Department of Pharmaceutical Sciences
School of Engineering and Technology
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(A Central University)

Scheme& Syllabus
Ph.D. Course Work

Scheme of Ph.D. Course Work

W.E.F.: Session 2020 - 21

Course code		Title	Credits
PHS CC 1401		Research Methodology (Theory)	04
PHS CC 1402		Cu rrent Trends in Pharmaceutical Sciences (Theory)	03
PHS CC 1403		Research and Publication Ethics (Theory)	01
PHS EC 1404	a	Advances in Pharmaceutics Research (Theory)	04 *
PHS EC 1404	b	Molecular Biology in Targeted Drug delivery (Theory)	
PHS EC 1404	c	Advances in Medicinal Chemistry (Theory)	
PHS EC 1404	d	Advances in Herbal Drug Technology (Theory)	
PHS CC 140 5		Current Trends in Pharmaceutical Sciences (Practical)	01
PHS CC 1406		Research and Publication Ethics (Practical)	01
PHS CC 1407		Review of Published Research	03
PHS CC 1408		Seminar & Viva - Voce	01
		Course Credit	1 8

**Any one of four elective subjects is to be opted.*

Course Title: Research Methodology (T)

Course Code: **PHSC C1401** Course Credit **: 04**

LOCF:

Upon successful completion of the course, the student will be able to:

01 Explain the Basics of research, what are the component of Literature review and about research problem

02 Describe the Hypothesis formation like null and alternative hypothesis, errors in hypothesis, basics of statistical test and Sampling methods

03 Understand and explain the research design like need and synthesis of design of experiments, quality by design, randomization, replication, local control, experimental error and standard design test and Optimization procedure

04 Describe about the research and report proposal writing, protocol writing and investigational brochure.

05 Describe the computer applications in research and development, data collection, analysis, graph plotting and decision -making using ISIS draw / smart draw and SPSS.

Unit-I (12Hrs)
Basics of research **:** Definition, setting goals and objectives, types of researches .
Literature review **:** Need, sources, search procedure and collection, citation index, impact factor *Formulation of research problem* **:** Problem source, objectives, domain restriction .

Unit-II (12Hrs)
Hypothesis formation **:** Null and alternative hypothesis, errors in hypothesis, basics of statistical test construction, one -tail and two-tail critical regions, p -values, degrees of freedom, level of significance.
Z-Test, Chi - square-test, t -test for means, and comparisons, F -test of variance comparisons, one -way and two -way ANOVA.
Sampling methods : Need and requirement, judgment and random sampling, simple random sampling, stratified random sampling, systematic sampling, cluster sampling, sources of sampling errors and non - sampling errors.

Unit-III (12Hrs)

Research design and standard test procedure : Need and synthesis of design of experiments, quality by design, randomization, replication, local control, experimental error
Standard design: Construction of completely randomized design, block design, latin square design.

Optimization : Quantitative process studies using factorial design, two level full and factorial design, factorial design for process optimization, experimental design for formul ation optimization.

Unit-IV (12Hrs)

Research proposal writing **:** Problem definition and formulation, design, objective, hypothesis formulation, population identification, setup requirement, measurement procedure, data analysis, table display, expected output.
Research report writing **:** Pre -writing considerations, developing an outline, introduction,review, key elements, experimental methods used, measurement procedure used, result,discussion, conclusions, referencing format for books, journals and other l iterature, paper writing, formats of paper writing in journals, thesis writing formats, CONSORT and ICMJE guidelines, STROBE observational studies, clinical study report writing, protocol writing, investigational brochure.

Unit -V (12 Hrs)
Computer applicati ons in research and development **:** Introduction to ICT, use of communication and information technology, applications of world wide web and internet services.
Documentation and presentation techniques using various tools of MS -Office.
data collection, anal ysis, graph plotting and decision making using ISIS draw / smart draw and SPSS.

