

FACULTY OF LIFE SCIENCES

SYLLABUS

FOR

Pre-Ph.D Course in Pharmaceutical Sciences (Credit Based Evaluation & Grading System)

Examinations: 2019-20



GURU NANAK DEV UNIVERSITY AMRITSAR

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PRE PH.D COURSE IN PHARMACEUTICAL SCIENCES
(Credit Based Evaluation & Grading System)

Course Scheme

Course No.	C/E/I	Course Title	Lecture (L)	Tutorial (T)	Practical (P)	Credits
PHL901	C	Research Methodology	3	0	0	3

Elective (Choose any three courses)

Course No:	C/E/I	Course Title	Lecture (L)	Tutorial (T)	Practical (P)	Credits
PHL 902	E	Pharmaceutical Techniques	3	0	0	3
PHL903	E	Advanced Medicinal Chemistry	3	0	0	3
PHL905	E	Advanced Drug Delivery Systems	3	0	0	3
PHL906	E	Advances in Phytomedicine	3	0	0	3

***Interdisciplinary/Optional Course**

	I					04
Total Credits						16

PRE PH.D COURSE IN PHARMACEUTICAL SCIENCES
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PHL-901 - Research Methodology

Time: 3 Hrs.

Credits 3-0-0

Max. Marks : 100

Mid Semester Marks : 20

End Semester Marks : 80

Mid Semester Examination: 20% weightage

End Semester Examination: 80% weightage

Instructions for the Paper Setters:

Eight questions of equal marks (Specified in the syllabus) are to be set, two in each of the four Sections (A-D). Questions may be subdivided into parts (not exceeding four). Candidates are required to attempt five questions, selecting at least one question from each Section. The fifth question may be attempted from any Section.

Note: The course will be numerical oriented to train the students for the analysis of research data. Use of calculators will be allowed in the examination.

SECTION-A

1. **Descriptive statistics:** Statistical expressions, central tendency, dispersion of data (arithmetic and geometric), moments, skewness, kurtosis, sample size estimation.
2. **Probability:** Concept of probability, conditional probability, distributions: Normal, Poisson, binomial, 't', χ^2 , F-distributions.

SECTION-B

3. **Testing of hypothesis:** Central limit theorem, null hypothesis and alternative hypotheses, Z-test, Student's t-test, χ^2 -square, F-test, sample size, confidence intervals, odds ratio, index numbers, Probit analysis.
4. **Correlation and regression analysis:** Linear correlation and regression, exponential regression, logarithmic regression, reciprocal regression, Michael-Menten's regression, logistic regression, Gompertz regression, monomolecular regression.

SECTION-C

5. **Multiple correlation and regression:** MLR with 2 and 3 independent variables, quadratic and cubic polynomial regressions, Beta regression, sine curve, multiple correlation, partial correlation, path analysis, time series analysis.
6. **Experimental designs:** Experimental designs, central composite designs with 2 and 3 factors.

SECTION-D

7. **Analysis of Variance:** Assessing normality, one way and 2-way ANOVA, Tukey's multiple comparison test, HSD.
8. **Multivariate analysis:** Cluster analysis and dendrogram, principal component analysis, factor analysis, artificial neural networks.
9. **Non-parametric tests:** Wilcoxon's, Mann-Whitney's tests, Spearman's rank correlation, Kendall's Tau.
10. **Basic Greek and Latin words:** The students will learn Greek alphabet and more than 100 basic roots and words used in science.

Note: The students will be asked to submit an assignment of computer softwares designed by them on the basis of the Research methodology syllabus.

PRE PH.D COURSE IN PHARMACEUTICAL SCIENCES
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References:

1. Bailey, N.T.J. (1995). Statistical Methods in Biology. Cambridge University Press, Cambridge.
2. Kothari, C.R. (2004). Research Methodology: Methods and Techniques, New Age International Publishers, New Delhi.

PRE PH.D COURSE IN PHARMACEUTICAL SCIENCES
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PHL902: Pharmaceutical Techniques (Elective)

Time: 3 Hrs.

3 Credits (3-0-0)

Max. Marks : 100

Mid Semester Marks : 20

End Semester Marks : 80

Mid Semester Examination: 20% weightage

End Semester Examination: 80% weightage

Instructions for the Paper Setters:

Eight questions of equal marks (Specified in the syllabus) are to be set, two in each of the four Sections (A-D). Questions may be subdivided into parts (not exceeding four). Candidates are required to attempt five questions, selecting at least one question from each Section. The fifth question may be attempted from any Section.

