SYLLABI OF M. PHIL PHARMACY (PHARMACOGNOSY)

DEPARTMENT OF PHARMACOGNOSY, FACULTY OF PHARMACY, BAHAUDDIN ZAKARIYA UNIVERSITY MULTAN

M.Phil. Pharmacy (Pharmacognosy) comprises of four semesters (30 Credit hours) i.e. two years programme. The First two semesters (24 credit hours) i.e. one year consist of a course work whereas the 3rd and 4th semesters (06 credit hours) i.e. one year is devoted for research work. The syllabi
courses of reading during the first two semesters are outlined below:

1st SEMESTER (12 Credit Hours)

Course No	Title of Course	Credit Hours
PHG-701	Analytical Pharmacognosy	3
PHG-702	Biosynthesis of Natural Products	3
PHG-703	Nutraceuticals & Cosmeceuticals	3
PHG-704	Industrial and marine Pharmacognosy	3

2nd SEMESTER (12 Credit Hours)

Course No	Title of Course	Credit Hours
PHG-751	Spectral analysis of natural origin compounds	3
PHG-752	Pharmacobiotechnology and Toxicology	3
PHG-753	Research Methodology	3
PHG-754	Biostatistics	3

3nd and 4th SEMESTER (06 Credit Hours)

Course No	Title of Course	Credit Hours
PHG-801	Thesis	06

Syllabi/ Courses of Reading for M.Phil. Pharmacognosy 1st Semester

PHG-701
ANALYTICAL PHARMACOGNOSY **Cr. Hrs. 3**
M. PHIL 1St SEMESTER

(a). **Extraction techniques:**

Different techniques of extraction for crude drugs i.e maceration, percolation, digestion, infusion, decoction, soxhlet extraction, microwave-assisted extraction (MAE), ultrasound-assisted extraction (UAE), supercritical fluid extraction (SFE), accelerated solvent extraction (ASE) and pressurized solvent extraction (PSE).

(b). **Chromatographic techniques:**

Instrumentation and application of thin layer chromatography, column chromatography, droplet counter current chromatography, gas chromatography, high pressure liquid chromatography, gel chromatography, Capillary electrophoresis and gel electrophoresis for the separation of bioactive compounds from natural sources.

(c). **Quality control of crude drugs:**

Qualitative and quantitative microscopy in quality control of crude drugs, monograph of crude drugs, assay techniques of active constituents of crude drugs.

Books Recommended:

1. Florence AT, Attwood D. Physicochemical Principles of Pharmacy. 5th Ed. Pharmaceutical Press; 2011.
2. Zaheer Ahmad. Advance in Natural Products Importance Hawood Academic Publishers USA 2008.
3. Identification of Drugs in Pharmaceutical Formulations by Thin Layer chromatography (2nd ed.), P.D. Sethi, CBS Publisher & Distributors P Ltd; 2nd edition (2010)
4. Plant Drug Analysis: A Thin Layer Chromatography Atlas (2nd ed.), Hildebert Wagner, Springer-Verlag, New York (2007).
5. Supercritical Fluid chromatography, Webster, Gregory K, (2014), Published by, Singapore: Pan Stanford publishing

6. Natural Products Analysis Instrumentation Methods and Applications 2014, Vladimir, (2014), Published by, India: John Wiley and sons.
7. Herbal Drugs and Finger Prints: Evidence Based Herbal Drugs, Devi Datt Joshi, Springer (2012).
8. Natural Products Analysis Instrumentation Methods and Applications 2014, Vladimir, (2014), Published by, India: John Wiley and sons.

PHG-702

BIOSYNTHESIS OF NATURAL PRODUCTS **Cr. Hrs. 3**

M. PHIL 1St SEMESTER

(a). Basic metabolic pathways i.e shikimic acid pathway, acetate mevalonate pathway and acetate malonate pathway Interrelationship between primary and secondary metabolite.

(b). Biosynthetic pathway of amino acids (alanine, glycine, lysine and tyrosine), polysaccharides (dextrin, glycogen, pectin and carrageenan), poly peptides (glutathione and anserine), fat and water soluble vitamins, phenolic plant products (flavonoids, xanthones, phenols and phenolic acids), terpenes (camphor, menthol, squalene), steroids (testosterone, progesterone, beta sitosterol and lanosterol), alkaloids (tryptophan, histidine, tyrosine and ornithine derived) and glycosides (cyanophore, anthraquinone and cardio active etc.).