Recommended Books:

1. Kothari C.R.: Research Methodology - Methods and Techniques Wiley Eastern Ltd.
2. Gupta and Kapoor: Fundamentals of Applied Statistics, Sultan Chand, New Delhi.
3. Gupta and Kapoor: Fundamentals of Mathematical Statistics, Sultan Chand, New Delhi.
4. Joe Habranken: M.S. Office, 8 IN 1, Printice Hall of India.
5. S. Jaswal: Information Technology TODAY (4th Edition), Galgotia Pub. Pvt. Ltd. New Delhi.

Course Title: Current Trends in Pharmaceutical Sciences (T)

Course Code: **PHSC C1402** Course Credit **: 03**

LOCF:

Upon successful completion of the course, the student will be able to:

01 Explain the stability as per ICH guidelines of various pharmaceuticals and also about the Intellectual property right, patenting systems, patent search, components of patent applications, claims.

02 Describe the screening tools and technologies like X -ray diffraction, scanning electron m icroscopy and transmission electron microscopy, confocal laser scanning microscopy, atomic force microscopy.

03 Explain WHO guidelines for assessment of herbal medicines. GMP and other regulatory requirements as per schedules of Drugs and Cosmetics Act an d rules for herbal, ayurvedic and other drugs of traditional origin. preparation of documents for new drug application and export registration,

04 Describe cell cycle, signaling, approaches to the rational design of enzyme inhibitors, drug target binding forces, bioinformatics and its role in drug discovery, structure -based drug design.

05 Explain various techniques of blood collection in laboratory animals, screening methods in pharmacology for anti -inflammatory, cardiovascular activity, psychotropic and neurotropic activity and anti -diabetic activity.

Unit - 01 (9Hrs)
Pharmaceutical stability: stability indicating assays, ICH guidelines for stability testing of various pharmaceuticals. Intellectual property right (IPR) considerations: patenting systems, patent search, components of patent applications, claims.

Unit - 02 (9Hrs)
Screening tools and technologies: X-ray diffraction, scanning electron microscopy and transmission electron microscopy, confocal laser scanning microscopy, atomic force micr oscopy.

Unit - 03 (9Hrs)
WHO guidelines for assessment of herbal medicines. GMP and other regulatory requirements as per schedules of Drugs and Cosmetics Act and rules for herbal, ayurvedic and other drugs of traditional origin. preparation of documents fo r new drug application and export registration,

Unit - 04 (9Hrs)

Cell cycle; phases of cell cycle, moleculer events during cell cycle, regulation of cell cycle. Signaling pathway: signal transduction, G proteins, cyclic nucleotide and kinase signaling, phospholipid and Ca^{++} signaling, signaling via regulated proteolysis.

Approaches to the rational design of enzyme inhibitors, drug target binding forces, bioinformatics and its role in drug discovery, structure based drug design.

Unit - 05 (9Hrs)

Techniques of blood collection in laboratory animals, screening methods in pharmacology for anti-inflammatory, cardiovascular activity, psychotropic and neurotropic activity and anti-diabetic activity.

Recommended Books:

1. Niazi S.K Hand book of Preformulation. Informa healthcare, New York
2. Gibson M. Pharmaceutical Preformulation and formulation. LHS Health group, CRC press,New York.
3. Vyas S.P. and Khar RK Targeted and controlled drug delivery, CBS Publisher & Distributer, New Delhi.
4. Molema G and Meijer KF. Drug targeting organ-specific strategies, Wiley-VCH, Verlage GmbH.
5. Remington's Pharmaceutical Sciences.
6. Vogel H.G. " Drug Discovery and Evaluation, Pharmacological Assays", 2nd edition, Springer.
7. Rasstad – Modern Pharmacognosy.
8. Paul J. Schewer, Chemistry of Marine Natural Products.
9. WHO Guidelines for herbal medicinal products.
10. David Morgan" The Cell cycle: Principles of control"
11. Ralph A. Bradshaw, Edward A. Dennis " Hand book of cell signaling"

Course Title: Research and Publication Ethics (T)

Course code: PHS CC 1403 **Course Credit: 01**

LOCF:

Upon successful completion of the course, the student will be able to:

01 Explain philosophy, ethics, moral philosophy, nature of moral judgements and reactions.

02 Understand and describe the scientific conduct and scientific misconducts.

03 Describe redundant publications including duplicate and overlapping publications, salami slicing, selective reporting and misrepresentation of data.

