open Seminar and Viva Voce Examination.....

10. *Having completed all steps for a PhD degree from Tripura University and having incorporating all modifications suggested by the examiners of the final viva voce examination I want to submit an electronic (.pdf) and printed copies of my PhD thesis. I followed all instructions of INFLIBNET (e-Shodh Sindhu) for the electronic version and those of Tripura University for the Printed and Bound Version. I submit printed and bound copies of the thesis: (a) for the Supervisor, (b) for the Co-Supervisor (if any), (c) for the Department/ Centre and (d) for the Central Library.*

Signature of Student:..... Date:.....

I/We have checked the electronic and the printed and bound copies of the final version of the thesis. All instructions of the INFLIBNET and Tripura University are followed for the electronic and the printed versions, respectively.

Submission of the final thesis is APPROVED/ Not Approved (circle one only). If not approved write the reasons in detail and attach.

(i) Supervisor: Name ....Signature:..... .....Date:.....

(ii) Co-Supervisor: Name ....Signature:..... .....Date:.....

Signature of Dean:..... Date:.....

The electronic copy and a printed and bound copy is received.

Librarian: Name ....Signature:..... .....Date:.....

Tripura University
Suryamaninagar 799022
Tripura, India

A Printed and Bound copy of the thesis is received.

HOD/Coordinator of the Dept./Ctr.:

Name ....Signature:..... .....Date:.....

A Printed and Bound copy of the thesis is received.

Supervisor:

Name ....Signature:..... .....Date:.....

A Printed and Bound copy of the thesis is received.

Co-Supervisor (if any):

Name ....Signature:..... .....Date:.....

TRIPURA UNIVERSITY
(A Central University)

Syllabus

FOR

Pre-Ph.D. Course Work

of

Doctoral of Philosophy

In

Pharmacy

DEPARTMENT OF PHARMACY

SURYAMANINAGAR

2015

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

SYLLABUS FOR PRE-PH.D COURSE WORK OF DOCTORAL OF PHILOSOPHY IN PHARMACY

Course Code	Name of Subjects	Marks	Credit Distribution (Subject wise)	Total Marks	Total Credit
PA-Z01	Research Methodology Including Quantitative Method & Computer Applications	100	4	400	15
PA-Z02	Basics of Pharmaceutical Analysis And Other Techniques	100	4		
PA-Z03	Elective Paper	100	3		
PA-Z04	Seminar / Practical / Project and Assignment etc.	100	4		

Note:

The letter grades and their equivalent grade points are:

A (Outstanding) =	10	C (Average) =	06
A (-) (Excellent) =	09	C (-) (Below Average) =	05
B (Very Good) =	08	D (Marginal) =	04
B (-) (Good) =	07	E (Poor) =	02

RESEARCH METHODOLOGY INCLUDING QUANTITATIVE METHOD & COMPUTER APPLICATIONS

Paper-I
[Code: PA-Z01**]**

Total Marks: 100 **Total Credits: 4**

A. Research Methodology: **10hrs**

Scientific Research: Definition, Characteristics, types, need of research. Identification of the problem, assessing the status of the problem, formulating the objectives, preparing design (experimental or otherwise), actual investigation, Role of IPR in Research.

Literature survey: References, Abstraction of a research paper, possible ways of getting oneself abreast of current literature.

Documentation and scientific writing: Results and Conclusions, Preparation of manuscript for Publication of Research paper, Presenting a paper in scientific seminar, Thesis writing. Structure and Components of Research Report.

Types of Report: Research papers, Thesis, Research project reports, Pictures and Graphs, Citation styles, Writing a review of paper, Bibliography.

B. Biological Methods: **10hrs**

Light microscopy, phase Contrast Microscopy, Fluorescent Microscopy, Scanning Electron Microscopy (SEM), Transmission Electron Microscopy (TEM), Confocal Microscopy and Atomic force microscopy.

Electrophoresis (1D & 2D): Theory and application of Polyacrylamide and Agarose gel electrophoresis; Capillary electrophoresis; 2D Electrophoresis; Disc gel electrophoresis; Gradient electrophoresis; Pulsed field gel electrophoresis.