(c) Techniques used in detecting intermediate compounds during biosynthesis especially Tracer techniques.

Books Recommended:

1. Pharmaceutical Chemistry of Natural Products, Alagarsamy, V., (2012), Published by, India: Reed Elsevier.
2. Textbook of Natural Medicine (4th ed.), Joseph E. Pizzorno, Michael T. Murray, Elsevier (2013).
3. Textbook of pharmacognosy and phytochemistry, Jerald, E.Edwin (2010), , Published by , New Dehli: CBS Publisher & distribution
4. Textbook of Pharmacognosy &Phytochemistry. 2nd Ed. Biren, Shah (2014), Published by, India: Elsevier.

5. Fundamentals of pharmacognosy and phytotherapy; by Michael Heinrich, Joanne Barnes, Simon Gibbons and Elizabeth M Williamson (2012), Elsevier Ltd ISBN: 978-0-7020-3388-9.
6. Advances in Botanical Research: Biosynthesis of Vitamins in Plants A; Vitamin A, B1, B2, B3, B5 (Vol. 58), Fabrice Rebeille, Roland Douce (Eds.), Academic Press (2011).
7. Medicinal natural products: A biosynthetic approach 3rd edition. Paul M Dewick. Wiley India Pvt. Ltd. (2012)

PHG-703

NUTRACEUTICALS & COSMECEUTICALS **Cr.Hrs.3**

1St SEMESTER

a) Nutraceuticals

1. (a) Nutraceuticals, its classification, chemistry, role in healthcare system, toxicity and side effects.

   (b) Regulatory and market aspects of nutraceuticals.

2. Role of flavonoids, Carotenoids, Polysaccharides and fixed oils as Nutraceutical:
   a) Flavonoids and isoflavones (Quercetin, Kaempferol, Myricetin, Hesperetin, Naringenin Genistein and Glycitein)
   b) Carotenoids (Lycopene, Lutein, Zeaxanthin and Capsanthin)
   c) Oils (Flax seed oil, Fish oil and Olive oil)
   d) Polysaccharides (Chitosan, Carrageenan and Chitin)

3. Role of herbs, Amino acids, dietary supplements, minerals and probiotics as nutraceuticals:
   a) Herbs and extracts (cranberry, tea, ginkgo biloba, garlic, ginseng and *Linum usitatissimum*)
   b) Amino acid (Carnitine, Taurine, L-arginine, L-theanine and L-tryptophan)
   c) Dietary supplement (Glucosamine, Chondroitin, Royal jelly and Shark cartilage)
   d) Pro- and pre-biotics (Fructo oligosaccharides, Inulin, Fructan, Yogurt and Kefir)
   e) Minerals (Fluoride, Zinc, Potassium, Calcium and Selenium)

(b) Cosmeceuticals

a) Cosmeceuticals, its classification, chemistry, toxicity symptoms and its emergency method of treatment, regulatory and market aspects of cosmeceuticals.

b) Role of rosemary, lavender, chamomile, licorice, pomegranate, cinnamon, aloe, carrot, jojoba, apricot, ginger, olives, coconut, turmeric, thyme, walnut, cucumber, henna, onion, oats, hibiscus and honey which used commercially as cosmeceuticals.

Recommended Books:

1. Principle and Practice of Phytotherapy: Modern Herbal Medicine, Kerry Bone, Simons Mills, Churchil Livingstone (2013).
2. Herbal Supplements: Efficacy, Toxicity, Amitava Dasgupta, India John Wiley & Sons, 2011
3. Recent Advances in Plant-based, Traditional and Natural Medicine. SubramayamVemulpad, Joanne Jamie, CRC Press (2014).
4. Naturoclinical Approach of Chromopharmacy, Rizwani, Ghazala H. (2017), Published by, Karachi: Offset plate marker.
5. Herbal Principles in Cosmetics properties and mechanisms of Actions, Burlando, Bruno, (2010), Published by, New York: CRC Press Taylor & Francis Group
6. Lesley Braun and Marc Cohen. Herbs and Natural Supplements: An evidence Based guide. 3rd Ed. London: Elsevier Mosby; 2010.
7. Textbook of Natural Medicine (4th ed.), Joseph E. Pizzorno, Michael T. Murray, Elsevier (2013).