04 Explain the publication ethics, best practices/standards setting initiatives and guidelines and publication misconduct.

05 Describe the violation of publication ethics, authorship and contributorship, identification of publication misconduct, complaints and appeals and predatory publishers and journals.

Unit I (3 hrs.)
Philosophy: Introduction to Philosophy: definition, nature and scope, concept, branches.
Ethics : Definition, moral philosophy, nature of moral judgements and reactions.

Unit II (3 hrs.)
Scientific conduct : Ethics with respect to science and research Intellectual honesty and research integrity .
Scientific misconducts : Falsification, Fabrication, and Plagiarism (FFP) .

Unit III (3 hrs.)
Redundant publications : duplicate and overlapping publications, salami slicing ,selective reporting and misrepresentation of data.

Unit IV (3 hrs.)
Publication ethics : definition, introduction and importance .
Best practices/standards setting initiat ives and guidelines: COPE, WAME .
Conflicts of interest
Publication misconduct : definition, concept, problems that lead to unethical behavior and vice versa, types .

Unit V (3 hrs.)
Violation of publication ethics, authorship and contributorship .
Identification of p ublication misconduct, complaints and appeals .
Predatory publishers and journals .

References

Bird, A. (2006). Philosophy of Science. Routledge. MacIntyre, Alasdair (1967) A Short History of Ethics. London.

P. Chaddah, (2018) Ethics in Competitive Research: Do not get scooped; do not get plagiarized, ISBN: 978 -9387480865.

National Academy of Sciences, National Academy of Engineering and Institute of Medicine. (2009). On Being a Scientist: A Guid e to Responsible Conduct in Research: Third Edition. N ational Academies Press.

Resnik, D.B. (2011). What is ethics in research & why is it important. National Institute of Envir onmental Health Sciences, 1 -10. https://www.niehs.nih.gov/research/resources/bioethics/wh atis/index.cfinBeall,J.(2012).Predatorypublishersarecorruptingopenaccess.Nature,489(741 5),179 -179.https://doi.org/10.1038/489179a

Indian National Science Academy (INSA), Ethicsin Science Education, Research and Govemance (2019), ISBN:978 -81 -939482 -l-7.htt p://www.insaindia.res.in/pdfrEthicsBook.pdf

Course Title: Advances in Pharmaceutics Research (T)

Course Code: **PHS E C 1404 a** Course Credit **: 04**

LOCF:

Upon successful completion of the course, the student will be able to:

01 Describe the role of nanotechnology in drug delivery and Nanoparticulate drug delivery systems like liposomes, niosomes, microemulsions, nanoparticles, dendrimers etc for drug delivery.

02 Describe the Lipid nanoparticulate drug delivery systems and functional properties of lipids used in formulating lipid drug delivery systems

03 Explain nanoparticulate toxicity and their routes of exposure their toxicological aspects, proposed mechanism of NP induced toxicity (oxidative stress), toxicity assessment of novel drug delivery systems.

04 Describe gene delivery systems, geneand non-viral gene *therapy* including chronology, viral gene delivery systems, retroviral systems, lentiviral systems, del ivery system, polymers, electrostatic interaction, encapsulation, adsorption, vesicular and particulate systems.

05 Explain the smart polymers along with their classification like pH -senstive polymers, temperature responsive polymers; polymers with dual stimuli - responsiveness, phase sensitive smart polymers, light sensitive smart polymers, polymers of natural origin, po lymer - protein bio -conjugates.