Blotting techniques: Southern, northern, western, south-western blotting techniques; choice of membranes and blotting conditions.

PCR, RT-PCR, in-situ hybridization (FISH & GISH).

C. Computer Applications: **10hrs**

Characteristics of computer, computer generations, functional units of computer, number system conversion, Operation on binary numbers, Memory hierarchy, Primary memory and secondary memory, Software and its types, Computer networks and its types. Use of word processing, spreadsheet and database software, plotting of graphs. Internet and its application: E-mail, World Wide Web (www), Web browsing, acquiring technical skills.

D. Bio-statistics: **20hrs**

Descriptive statistics, Probability Theory. Probability Distribution: Poisson, Binomial, Normal. Correlation and Regression Analysis. Test of Means and Proportions. Chi-Square Test, Association of Attributes, t-test, ANOVA. Sampling, Statistical analysis using software's.

Further Reading:

1. Thesis & Assignment Writing–J Anderson, B.H.Dursten & M.Poole, Wiley Eastern, 1977
2. A Hand Book of Methodology of Research – P. Rajammal and P. Devadoss, R. M. M. Vidya Press, 1976.
3. The Craft of Scientific Writing by Michael Alley, (Springer).

4. Research Methodology by R. Panneerselvam, PHI, New Delhi 2005
5. Research Methodology-A step by step Guide for Beginners, (2nd Ed.) Kumar Ranjit, 2005, Pearson Education.
6. How to write and Publish by Robert A. Day and Barbara Gastel, (Cambridge University Press).
7. Survival skills for Scientists by Federico Rosei and Tudor Johnson, (Imperial College Press).
8. How to Research by Loraine Blaxter, Christina Hughes and Malcum Tight, (Viva Books).
9. The Craft of Scientific Writing by Michael Alley, (Springer).
10. A Student vs. Guide to Methodology by Peter Clough and Cathy Nutbrown, (Sage Publications).
11. Research methodology techniques and methods by C L Kothari, New age International publishers.
12. Freifelder D., Physical Biochemistry, Application to Biochemistry and Molecular Biology, 2nd Edition, W.H. Freeman & Company, San Fransisco, 1982.
13. Keith Wilson and John Walker, Principles and Techniques of Practical Biochemistry, 5th Edition, Cambridge University Press, 2000.
14. Katoch, Rajan, Analytical Techniques in Biochemistry and Molecular Biology. XVIII, Springer, 2011.
15. Sambrook J, Russell DW, Molecular Cloning: A laboratory manual, 3rd ed, Cold Spring Harbor Laboratory Press, New York. 2001.

ANALYTICAL INSTRUMENTS AND OTHER TECHNIQUES

Paper-II

[*Course Code: PA-Z02*]

Total Marks: 100 Total Credit: 04

1. *Ultraviolet and visible spectroscopy:* Energy levels and selection rules, Woodward-Fieser and Fieser-Kuhn rules. Influence of substituent, ring size and strain on spectral characteristics; Solvent effect; Stereochemical effect; Non-conjugated interactions; Spectral correlation with structure.

2. *Infrared spectroscopy (IR):* Characteristic regions of the spectrum. Influence of substituent, ring size, hydrogen bonding, vibrational coupling and field effect on frequency. Determination of stereochemistry, Spectral interpretation with examples.

3. *Nuclear magnetic resonance spectrometry (NMR):* Magnetic nuclei, chemical shift and shielding, relaxation processes, chemical and magnetic non-equivalence, local diamagnetic shielding and magnetic anisotropy, spin-spin splitting, Pascal's triangle, coupling constant, mechanism of coupling, quadrupole broadening and decoupling, the effect of conformations and stereochemistry on the spectrum, diastereomeric protons, virtual coupling, long range coupling-epi, Peoria, bay effects. Shift reagents-mechanism of action, spin decoupling, and double resonance.

4. *Mass spectrometry (MS):* Molecular ion and metastable peak, fragmentation patterns, nitrogen and ring rules, McLafferty rearrangement, electron and chemical ionization modes, applications.