Section-A

1. **UV-Visible Spectroscopy:** Electromagnetic spectrum: UV-visible range. Energy wavelength and color relationship. Chromophores and their interaction with UV-visible radiation. Shifts in spectra including solvent induced shifts and their interpretation. Steps in a spectrophotometric measurement, instrumentation, sample handling, qualitative, and quantitative analysis of drug molecules.
2. **Infrared Spectroscopy:** Nature of infrared radiation and its interaction with organic molecules. Theory of characteristics absorbance bands of organic functional groups, sample handling, infrared instrumentation (light sources, monochromators, and detectors) Qualitative interpretation of I.R. spectroscopy.

Section-B

3. **Nuclear Magnetic Resonance Spectroscopy:** An Introduction to the theory of NMR, magnetic properties of the hydrogen nucleus, relaxation time, chemical shift, spin-spin coupling, instrumentation, quantitative analysis of drugs, analytical limitations of NMR in Pharmaceutical analysis. Introduction to 2-D NMR techniques: COSY, HETCORE, NOESY with applications.
4. **Mass Spectroscopy:** Basic principles and brief outline of instrumentation. Ion formation and types: molecular ion, meta-stable ions. Fragmentation processes. Fragmentation pattern and fragmentation characteristics in relation to molecular structure and functional groups. Application of mass spectroscopy in pharmaceutical analysis.

Section-C

5. **X-ray Diffraction Methods:** Introduction, Generation of X-rays. Miller indices, X-ray diffraction - Bragg's law, X-ray powder diffraction, obtaining and interpretation of X-ray powder diffraction data.
6. **Chromatographic Techniques:** Introduction, types of chromatography methods based on mechanisms of separation. Paper chromatographic technique, Thin Layer chromatography, HPLC, HPTLC. Preparative techniques, mobile phase selection, Stationary Phase, Applications of chromatography in Pharmaceutical industry.

PRE PH.D COURSE IN PHARMACEUTICAL SCIENCES
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Section-D

7. **Bioassays:** in-vitro and in-vivo techniques Bioavailability and bioequivalence testing: Definitions, in-vitro and in-vivo bioavailability testing.
8. **Immunochemical Techniques:** Immunolectrophores, Immunoprecipitation ELISA, Radio-immuno assays. Southern blot and northern blot assays.
9. **Lyophilization:** Principles and Practice of freeze-drying. Freeze drying equipment

Recommended Books:

1. Skoog: Principles of Instrumental Analysis (Saunders College Publishing Philadelphia).
2. M. Orchin and H.H. Jaffe – Theory and Applications of Ultra Violet Spectroscopy (John Wiley and Sons, N.Y).
3. Silverstein. Basseler, Moiril-Spectrometric Identification of Organic Compounds (John Wiley and Sons, N.Y).
4. Willard, Merritt, Dean-Instrumental Methods of Analysis (CBS Publishers and Distributors, Delhi).
5. Pharmaceutical Dosage forms Series by Herbert Lieberman
6. Bernard R. Glick Molecular Biotechnology: Principles and Applications of Recombinant DNA.
7. Remington: The Science and Practice of Pharmacy (Remington the Science and Practice of Pharmacy) Lippincott Williams & Wilkins.

PRE PH.D COURSE IN PHARMACEUTICAL SCIENCES
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PHL903: Advanced Medicinal Chemistry (Elective)

3 Credits (3-0-0)

Time: 3 Hrs.

Max. Marks : 100

Mid Semester Marks : 20

End Semester Marks : 80

Mid Semester Examination: 20% weightage

End Semester Examination: 80% weightage

Instructions for the Paper Setters:

Eight questions of equal marks (Specified in the syllabus) are to be set, two in each of the four Sections (A-D). Questions may be subdivided into parts (not exceeding four). Candidates are required to attempt five questions, selecting at least one question from each Section. The fifth question may be attempted from any Section.