Unit – I (12 Hrs)

Nanotechnology in drug delivery : Multifunctional drug carriers, polymer -drug conjugates, smart drug delivery systems. *Nanoparticulate drug delivery systems :*application of liposomes, niosomes, microemulsions,anoparticles, dendrimers etc for drug delivery.

Unit – II (12 Hrs)

Lipid nanoparticulate drug delivery systems: a revolution in dosage from design and development, lipids, classification of solid lipids for delivery of bioactive. Solid lipi d nanoparticles (SLN), nanostructured lipid carriers (NCL) etc.
Functional properties of lipids used in formulating lipid drug delivery systems: Crystalinity and polymorphism of lipids, melting characteristics of lipid matrices crystalinity and polymorphis m vs drug loading capacity and drug release, strategies to improve drug loading in lipid particulate drug delivery systems

Unit – III (12 Hrs)

Nanoparticulate toxici ty and their routes of exposure: Toxicological aspects of NPs, proposed mechanism of N P induced toxicity (oxidative stress), toxicity assessment of novel drug delivery systems.

Unit – IV (12 Hrs)

Gene delivery systems: recent progress in viral and non -viral therapy.

Gene therapy: Chronology, viral gene delivery systems, retroviral systems, lentiviral systems,non - viral gene delivery system: Physical methods: Gene gun; Chemical methods: polymers, electrostatic interaction, encapsulation, adsorption, vesicular and particulate system s.

Unit – V (12 Hrs)

Smart polymers: Classification of smart polymers and their applications as biomaterials . pH-senstive polymers, temperature responsive polymers; polymers with dual stimuli -responsiveness, phase sensitive smart polymers, light sensitive smart polymers, polymers of natural origin, polymer - protein bio -conjugates.

Recommended Books:

1. Niazi S.K Hand book of Preformulation. Informa healthcare, New York.
2. Gibson M. Pharmaceutical Preformulation and formulation. LHS Health group, CRC press,New York.
3. Vyas S.P. and Khar RK Targeted and controlled drug delivery, CBS Publisher & Distributer, New Delhi.
4. Molema G and Meijer KF. Drug targeting organ -specific strategies, Wiley -VCH, Verlage GmbH.
5. Remington's Pharmaceutical Sciences.

Course Title: Molecular Biology in Targeted Drug delivery (T)

Course Code: **PHS E C 1404 b** Course Credit **: 04**

LOCF:

Upon successful completion of the course, the student will be able to:

01 Describe the membrane dynamics and transport mechanism, transport processes like protein mediated transport, active transport, carrier mediated transport, vesicular transport and epithelial transport systems.

02 Explain the receptors their regulation, binding and acti vation and types of receptors & ligands.

03 Explain cell signaling, signaling via cell surface enzymes, intracellular signaling and apoptosis as well as the role of mitochondria in apoptosis and aging.

04 Describe cell cycle initiation and termination mechanism of the S phase mitosis, MPF and the initiation of mitosis, termination mechanism of mitosis, meiosis.

05 Explain the DNA recombination, homologous recombination, the Holliday model of DNA crossover, gene conversion, unequal crossover, site speci fic recombination, transpositional recombination

Unit – I (12 Hrs)

Membrane dynamics and transport mechanism

Introduction to biological membrane, composition and structure of biological membrane,Transport processes: diffusion,

Protein mediated transport: membrane proteins, channel proteins from open, water -filledPassageways, carrier proteins change, facilitated diffusion uses carrier proteins

Active transport, carrier – mediated transport

Vesicular transport: phagocytocis, endocytocisexocytocis

Epithelial transport: paracellular, transcellular, transcytosis.

Unit – II (12 Hrs)

Receptors

Structure, receptor regulation

Binding and activation: agonist vs antagonist, constitutive activities, theories of drug interaction like occupation theory, Ariens and Stephenson rate theory and induced fit theory.