5. *Chromatography:* General principles, classification of chromatographic techniques, normal and reversed phase, bonded phase, separation mechanisms.

6. *Column chromatography:* Merits and demerits, short-column chromatography and flash chromatography, vacuum liquid chromatography (VLC), medium pressure liquid chromatography, high pressure liquid chromatography (HPLC) and HPTLC.

7. Gas chromatography, introduction to GC-MS and LC-MS techniques.

8. *Pharmacological Screening and Assays:* General principles of screening, correlations between various animal models and human situations, animal ethics. Special emphasis on cell based assay, biochemical assay, radioligand binding assay, high through put screening.

Suggested readings:

1. Brown, T.A. (2010). Gene cloning and DNA analysis: An Introduction, Wiley-Blackwell; New York.
2. Goldsby, R. A., Kindt, T. J. and Osborne, B. A. (2008). Kuby Immunology. W. H. Freeman & Company, San Francisco.
3. Gupta, P. K. (2005). Elements of biotechnology, Rastogi Publications, Meerut.
4. Gupta, S. (2005). Research methodology and statistical techniques, Deep & Deep Publications (p) Ltd. New Delhi.
5. Kothari, C. R. (2008.) Research methodology(s), New Age International (p) Limited.New Delhi
6. Lewin, B. (2010). Genes X, CBS Publishers & Distributors. New Delhi.

7. Mangal, S. K. (2007). DNA Markers In Plant Improvement, Daya Publishing House, New Delhi.
8. Nelson, D. and Cox, M. M. (2009). Lehninger Principles of Biochemistry, W.H. Freeman and Company, New York.
9. Beckett and Stenlake, Practical Pharmaceutical Chemistry, CBS.
10. Instrumental Method of Chemical Analysis, B. K. Sharma.
11. Organic Spectroscopy-William Kemp. 3rd edition.
12. S. Lindsay, High Performance Liquid Chromatography, Analytical Chemistry by Open Learning (ACOL), Wiley, 1987.
13. Sethi and Charcgankar, Identification of Drugs in Pharmaceutical Formulations by TLC.
14. Sethi P.D., HPLC, Quantitative Analysis of Pharmaceutical Formulations, CBSPublishers, Delhi.
15. Sethi P.D., HPTLC, Quantitative Analysis of Pharmaceutical Formulations, CBSPublishers, Delhi
16. Sethi P.D., Quantitative Analysis of Pharmaceutical formulations, CBS Publishers, New Delhi.
17. Silverstein, Spectrometric identification of Organic compounds, Willy.
18. Skoog D.A., Heller F.J., Nieman T.A., Principles of Instrumental Analysis, WB saunders.
19. Spectroscopy of organic compounds by P.S. Kalsi.

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[Option-I]

ADVANCED PHARMACEUTICAL CHEMISTRY

Paper-III

[*Course Code: PA-Z03*]

Total Marks: 100 Total Credit: 03

1. **Logics of Organic Synthesis:** Methods of determining reaction mechanisms (kinetic and non-kinetic methods); Energy profile diagrams, reaction intermediates, crossover experiments and isotopic labelling; Order of reactions, reversible, consecutive and parallel reactions, solvent, ionic strength and salt effects; Acid-base catalysis; Nucleophilic substitution reactions; Uni- and bimolecular reactions, attacking and leaving groups, steric and electronic effects; Neighbouring group participation; Formation and hydrolysis of esters, amides and acyl halides; Different mechanisms. Electrophilic substitution reactions; Aromatic electrophilic substitutions including Friedel-Crafts reactions; Addition and elimination reactions.

2. **Reaction of yields:** Phosphorus yields; Structure and reactivity, stabilized yields, effects of ligands on reactivity, Witting, Wittig-Horner and Wadsworth, Emmons reactions mechanistic realization; E/Z selectivity for olefin formation, Schlosser modification: Petersons olefin synthesis. Sulphur yields; Stabilized and non-stabilized yields: Thermodynamically and kinetically controlled reactions with carbonyl compounds, region and stereo-selective reactions.