Pharmaceutical Chemistry (Source/ synthesis, Structure, stereochemistry, physico-chemical properties, Structure activity relationships. Mode of action and Applications) of the following classes of drugs:

Section-A

1. Sulfonamides Sulfones and folate reductase inhibitors with antibacterial action: Sulfonamides and folate reductase inhibitors, well absorbed, short and intermediate acting sulfonamides. Well-absorbed and long acting sulfonamides. Sulfonamides for ophthalmic infections. Sulfonamides for burn therapy sulfonamides for intestinal infections. Therapy ulcerative colitis and of reduction of bowel flora. Folate reductase inhibitors.
2. Diuretics: Water and osmotic agents. Acidifying salts. Mercurials phenoxyacetic acids. Purines and related heterocycles. Sulfonamides, Sulfamyl benzoic acid derivatives. Endocrine antagonists. Miscellaneous compounds.

Section-B

3. Antibacterials: Introduction, Development of resistance to known antibacterials and search for new drugs. Bacterial DNA-gyrase inhibitors - Mode of action of fluoroquinolones and development of newer analogues: Trovafloxacin, Levofloxacin, Gratifloxacin, Moxifloxacin. Anguacyclines: Urdamycinone, Aquayamycin. Redesigned Vancomycins. Carbapenams, Carbacephams. Oxazolidinones: Linezolid, eperzolid. Inhibitors of DNA Synthesis: Quinupristin, Rifampicin, Dalforpistin. Glycopeptides. Macrolides.

Section-C

4. Antineoplastic Agents: Alkylating agents (Nitrogen mustards , Aziridines, Sulfonic acid esters, Nitrosoureas Expoxides. Trizines, phosphemides, Mitomycin).Antimetabolites (Methotroxate). Antimetabolites involved in the synthesis of nucleic acids (Mercaptopurine, Thioguanine, Fluorouracil, Floxuridine, Cytarabine, Azathioprine). Antitumor antibiotics Dactinomycin Daunorubicin, Aalarinomycin, Mithramycin, Bleomycin). Antitumer alkaloids (vincristine vinblastine). Hormones(Steroids, Tamoxifan, mitotane, Dormantanolone propinate Testalactone Magestrol acetate Miscellaneous compounds (Hydroxy urea, cisplatin, Pipobroman.

PRE PH.D COURSE IN PHARMACEUTICAL SCIENCES
(Credit Based Evaluation & Grading System)

Section-D

5. Cardiovascular Drugs: Antianginal drugs and vasodilators. Antiarrhythmic agents. Antihypertensive drugs. Antihyperlipidemic agents . Coagulants and anticoagulants. Sclerosing agents, Synthetic hypoglycemic drugs. Thyroid hormones and antithyroid drugs. Cardiotonic agents.

Books Recommended:

1. Wilson & Gisvold's Text Book of Organic Medicinal and Pharmaceutical Chemistry, 10th Edition, J. B. Lippincott Co, Philadelphia, USA.
2. W.C. Foye, Principle of Medicinal Chemistry, Lea & Febiger, Philadelphia, USA
3. M.E. Wolff, Ed. Burger's Medicinal Chemistry and Drug Discovery, John Wiley and Sons, New York (Latest Edition).
4. J.E.F. Reynolds, Martindale, The Extra Pharmacopoeia. The Pharmaceutical Press, London, U.K.
5. B.G. Raben and H.A. Wittcoff, Pharmaceutical Chemicals in Perspective, John Wiley & Sons, New York, 1989.

PRE PH.D COURSE IN PHARMACEUTICAL SCIENCES
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PHL905: Advanced Drug Delivery Systems (Elective)

Time: 3 Hrs.

3 Credits (3-0-0)

Max. Marks : 100

Mid Semester Marks : 20

End Semester Marks : 80

Mid Semester Examination: 20% weightage

End Semester Examination: 80% weightage

Instructions for the Paper Setters:

Eight questions of equal marks (Specified in the syllabus) are to be set, two in each of the four Sections (A-D). Questions may be subdivided into parts (not exceeding four). Candidates are required to attempt five questions, selecting at least one question from each Section. The fifth question may be attempted from any Section.