Types of receptors: Transmembrane, G -Protien linked, enzyme -linked (tyrosine kinases) other intracellular transcription factors

Ligands: extracellular and intracellular

Role in genetic disorders, role in the immune system

Unit – III (12 Hrs)

Cell signaling and apoptosis

Overview, signaling via hydrophobic molecules, signaling via ion channels, signaling via G -protein -coupled receptors: G proteins, G -protein effectors

Signaling via cell surface enzymes : receptor tyrosine kinases, receptor serine/threonine kinases
Non –receptor tyrosine kinases, Ras and other small G -Protein
Intracellular signaling: signaling by cAMP, signaling by NF -kB, signaling by STAT, the MAPK signaling pathway, apoptosis
Role of mito chondria in apoptosis and aging

Unit – IV (12 Hrs)

Cell cycle initiation and termination mechanism of the S phase mitosis, MPF and the initiation of mitosis, termination mechanism of mitosis, meiosis.

Unit – V (12 Hrs)

DNA recombination, homologous recombi nation, the Holliday model of DNA crossover, gene conversion, unequal crossover, site specific recombination, transpositional recombination

Recommended Books:

1. S. P. Vyas and D. V. Kohli, 'Methods in Biotechnology and Bioengineering', CBS Publishers, New Delhi.
2. J. M. Pezzuto, M. E. Johnson and H. R. Manesse, 'Biotechnology and Pharmacy, Chappmen and Hall, New York.
3. J. R. Crowther, 'Methods in Molecular Biology, Vol. 2 ELISA Theory and Practice,' Humana Press, Totowa, NJ.
4. G. G. Carmichael and G. K. McM aster, 'Methods in Enzymology,' Academic Press.
5. S. P. Vyas and H. D. Kumar,'Advances in Pharmaceutical Biotechnology,' CBS Publishers,New Delhi.
6. G. P. Talwar and S. K. Gupta, 'A Handbook of Practical and Clinical Immunology,' CBS Publishers, New Delhi.
7. S. Sadasivam and A. Manickem, 'Biochemical Methods,' New Age International Publishers, New Delhi.
8. Vyas S.P. &Khar R.K.: Targeted & Controlled Drug Delivery, CBS Publisher, New Delhi

Course Title: Advances in Medicinal Chemistry (T)

Course Code: **PHSEC 1404 c** Course Credit **: 04**

LOCF:

Upon successful completion of the course, the student will be able to:

01 Explain drug, discovery and design including Molecular modeling methods, molecular mechanics, molecular dynamics, principle of docking, concept of prodrug design, concept of combinatorial chemistry, high throughput screening, 3D - QSAR based CoMFA, AdvCoMFA and COMSIA approaches.

02 Describe bioinformatics like drug receptor interactions, drug tar get binding forces, types of receptors, mechanisms of receptor signal transduction, receptor selection for drug design.

03 Explain targets for development of drugs for disease like cancer, tuberculosis, malaria, epilepsy, and cardiovascular diseases.

04 Interpretate the spectra from UV, IR, PMR, CMR, 2DNMR and Mass spectrophotometer for structure elucidation of organic compounds.

05 Describe g *reen Chemistry* with principles of green chemistry, alternative starting materials, reagents, solvents, catalysts, types of chemical transformations, Salient examples of green chemistry and its future prospects, Microwave assisted synthesis and processing techniques.

Unit – I (12Hrs)

Drug, discovery and design: Molecular modeling methods, molecular mechanics, molecular dynamics, principle of docking, concept of prodrug design, concept of combinatorial chemistry, high throughput screening, 3D - QSAR based CoMFA, AdvCoMFA and COMSIA approaches.

Unit – II (12Hrs)

Bioinformatics : Drug receptor interactions, drug target binding forces, types of receptors, mechanisms of receptor signal transduction, receptor selection for drug design.