PHG-704

INDUSTRIAL AND MARINE PHARMACOGNOSY **Cr. Hrs.3**
M. PHIL 1St SEMESTER

A). Industrial Pharmacognosy

a) Herbal drug regulatory affairs with reference to Pakistan (DRAP act 2012):

b) Procedure for patenting the natural formulations/products

c) Herbal formulation

i. Brief information on the traditional drug discovery process, Latest trends in the drug discovery, process of drug development,

ii. Methods involved in single herb formulation, poly-herbal formulation & their merits and demerits.

d) Review of natural sweeteners (stevia, erythritol, yacon syrup, blackstrap molasses), coloring agents (Euterpe oleracea, Alkanna tinctoria, Bixa orellana), flavoring agents (amyl acetate, citral, Linden ether, acetoin) and preservatives (Rosemary oil extract, Lemon juice, Grapefruit seed extract, Liqua par oil etc)

B). Marine Pharmacognosy:

History of marine Pharmacognosy, Introduction to marine resources, Classification, Collection, Handling and storage of marine drugs, Marine habitat as source for pharmaceuticals

Recommended books:

1. Textbook of Industrial Pharmacognosy, Kalia, A.N. (2012), Published by, New Delhi: CBS Publishers & Distributors Ltd.
2. A textbook of Pharamcognosy theory and practical's .17th end, Qadry, J.S., (2014), Published by, Delhi: Nikunj Print Process
3. Fundamentals of Pharmacognosy and phyto-therapy; by Michael Heinrich, Joanne Barnes, Simon Gibbons and Elizabeth M Williamson (2012), Elsevier Ltd ISBN: 978-0-7020-3388-9.
4. Natural Products Analysis Instrumentation Methods and Applications 2014, Vladimir, (2014), Published by, India: John Wiley and sons
5. Herbal Drugs and Finger Prints: Evidence Based Herbal Drugs, Devi Datt Joshi, Springer (2012).
6. Herbal Medicines: Development and Validation of Plant-derived Medicines for Human Health, Giacinto Bagetta, Marco Cosentino, Marie TizianaCorasaniti, Shinobu Sakurada, CRC Press (2012).
7. Marine Products for Health care: Functional and Bioactive Marine Nutraceuticals Series, Vazhiyil Venugopal, CRC Press (2009).
8. Marine Toxins and other Bioactive Marine Metabolites, Yoshiro Hashimoto, Japan Scientific Societies Press (2009).

PHG-751

SPECTRAL ANALYSIS OF NATURAL ORIGIN COMPOUNDS **Cr. Hrs. 3**
M. PHIL 2nd SEMESTER

Interpretation of IR, UV, NMR and mass spectra of different natural compounds with particular reference to alkaloids (caffeine, capsaicin, atropine, quinine), steroids (cholesterol, progesterone and testosterone), saponins (glycyrrhizin, ginsenoside), anthraquinones (barbaloin, aloin), flavonoids (hesperidin, quercetin) and terpenes (menthol, camphor and phytol etc).

Books Recommended:

1. Skoog and West's: Fundamental of Analytical Chemistry. 9th Ed. Holler, F. James, (2014), Published by, Hong kong: Cengage
2. Learning Spectroscopy. 4th Ed. Lampman, Gary M. (2010), Published by, Hong kong: Cengage Learning
3. Analytical chemistry for technicians 4th ed, Kenkel, john, (2014), Published by, New York: CRC Press Taylor & Francis group
4. Analytical techniques for Natural Product Research, Satyanshu, Kumar, (2016), Published by, UK: CABI
5. Mass Spectrometry: Instrumentation, Interpretation and Applications, Rolf Ekman, Jerzy Silberring, Ann Westman-Brinkmalam, Agnieszka Kra (Eds.), WielyInterscience, New Jersy (2009).
6. NMR Spectroscopy in Pharmaceutical Analysis, IwonaWawer, Ulrike Holzgrabe, Bernd Diehl, Elsevier Publisher (2008).
7. Mass Spectrometry: Instrumentation, Interpretation and Applications, Rolf Ekman, Jerzy Silberring, Ann Westman-Brinkmalam, Agnieszka Kra (Eds.), WielyInterscience, New Jersy (2009).
8. Atomic Molecular Spectrosocopy, Dogra, S.K. (2015), Published by, Delhi: Pearson