3. **Principles of synthetic planning:** Logic-centered molecular synthesis; Dislocation, synthetic tree, synthons, logical imposition of boundary conditions, direct associated approach; Structure functionality relationships, functionality and unsaturation levels; Polar reactivity analysis; Control elements, consonant and dissonant circuits; Protocol for synthetic design.

4. **Alkylation:** Enolates; Regio- and stereo-selective enolate generation, "O" versus "C"- alkylation, effects of solvent, counter cation and electrophiles; Symbiotic effect; Thermodynamically and kinetically controlled enolate formations; Various transition-state models to explain stereoselective enolate formation; Enamines and metallo-enamines; Regioselectivity in generation, applications in controlling the selectivity of alkylation.

5. **Structure Activity Relationships in drug design:** Qualitative versus quantitative approaches, advantages and disadvantages; Random screening, nonrandom screening, drug metabolism studies, clinical observations, rational approaches to lead discovery; Homologation, chain branching, ringchain transformations, bioisosterism; Insights into molecular recognition phenomenon; Structure based drug design, ligand based drug design.

6. **Molecular Modeling:** Energy minimization, geometry optimization, conformational analysis, global conformational minima determination; Approaches and problems; Bioactive vs. global minimum conformations; Automated methods of conformational search; Advantages and limitations of available software; Molecular graphics; Computer methodologies behind molecular modeling including artificial intelligence methods.

7. **QSAR:** Electronic effects; Hammett equation, Lipophilicity effects; Hansch equation, Steric Effects; Taft Equation; Experimental and theoretical approaches for the determination of physico-chemical parameters, parameter inter-dependence; Case studies; Regression analysis, extrapolation versus interpolation, linearity versus non-linearity; The importance of biological data in the correct form; 2D QSAR; 3D-QSAR-examples CoMFA and CoMSIA.

8. **Molecular docking and dynamics:** Rigid docking, flexible docking, manual docking; Advantages and disadvantages of flex-X, flex-S, autodock and dock software's with successful examples; Monte Carlo simulations and molecular dynamics in performing conformational search, docking etc.

9. **Pharmacophore:** Concept, pharmacophore mapping, methods of conformational search used in pharmacophore mapping; Comparison between the popular pharmacophore methods like catalyst/HipHop, DiscoTech, GASP, etc. with practical examples.

Suggested readings:

1. Alfred Berger Biochemical Basis of Drug Design
2. Ariens. Drug design medicinal chemistry a series of monograph-volume 11- III, academic press, an imprint of Elsevier pub.
3. Berger's Medicinal Chemistry and Drug Design. 8th Edition.
4. Corwin , Hansen Comprehensive Medicinal Chemistry
5. Finar, I.L., (2012). Organic Chemistry Vol. 1& II, Pearson Education, 6th edition, UK.
6. Fleming (1999). Pericyclic Reactions, Oxford University Press, Oxford.
7. Fleming (2010). Molecular Orbitals and Organic Chemical Reactions, John Wiley & Sons.
8. Gyorgy Keri & Istdan Toth Molecular Pathomechanism and New Trends in Drug Research, Taylor & Francis Pub.
9. Jie Jack Li, (2009). Name Reactions: A collection of Detailed Reaction Mechanism, Publisher: Springer-verlag
10. Kalsi, P.S., (2010). Organic Reactions and Their Mechanisms, New Age International Pub., 3rd edition, New Delhi.
11. Kalsi, P.S., (2010). Stereochemistry: Conformation and Mechanism, New Age International (p) Ltd., New Delhi.
12. Lowry, T.H., Richardson K.S., (1998). Mechanism and Theory in Organic Chemistry, Addison-Wesley Longman Inc.
13. Mc Murry, J., Organic Chemistry, Asian Book Pvt Ltd, New Delhi
14. Reinhard Bruckner, (2001). Advanced organic chemistry: Reaction Mechanism, Academic Press.
15. Richard B. Silvermann, Org. Chemistry of Drug Design and drug Action.
16. Smith, M.B., March J., (2001). March's Advanced Organic Chemistry, John Wiley & Sons, New York.
17. Structure based Drug Design by Pandi Veerapandion
18. Testa B and Jenner P. Drug Metabolism Chemical & Biochemical Aspects, Marcel Dekker.