Unit – III (12Hrs)

Targets for development of drugs for following diseases: cancer, tuberculosis, malaria, epilepsy, and cardiovascular diseases.

Unit – IV (12Hrs)

Interpretation of spectra from UV , IR, PMR, CMR, 2DNMR and Mass spectrophotometer for structure elucidation of organic compounds.

Unit – V (12Hrs)

Green Chemistry : Principles of green chemistry, Alternative starting materials, reagents, solvents, catalysts, types of chemical transformations, Salient examples of green chemistry and its future prospects, Microwave assisted synthesis and processing techniques.

Recom mended Books:

1. Microwaves in Organic and Medicinal Chemistry by C. Oliver Kappe and Alexander Stadler, Wiley VCH Verlag, GmbH and Co. KGaA.
2. An introduction to medicinal chemistry by Graham L. Patrick, Oxford University Press.
3. Wilson and Gisvold's text book of organic medicinal and pharmaceutical chemistry by John H Block and John M, Beale, 12 ed.
4. Medicinal chemistry, A molecular and biochemical approach by Thomas Nogradyad Donald F. Weaver , 3 ed., Oxford University Press.
5. Essential bioinformatics, by ji nXiong, Cambridge University Press, 1 ed.
6. Burgers' Medicinal chemistry drug discovery Edt by Donald J. Abraham, 6 ed , vol 1 Recent Advances in QSAR studies Methods and applications, by JeezyLeszczynski, Springer
7. Fundamental of medicinal chemistry by Gareth Thomas An introduction to cheminformatics by Andrew R. Leach and Valerie J. Gillet

Course Title: Advances in Herbal Drug Technology (T)

Course Code: **PHSEC 1404d** Course Credit **: 04**

LOCF:

Upon successful completion of the course, the student will be able to:

01 Describe the building blocks and basic metabolic pathways involved in biosynthesis of phyto -constituents use of radiotracers enzymes and cofactors in study of biosynthetic pathways.

02 Explain profiles for commercial cultivation technology and post harvest care of ashwagandha, belladona, guggul, papaya, dioscorea, isapgol, umbelliferous fruits, ginger, turmeric, aloes, digitalis, vinca, ephedra, senna, guar, peppermint, col chicum, lemongrass.

03 Describe the phyto -constituents including andrographolide, amarogenin, asiaticisides, atropine, solasodine, bacoposide, caffeine, cubebol, citral, curcumin, digitoxin, diosgenin, embelin, emetine, ergometrine, eugenol, gingerol, gycerrhetinic acid, hesperidine, kutkoside, piperine, plumbagin, quinine, quinidine, sennosides, taxol, vinca alkaloids, withaferin.

04 Explain the pharmaceutical aids and marine natural products including their introduction, chemistry and biology of marine natural products, marine toxins, marine biomedicinals falling under the class of cardiovascular, anticancer, antimicrobial, anti -inflammatory and antibiotic drugs.

05 Describe the basic principles of ayurveda, salient features of the techniques of preparation and standardization of traditional formulations as per A yurvedic Pharmacopoeia.

Unit – I (12Hrs)

Building blocks and basic metabolic pathways involved in biosynthesis of phyto -constituents use of radiotracers enzymes and cofactors in study of biosynthetic pathways.

Unit – II (12Hrs)

Profiles for commercial cultivation technology and post harvest care of ashwagandha, belladona, guggul, papaya, dioscorea, isapgol, umbelliferous fruits, ginger, turmeric, aloes, digitalis, vinca, ephedra, senna , guar, peppermint, colchicum, lemongrass.

Unit – III (1 2 Hrs)

Modern methods of assay of phyto -constituents including andrographolide, amarogenin, asiaticisides, atropine,solasodine, bacoposide, caffeine, cubebol, citral, curcumin, digitoxin, diosgenin, embelin, emetine, ergometrine, eugenol, gingerol, gycerrhetinic acid, hesperidine, kutkoside, piperine, plumbagin, quinine, quinidine, sennosides, taxol, vinca alkaloids, withaferin.