PHG-752
PHARMACOBIOTECHNOLOGY AND TOXICOLOGY **Cr. Hrs. 3**
M.Phil. 2nd Semester

a). Introduction and history:

Biotechnology- definition and history, branches of biotechnology, safety in biotechnology, biotechnology and ethics, Tools of Biotechnology, Production of Recombinant Proteins and Peptides, Impact of Biotechnology in Pharmacy Practice, Biotechnology-Derived Pharmaceuticals of the Near Future, Biotechnology and Drug Discovery.

b). Cell Cultures as sources of Drugs:

Cell and tissue culture, plant tissue culture media, plant hormones and growth regulators in tissue culture, preparation of suitable explants. Genetic engineering in plants, selectable markers, reporter genes and promoters used in plant vectors - direct transformation of plants by physical methods. Application of DNA technology

c). **Toxicology**

Concepts of toxicology, An overview of plant toxicants. It includes the study of treatment, prevention and natural antidote of bacterial (Clostridium tetani, Clostridium botulinum and Vibrio cholerae), fungal (Aspergillus spp, Penicillium spp, Fusarium spp and Gyromitra esculenta), alga (Dinophysis, Heterosigma akashiwo and blue-green algae) and phyto allergens (Euphorbia spp, Dieffenbachia picta, Narcissus pseudonarcissus and Agave americana) toxicoses.

Books Recommended:

1. Traditional Herbal Medicine Research methods, Lili, Willow J.H, (2011), Published by, New York: Wiley A John wiley & sons, inc. publication
2. Pharmacognosy: An Indian Perspective., Mangathayaru, K. (2013), Published by, Delhi: Pearson
3. Herbal Medicine: Biomolecular and Clinical Aspects (2nd ed.) Iris F. F. Benzie and SissiWachtel-Galor. CRC Press (2011).
4. Herbal Supliments: Efficacy, Toxicity, Amitava Dasgupta, India John Wiley & Sons, 2011
5. Poisonous Plants of Pakistan, S. H. Abid Askari, Oxford University Press, 2010
6. A textbook of Pharamcognosy, Trease and Evans 16th ed, Trease and Evans, (2009), Published by, London: Saundres
7. Textbook of pharmacognosy and phytochemistry, Malviya, Sapna, (2015), Published by, New Delhi: CBS Publishers & Distributors Ltd.
8. Biotechnology (1st ed.), David P. Clark, Nanette J Pazdernik, Academic Press (2012).
9. Plant Genetics, Biotechnology and Microbiology Vol. I & II Dr. Arun K. Zingare 978-93-82664-04-8, Satyam, 2014
10. Biotechnology and Plant Improvement Dr. Arun K. Zingare 978-81-921419-5-4, Satyam, 2013

PHG-753
RESEARCH METHODOLOGY **Cr. Hrs. 3**
M.PHIL 2nd SEMESTER

1. Research objective

2. Selection of the area of research.

Medical, pharmaceutical sciences, basic health sciences, applied sciences, social sciences, literature.

3. Issues/problem regarding the selection of research topic

i. Construction of a strong statement that summarizes the selected topic.

ii. Summarize key points on which research would be carried out and make it a part of work plan.

iii. Type of Instruments: Their models, make and country of origin; Validation: reliability and accuracy; Service centers: availability of supplies and engineers; Environment: laboratory conditions.

4. Sources of information

Books, journals/periodicals, traditional knowledge, newspapers, internet, proceedings of conferences, seminars, workshops, training programs and conversations.

5. Plan of work

a. Collection of material/authentication

b. Preliminary screening/ pilot plan

c. Experimental: detailed procedure, recording of observations, calculations, results, conclusion.

6. Result compilation

Selection of results: What kind of results can be submitted? Where to submit? How to submit? How non-significant results can be submitted? Who will benefit from this research? Prospects of implementing research work.