[Option-II]

ADVANCED PHARMACEUTICS

Paper-III

[*Course Code: PA-Z03*]

Total Marks: 100 Total Credit: 03

1. **Kinetics and drug stability:** Stability calculations, rate equation, complex order kinetics, kinetics of some decompositions, strategy of stability testing, method of stabilization, method of accelerated stability testing in dosage forms, Freeze Thaw methods, centrifugal methods, temperature and humidity control, physical stability testing of pharmaceutical products.

2. **Bioavailability and bioequivalence studies**: Designing of bioavailability and bioequivalence studies and interpretation of results. Physicochemical properties affecting bioavailability, pH-partition theory, dissolution, surface area adsorption, complexation, polymorphism and techniques of enhancing dissolution rate.

3. Formulation factors affecting bioavailability of drugs in dosage forms of tablets, capsules, parental, liquid orals and topical dosage forms.

4. **Basic concepts of pharmacokinetics:** compartment models: One, two and non-compartmental approaches to pharmacokinetics. Recent trends, merits and limitations of these approaches. Application of these models to determine the various pharmacokinetic parameters pertaining to
   a. Absorption: (wherever applicable) absorption rate constant, absorption half-life, lag time and extent of absorption, AUC.
   b. Distribution: Apparent volume of distribution and its determination.
   c. Metabolism: Metabolic rate constant
   d. Elimination: Over all apparent elimination rate constant, and half life.
   All the above under the following conditions:
      1. Intravenous bolus injection
      2. Intravenous infusion
      3. Single dose oral administration
      4. Multiple dose injections
      5. Multiple dosage oral administration

5. Concept of clearance: organ, total clearance, hepatic clearance, lung clearance and renal clearance. Fundamentals of controlled drug delivery systems, use of polymers in controlled drug delivery, pharmacokinetic and pharmacodynamic basis of controlled drug delivery. Pharmacodynamix study. Design, fabrication, evaluation and applications of the following controlled releasing systems

   (a) Controlled release oral drug delivery systems
   (b) Parental controlled release drug delivery systems
   (c) Implantable therapeutic systems
   (d) Transdermal delivery systems including iontophoresis
   (e) Ocular and intrauterine delivery systems

(f) Bioadhesive drug delivery systems
(g) Proteins and peptide drug delivery

6. Biochemical and molecular biology approaches to Novel Drug Delivery Systems (NDDS) likes: Liposomes, Niosomes, Microspheres, Nanoparticle and Resealed erythrocytes.
    1. Monoclonal antibodies
    2. Drug targeting to particular organs:
    (a) Problems of drug delivery to the brain and targeting to brain
    (b) Drug targeting in neoplastic diseases

Suggested readings:

1. Biopharmaceutics and Clinical Pharmacokinetics - An Introduction by Robert E. Notari.
2. Biopharmaceutics and Clinical Pharmacokinetics by Milo Gibaldi.
3. Biopharmaceutics and Clinical pharmacy by Robert E. Notari.
4. Bio-Pharmaceutics and Pharmacokinetics by D.M. Brah.
5. Controlled and Novel drug delivery systems by N. K. Jain.
6. Controlled Drug Deliver by Joseph R. Robinson and Vincent H. L. Lee.
7. Controlled Drug Deliver by N.K Jain.
8. Cooper and Gunn`s Dispensing for Pharmaceutical Students by S.J. Carter.
9. Cooper and Gunn`s Tutorial Pharmacy by S.J Carter.
10. Modern Pharmaceutics by Gilbert S. Banker and Christopher T. Rhodes.
11. Novel Drug Delivery System by Yie W. Chien.
12. Pharmaceutical Dosage forms by Howard. C. Ansel.
13. Physical Pharmacy by Alfred Martin.
14. Practical Physical Pharmacy (Vol-I and Vol-II) by Gaud and Gupta.
15. Targeted and Controlled Drug Delivery (Novel carrier systems) by S. P. Vyas and Khar.