Unit – IV (1 2Hrs)

Pharmaceutical aids: Profile for manufacture and comme rce of papain, pectin, pharmaceutical gums, starch,absorbent cotton and gelatin.

Marine natural products: introduction, chemistry and biology of marine natural products, marine toxins, marine biomedicinals falling under the class of cardiovascular, antican cer, antimicrobial, anti -inflammatory and antibiotic drugs.

Unit – V (1 2Hrs)

Basic principles of ayurveda, salient features of the techniques of preparation and standardization of traditional formulations as per Aurvedic Pharmacopoeia .

Recommended Books:

1. Peach, T. Tracey, M.V. (1955), Modern methods of plant analysis Springer Berlin
2. Stahl, Ergan (1969), Thin Layer Chramatography, Springer, New York
3. Turner , Evaluation of Phytocharmaceuticals
4. Wallis, T.E. (985), Text Book of Pharmacognosy, CBS Publication, New Delhi
5. Trease& Evans, W.C., Pharmacognosy, 16 th Ed.
6. Turner, R.A., Screeing Methods in Pharmacology, Academic Press.
7. Tyler, V.E., Brady, L.R. &Robbet, J.E., Pharmacognosy, Lea &Febiger, 9 th Ed., 1981, Phaladelphia New York.
8. WHO Guidelines
9. Indian Pharmacopoeia
10. Herbal Pharmacopoeia

Course Title: Current Trends in Pharmaceutical Sciences (P)

Course Code: **PHSC C 1405** Course Credit **: 01**

LOCF:

Upon successful completion of the course, the student will be able to:

01 Stability of pharmaceutical as per ICH guidelines

02 X-ray diffraction techniques, scanning electron microscopy and transmission electron microscopy, confocal laser scanning microscopy, atomic force microscopy.

03 Assessment of quality and safety of herbal medicines as per WHO guidelines and preparation of documents for new drug application and export registration

04 Bioinformatics and structure -based drug design.

05 Blood collection in laboratory animals, screening methods in pharmacology for anti-inflammatory, cardiovascular activity, psychotropic and neurotropic activity and anti-diabetic activity.

Experiments based on the following topics .

Pharmaceutical stability: stability indicating assays, ICH guidelines for stability testing of various pharmaceuticals.

Screening tools and technologies: X-ray diffraction, scanning electron microscopy and transmission electron microscopy, confocal laser scanning microscopy, atomic force microscopy.

Assessment of quality and safety of herbal medicines as per WHO guidelines. Preparation of documents for new drug application and export registration.

Bioinformatics and its role in drug discovery and structure based drug design.

Techniques of blood collection in laboratory animals, screening methods in pharmacology for anti -inflammatory, cardiovascular activity, psychotropic and neurotropic activity and anti -diabetic activity.

Recommended Books:

1. Niazi S.K Hand book of Preformulation. Informa healthcare, New York
2. Gibson M. Pharmaceutical Preformulation and formulation. LHS Health group, CRC press,New York.
3. Vyas S.P. and Khar RK Targeted and controlled drug delivery, CBS Publisher & Distributer, New Delhi.
4. Molema G and Meijer KF. Drug targeting organ -specific strategies, Wiley -VCH, Verlage GmbH.
5. Remington's Pharmaceutical Sciences.
6. Vogel H.G. " Drug Discovery and Evaluation, Pharmacological Assays", 2nd edition, Springer.
7. Rasstad – Modern Pharmacogno sy.
8. Paul J. Schewer, Chemistry of Marine Natural Products.
9. WHO Guidelines for herbal medicinal products.
10. David Morgan" The Cell cycle: Principles of control"
11. Ralph A. Bradshaw, Edward A. Dennis " Hand book of cell signaling"