7. Data analysis and thesis writing

Data analysis using statistical techniques, Writing Techniques of Thesis.

8. Research article publication

What is research article, Type of research articles, how to write the articles, parts of the articles, types of research journals, selection of research journals.

Books Recommended:

1. Conducting Research Literature Reviews: From the Internet to Paper (3rd ed.) Arlene Fink., Sage Publications (2010).
2. Engaging Inquiry: Research and Writing in the Disciplines, Judy Kirscht, Mark Schlenz, Murray Media (North Miami Beach, FL, U.S.A.) (2013).
3. Practical Research Methods: A Process of Inquiry (8th ed.), Anthony M. Graziano, Michael L. Raulin, Allyn and Bacon (2013).
4. Practical Research: Pearson New International Edition: Planning and Design, Paul D. Leedy, Jeanne E. Ormrod, Pearson Education Ltd. (2013).

5. Mixed Methods in Health Sciences Research: A Practical Primer (vol. 1), Leslie Curry, Marcella Nunez-Smith, SAGE Publications (2014).

PHG-755
BIOSTATISTICS **Cr. Hrs. 3**
M. Phil 2nd semester

a) Introduction
Biostatistics, application of statistics in biological and pharmaceutical sciences. Types of biological data.

b) Samples and population
Simple random sampling, sample distribution and standard error, stratified random sampling, systematic and cluster sampling.

c) Test of hypothesis and significance
Statistical hypothesis, level of significance, test of significance, confidence interval, t test involving binomial and normal distribution.

d) Goodness-of-fit test
Chi-square distribution, its properties and application, contingency tables.Yate's correction for continuity, Test of homogencity.

e) "Student" t- and F-distribution
Properties of t-distribution and F-distribution; test of significance based on t-distribution and F-distribution.

f) Analysis of variance
One-way classification; partitioning of sum of squares and degree of freedom; two-way classification, multiple comparison test; the analysis of variance models.

g) Experimental designs
Experimental designs (advantages and disadvantages), their principles completely randomized designs (CB-designs), randomized complete block designs (RCB-design), latin square designs (LS design), complete methods of statistical evaluation. Co-relation/regression analysis

h) Epidemiology;

cohort, case-control and related observational studies; the advantages and disadvantages of each type of study; models for diseases association, risk difference, relative risk, odds, ratio, attributable risk, the analysis of binary outcomes for retrospective and prospective data. Inference for 2x2 tables, the analysis of 2x2 tables and appropriate test procedures. Wald test, Likelihood Ratio test, profile likelihood; conditional inference for 2x2 tables; Fisher's Exact test: McNemar's test for matched pairs data; Mantel Haenszel test for comparing several 2x2 tables. Case studies on drug trials.

I) Software's such as END Note, Graph Pad Prism etc

Books Recommended:

1. Bio-Statistic: A Foundation for Analysis in the Health Sciences (4th ed.), Wayne. W. Daniel, Wiley Global Education (2012).
2. Introduction to Statistics (3rd ed.), Ronald E. Walpole, Prentice Hall International (1997).
3. Biostatistics: A Methodology for Health Sciences, Gerald van Belle, Lloyd D. Fischer, Patrick J. Heagerty, Thomas Lumely, John Wiley and Sons (2004).
4. Basic Biostatistics: Statistics for Public Health Practice (2nd ed.), B. Burt Gerstman, Jones and Bartlett Learning (2015).
5. Introduction to Biostatistics and Research Methods, P.S.S. Sunder Rao, J. Richard, PHI Learning Pvt. Ltd. (2012).

THESES (Cr. Hr. 6)

M.Phil. 3rd & 4th Semester

The research work will be carried out on problems related to medicinal botany or Pharmacognosy. The theses shall embody the result of research, which may either be continuation to the existing knowledge of the subject, or application of known methods of research to some technical problems. This will also include seminar and viva voce examination concerning research topic. Five copies of research thesis printed or type written shall be submitted for examination at the end of the academic year.

Note: The collection of medicinal plants will be the integral part of course of study in Pharmacology. Nearly 100 medicinal plants are to be collected during study tour which are to be mounted on herbarium sheets.