Section-A

- 1. Pharmaceutical Product Development and Its Associated Quality System**
- 2. Procurement, Qualification, and Calibration of Laboratory Instruments**

Section-B

- 3. Application of Pharmacokinetics and Pharmacodynamics in the Design of Controlled Delivery Systems**
- 4. Physiological and Biochemical Barriers to Drug Delivery**

Section-C

- 5. Diffusion-Controlled Drug Delivery Systems**
- 6. Dissolution Controlled Drug Delivery Systems**

Section-D

- 7. Biodegradable Polymeric Delivery Systems.**
- 8. Prodrugs as Drug Delivery Systems**

PRE PH.D COURSE IN PHARMACEUTICAL SCIENCES
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Books Recommended:

1. Encyclopedia of Controlled Drug Delivery, Vol. 1 to 3, Edith, Mathiowitz Brown University Providence, Rhode Island, A Wiley–Interscience Publication John Wiley & Sons, Inc. New York.
2. Encyclopedia of Pharmaceutical Technology Series Executive Editor: James Swarbrick edited by James Swarbrick PharmaceuTech, Inc. Pinehurst, North Carolina, USA Informa, Healthcare USA, 270 Madison Avenue, New York, NY, 10016.
3. Modern Pharmaceutics edited by Gilbert S. Banker University of Iowa, Iowa City, Iowa and Christopher T. Rhodes University of Rhode Island Kingston, Rhode Island Edition, Revised and Expanded Marcel Dekker, Inc. New York.
4. Polymeric Drug Delivery Systems Edited by Glen S. Kwon Drugs and The Pharmaceutical Sciences, Executive Editor James Swarbrick, PharmaceuTech, Inc. Pinehurst, North Carolina.

PRE PH.D COURSE IN PHARMACEUTICAL SCIENCES
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PHL906: ADVANCES IN PHYTOMEDICINE (Elective)

Time: 3 Hrs.

3 Credits (3-0-0)

Max. Marks : 100

Mid Semester Marks : 20

End Semester Marks : 80

Mid Semester Examination: 20% weightage

End Semester Examination: 80% weightage

Instructions for the Paper Setters:

Eight questions of equal marks (Specified in the syllabus) are to be set, two in each of the four Sections (A-D). Questions may be subdivided into parts (not exceeding four). Candidates are required to attempt five questions, selecting at least one question from each Section. The fifth question may be attempted from any Section.

Section-A

1. Natural sources of drugs and their contribution to modern therapeutics

1.1 Plants

1.2 Animals

1.3 Minerals

1.4 Marine

1.5 Plant Tissue culture as a source of biomedicinals

1.6 Natural Products as leads for new pharmaceuticals

Section-B

2. General methods of extraction and separation techniques.

3. An introduction to active constituents of drugs: Their extraction, classification and identification tests.

Section-C

4. Selection of natural sources for drug development: Based on random approach, phytoconstituents and ethnopharmacological records. Synergy principle in herbal drugs. Bioactivity directed fractionation. Preparation of plant material for biological evaluation (preliminary treatment of material, preparation of extracts and enrichment of constituents, dose and mode of administration for pharmacological screening). Recent developments in natural products.

Section-D

5. Quality control of crude drugs: Adulteration of crude drugs and their detection by organoleptic, microscopic, physical, chemical and biological methods of evaluation.

6. Ensuring identity, quality, purity and uniformity in therapeutic efficacy of crude drugs, extracts, fractions, pure isolates and formulations.

PRE PH.D COURSE IN PHARMACEUTICAL SCIENCES
(Credit Based Evaluation & Grading System)

Reading Material Recommended: (Latest editions unless specified):

1. Harvey AL. Ed. *Advances in Drug Discovery Techniques*. John Wiley and Sons, New York. Latest Edition.
2. *Journal of Ethnopharmacology* (1996). Vol. 51 (1-3 special issue).
3. Grabley S. and Thiericke R. Eds. *Drug Discovery from Nature*. Springer-Verlag, Berlin Heidelberg. Latest Edition.
4. Vogel HG and Vogel WH. *Drug Discovery and Evaluation*. Springer-Verlag, Berlin. Latest Edition.
5. Kaufman PB, Warber CS, Duke JA and Brielmann HL. Eds. *Natural Products from Plants*. CRC Press, Florida. Latest Edition.
6. Williamson EM, Okpako DT and Evans FJ. Eds. *Selection, Preparation and Pharmacological Evaluation of Plant Material*. John Wiley and Sons, New York. Latest Edition.
7. WHO guidelines on relevant topics.
8. *Plant Drug Analysis*, H. Wagner, S. Bladt and E.M. Zgainski, Springer Verlag New York.
9. *Pharmacopoeia of India*, Govt. of India, Ministry of health and family welfare, Delhi