Course Title: Research and Publication Ethics (P)

Course code: PHSCC 1406 **Course Credit:** 1

LOCF:

Upon successful completion of the course, the student will be able to:

01	Check SHERPA/RoMEO online resource publisher copyright & self -archiving policies.
02	Describe software tool to identify predatory publications developed by SPPU.
03	Search online for journal finder/journal suggestion tools viz. JANE, Elsevier Journal Finder, Springer Journal Suggester,etc.
04	Explain subject specific ethical issues, FFP, authorship. conflicts of interest and complaints and appeals: examples and fraud from India and abroad
05	Use the plagiarism software like Turnitin, Urkund and other open source software tools.
06	Explain the Indexing and citation databases like web of Science, Scopus, etc.
07	Describe the impact Factor of journal as per Journal Citation Report, SNIP, SJR, CiteScore.

Open access publications and initiatives (4 Hrs).

- Open access publications and initiatives
- SHERPA/RoMEO online resource to check publisher copyright & self archiving policies.
- Software tool to identify predatory publications developed by SPPU.
- Journal finder/journal suggestion tools viz. JANE, Elsevier Journal Finder, Springer Journal Suggester, etc.

Publication Misconduct (4 Hrs)

Group Discussions

- Subject specific ethical issues, FFP, authorsh
- Conflicts of interest.
- Complaints and appeals: examples and fraud from India and abroad

Software tools

- Use of plagiarisms software like Turnitin, Urkund and other open source software tools

Databases and Research Metrics (7 Hrs .)

Databases

- Indexing databases.
- Citation databases: Web of Science, Scopus, etc.

Research Metrics

- Impact Factor of journal as per Journal Citation Report, SNIP, SJR, IPP, CiteScore.
- Metrics: h -index, g index, i10 index, altmetrics

References

Bird, A. (2006). Philosophy of Science. Routledge. MacIntyre, Alasdair (1967) A Short History of Ethics. London.

P. Chaddah, (2018) Ethics in Competitive Research: Do not get scooped; do not get plagiarized, ISBN: 978 -9387480865.

National Academy of Scien ces, National Academy of Engineering and Institute of Medicine. (2009). On Being a Scientist: A Guide to Responsible Conduct in Research: Third Edition. National Academies Press.

Resnik, D.B. (2011). What is ethics in research & why is it important. National Institute of Environmental Health Sciences, 1 -10. https://www.niehs.nih.gov/research/resources/bioethics/whatis/index.cfinBeall,J.(2012).Predatorypublishersarecorruptingopenac cess.Nature,489(7415),179 -179.https://doi.org/10.1038/489179a

Indian National Science Academy (INSA), Eth icsin Science Education, Research and Govemance (2019), ISBN:978 -81 -939482 -l-7.http://www.insaindia.res.in/pdfrEthicsBook.pdf

Course Title: Review of published research

Course Code: PHS CC 1407 Credit: 03

LOCF :

Upon successful completion of the course, the student will be able to:

01 Develop an overview on published research.

02 Develop a review on specific area(s) of published research.

03 Explain the published reports/patents/articles in the field of Pharmaceutical Sciences

04 Describe ethical issues involved in preparation of review article/report on published research.

The student(s) is/are required to review the research publications/reports/patents in the field of Pharmaceutical Sciences and submit the report.

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Course Title: Seminar & Viva -Voce

Course Code: PHS CC 1408 Credit: 01

LOCF :

Upon successful completion of the course, the student will be able to:

01 Present a quality seminar on the review of research publications/reports/patents in the field of Pharmaceutical Sciences before the assessment panel.

02 Describe the ethical issues involved in preparation of presentation and conducting a seminar on published research.

03 Explain the effective presentation on research findings and published research.

The student(s) is/are required to present a seminar on the review of research publications/reports/patents in the field of Pharmaceutical Sciences before the assessment panel.