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[Option-III]

ADVANCED PHARMACOLOGY

Paper-III

[*Course Code: PA-Z03*]

Total Marks: 100 Total Credit: 03

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1. Receptor Mechanisms: i) Molecular and chemical characterization of membrane receptors; Use of monoclonal antibodies in receptor characterization and purification; Immunopreciptation and eletrophoretic analysis of membrane proteins; Peptide mapping; Molecular weight determination by radiation inactivation; Solubilization of the receptors; Reconstitution of membrane receptors.

ii) Biochemical mechanisms of cell signaling; Plasma membrane and cytosolic receptor structure; Plasma membrane as a signal transduction element; Mechanisms of receptor mediated signaling; Ion gated channels; Ligand activated receptors with intrinsic enzyme activity; Amplification of transmembrane signals.

iii) Structure of G proteins, sub-classification of G proteins; Role of heterotrimeric G proteins in signaling; Generation of intracellular second messengers; Modulation of G protein activity.

iv) Calcium as second messenger, PIP2, IP3 receptors, calcium influx and efflux, intracellular sources of calcium and release, calcium oscillations; Intracellular calcium determinations in cell suspensions; Development of fluorescent indicators, fura-2, fluo-3, BAPTA; Digital ratio imaging in single cells.

v) Receptor dynamics and signaling; the mobile receptor paradigm; Receptor microclustering, patching, internalization, receptor mobility and cell activation; Homologous and heterologous regulation of receptors, sequestration, receptor turnover.

vi) Signal transduction of neurotransmitters and neuromodulators viz., norepinephrine

vii) HT, pathophysiological implications of neurotransmitter receptors.

viii) Introduction to mechanistic approach of drug design, receptor mapping, and computer aided drug design.

2. Stages of drug development: Drug laws, FDA, OECD, ICH, schedule Y; Design of preclinical toxicity studies and clinical development, clinical risk/ benefit analysis. Safety evaluation of medical devices and bio materials. Good Laboratory Practices (GLP), issues and implementation. Different methods in toxicity testing: Dose determination, response characterization, NOAEL, MTD and threshold limitations; Hormesis, lower dose extrapolation, in vitro and in vivo correlation, animal to human extrapolation; Flow chart.

3. Mechanism of toxicity: Evaluation across different models; Target organs, cell death, necrosis, apoptosis, oxidative stress, chromosome and DNA damage. Acute and chronic toxicity, genetic toxicity: Types of genetic toxicity testing; Principles of detection; Genotoxicity of marketed drugs, test batteries, Salmonella test, micronucleus test, chromosome aberration test, comet assay, new-bio assays.

4. Carcinogenicity, carcinogen identification: Carcinogenesis process, drug induced carcinogenicity, lifetime carcinogenicity bio assays, neonatal mouse models; Short and medium term bio assays, limitations and impacts.

5. Pharmacological Screening: Pharmacological screening models for therapeutic areas such as hypertension, cerebral ischaemia, pain, epilepsy, depression, Parkinson's disease, Alzheimer's disease, diabetis, leishmaniasis etc. Correlation between *in-vitro* and *in-vivo* screens; Special emphasis on cell based assay and specific use of reference drugs and interpretation of results.

Suggested readings:

1. Drug discovery and evaluation by H.G.Vogel and W.H.Vogel, Springerverlag, Berlin Heideleberg.
2. Essentials of Medical Pharmacology by K.D.Tripathi
3. Handbook of experimental pharmacology by S.K. Kulkarni, Vallabh Prakashan, Delhi.
4. Pharmacology and Pharmacotherapeutics by R.S Satoskar, S.D Bhandarkar and S.S Ainapure.
5. Pharmacology by H.P Rang M.M, Dale, J.M.Ritter & P.K.Moore
6. Principles of clinical research edited by Giovanna di ignazio, Di Giovanna and Haynes
7. Screening methods in Pharmacology, Vol.-1&2 by Robert .A. Turner and Peter Hebborn.
8. Textbook of clinical trials edited by David Machin, Simon Day and Sylvan green.
9. The Pharmacological basis of therapeutics by Joel G.Hardman. Lee E Limbird and Alfred Goodman Gilman.

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[Option-IV]

PHYTOCHEMISTRY AND ETHINOPHARMACOLOGY

Paper-III

[*Course Code: PA-Z03*]

Total Marks: 100 Total Credit: 03

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1. **Medicinal plants cultivation:** General aspects involved in the cultivation of medicinal plants: Conservation of medicinal plants, biodiversity law, WTO & TRIPS agreement. Factor involved in production of crude drug.

2. Approaches available for drug development, role of natural products in new drug development, plant derived drugs, bioactive compounds from natural sources. Bio-assay

3.Detailed phytochemical study of following class of phytoconstituents, including important drugs.

a) Phospholipids b) Terpenes and terpenoids c) Resins and related compounds d) Plant phenols
e) Alkaloids f) Glycosides g) Steroids

4. Study of information retrieval methods of natural plants and herbal databases. Screening and review of literature for the following:

a) Anti-hepatotoxics b) Anti-fertility agents c) Anti-microbials & Anti-Virals
d) Anti-cancer agents e) Hypolipidaemics f) Anti-obesity agents
g) Anti-diabetics h) Antiallergics h) Adaptogenics
i) Immunomodulators j) Cardio-vascular agents.

5. *Nutraceuticals:* Historical perspective, classification, scope & future prospects. Applied aspects of the Nutraceutical Science. Sources of Nutraceuticals. Glucosamine, Octacosanol, Lycopene, Carnitine, Melatonin and Ornithine alpha ketoglutarate. Use of proanthocyanidins. Nutraceutical remedies for common disorders like Arthritis, Bronchitis, circulatory problems, hypoglycemia, Nephrological disorders, Liver disorders, Osteoporosis, Psoriasis and Ulcers etc. Brief idea about some Nutraceutical rich supplements e.g. Bee pollen, Caffeine, Green tea, Lecithin, Mushroom extract, Chlorophyll, etc.

6. Biosynthetic studies on the following:
   a) Shikimic acid patway – Atropine and Morphine and Anthraquinone glycosides b) Acetate pathway – Cardiac glycosides

7. Structural elucidation of important phytoconstituents belonging to deffernt groups.
   a) Alkaloids – Nicotine, Atropine, Morphine, Caffeine. b) Glycosides–Amygdalin, strophanthidin.
   c) Steroids – Cholesterol d) Terpenes - Citral

8. *Marine Pharmacognosy:* Definition, present status, classification of important bioactive agents. General methods of isolation and purification. Study of important bioactive agents including chemistry& uses.

9. Complementary Alternative medicines including ethnomedicine Definition, principles and applications. Recent advances in phytochemical research.

Suggested readings:

1. An Introduction to Pharmacognosy by Smith Ely Jelliffe
2. Drugs of Natural Origin: A Treatise of Pharmacognosy by Gunnar Samuelsson, Lars Bohlin
3. Experimental pharmacognosy by Varro E. Tyler, Arthur Ernest Schwarting
4. Fundamentals of Pharmacognosy and Phytotherapy by Michael Heinrich, Joanne Barnes, Simon Gibbons
5. Marine Pharmacognosy: Trends and Applications by Se-Kwon Kim
6. Microscopic Pharmacognosy by William Mansfield
7. Molecular Pharmacognosy by Luqi Huang
8. Pharmacognosy and pharmacobiotechnology by James E. Robbers, Marilyn K. Speedie, Varro E. Tyler
9. Pytochemical methods by J.B.Haroborne
10. Text Book of Pharmacognosy by Titler, Brady & Robber
11. Text Book of Pharmacognosy by Trease & Evans
12. Textbook of Pharmacognosy and Phytochemistry by Biren Shah, Avinash Seth

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