KLE
EMPOWERING PROFESSIONALS

KLE Academy of Higher Education & Research
Belagavi
[DEEMED-TO-BE-UNIVERSITY]
REACCREDITED AT THE 'A+' LEVEL BY NAAC (THIRD CYCLE), PLACED IN 'A+' CATEGORY BY MHRD (GoI)

Value Added Course on

Preclinical & Toxicological Study Design

KLE COLLEGE OF PHARMACY
TRUTH, LOVE, SERVICE, SACRIFICE
BELAGAVI

Offered by

Dept. of Pharmacology
KLE COLLEGE OF PHARMACY
Belagavi

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Our B. Pharm Program has been accreditated by NBA for a period of 6 years (from July 2019 to June 2025)

Preamble

Toxicology seeks to understand the nature and mechanism of adverse effects of toxicants such as those found in industry, in the household, in food, in medicine and those that occur naturally in the environment.

The purpose and intent of toxicity studies is a review, to demonstrate the extensive scientific parameter assessments, basic preclinical toxicology screening models, alternative animal models and skill develop to research design and reporting.

The course is designed for students majoring the natural environment, the influence of pollutants upon the environment and also focus on the toxicants biotransformation of drugs, carcinogens and other toxicants, its implication on human and animals health.

Course objectives: -

1. To develop a conceptual framework to identify toxins and its remedies
2. To Provide toxicological information at an introductory level while combining regulatory guidelines enough comprehensive information to meet the unmet needs of students studying in the fields.
3. To generate an applicable practical knowledge on preclinical toxicological studies using computer aided software predictions and alternative to animal studies.
4. To appreciate the basic concepts on ADME profiling of toxicants, interactions at cellular toxicity and chemical actions on body organs systems.
5. To understand their research approach and research design of toxicology studies.

Syllabus Content

MODULE I: Introduction history, type, classification of toxicity, determination of ED50,LD50 & NOAEL and dose conversion **02 Hours**

Historical Evolution of toxicology, Definition, Classification, Determination LD50, ED50, NOEL, NOAEL, Therapeutic dose calculation of drugs on animals and human.

Course Outcome

By the end of this course, students will be able to:

- **Mol 1**. Describe the framework of the various stages of toxicology studies anddetailed information about dose calculation.
- **Mol 2.** Articulate the dose conversion from animals to human dose.

MODULE II: Regulatory Guidelines for Toxicological studies. **02 Hours**

OECD (Organization for Economic Co-operation and Development) guidelines; ICH (International Council for Harmonization) guidelines; GLP (Good Laboratory Practice) guidelines

Course outcome

By the end of this course, students will be able to:

- **Mol 1.** Categories the various OECD guidelines in preclinical toxicity studies.
- **Mol 2.** Describe ICH guidelines in safety pharmacology.
- **Mol 3.** Outline the various guidelines for GLP.

MODULE III: Alternate to animal models for toxicity studies **02 Hours**

In Silico approach (ADME Profiling); *In vitro* Cell line assay (MTT assay); Shrimp toxicity assay

Course outcome

By the end of this course, students will be able to:

- **Mol 1.** Analyze the ADME profiling of toxicants using Insilico toxicity studies.
- **Mol 2.** Illustrate the various alternatives animal toxicity models.

MODULE IV: Toxicokinetic and Toxicodynamic of Toxicants **2 Hours**

- Toxicokinetic - ADME profiling & to calculate Cmax, Tmax& factors affecting ADMEtoxicants and other toxicokinetic parameters.
- Toxicodynamic - Deals with dynamic interactions of a toxicant with a biologicaltarget like receptors, enzymes and their biological effects.

Course outcome

By the end of this course, students will be able to:

- **Mol 1.** Describe the principles of toxicokinetics and toxicodynamics.
- **Mol 2.** Identify the factors affecting ADME toxicity
- **Mol 3.** Correlate the various toxicants – receptors interaction and their biological effects.
- **Mol 4.** Compare and contrast toxicokinetics and toxicodynamic

MODULE V: Environmental toxicity studies **02 Hours**

Hazardous chemicals toxicants; Radiations frequencies causing health hazardous toxicity; Environmental Pollutants.

Course outcomes

By the end of this course, students will be able to:

- **Mol 1.** Summarize the radiological, chemical and environmental pollutants toxicity on health.
- **Mol 2.** Articulate the various Environmental toxicants manifestations of systemic diseases.
- **Mol 3.** Correlate the different radiation frequencies causing systemic toxicity.

MODULE VI: Systemic Toxicity studies **04 Hours**

1. Male & Female reproductive toxicity – OECD 421
2. Carcinogen to cause (Neoplasm) Carcinogenicity Studies OECD 451.
3. Toxicants - Mutagenicity studies OECD 471

Course Outcomes

By the end of this course, students will be able to:

- **Mol 1.** Discuss the various toxicants in systemic toxicity.
- **Mol 2.** Describe physiology of sexual behavior parameters.
- **Mol 3.** Categories the target organ for carcinogenicity.

- **Mol 4.** Explain the characterization of Genotoxicity.
- **Mol 5.** Identify allelic differences associated with increased cancer risk following toxicant exposure.
- **Mol 7.** Explain the effects of toxicants on neurological function.

MODULE VII: **Protocol Designing and writing** **01 Hour**

Introduction, Aim & objectives, Methodology, Ethical consideration, Research outcome, References.

Course outcome

By the end of this course, students will be able to:

- **Mol 1.** Discuss the framework of Protocol writing Mol2. Outline the different styles of references.

MODULE VIII: *In-silico*, In-vitro, In-vivo practical's **08 Hours**

In-silico approach in ADME and Systemic Toxicity predictions; *In-vitro* approach of Shrimp assay for Lethality and cytotoxicity test; *In-vitro* studies of cell viability by Trypan blue Assay; *In-vivo* hands on training on various routes of blood withdrawal techniques; *In-vivo* hands on training on various routes of drugs administrations.

Course outcomes

By the end of this course, students will be able to:

- **Mol 1.** Predict Toxicokinetic and Systemic toxicity profiles of chemicals using *In-silico* approach.
- **Mol 2.** Evaluate the drug lethality and dose calculation using shrimp assay.
- **Mol 3.** Discuss the cell viability assay by Trypan blue Assay.
- **Mol 4.** Demonstrate the various route of administration and blood withdrawal techniques

Module IX: 6 HOURS

Overview to Advanced Excel

Section One - Make a Start with Excel

- What is a Spreadsheet?
- Excel Rows and Columns
- Enter Text and numbers in a cell
- Data Formatting - Font formatting, Number formatting, colour of a cell; centre text and numbers; Table formatting, Conditional formatting, Hide/Unhide; Sort / filter, paste special, Find and select
- Text Functions Using: Mid/Search/Left/Right Functions; Using Trim/Clean/Upper/Lower Functions; Using Substitute/Text Functions; Using Trim/Clean/Proper/Dollar Function
- Currency symbols in excel

- How to save your work in excel

Section Two - Excel Formulae

- The SUM Function
- How to multiply in excel
- Subtract and Divide
- Combine the Arithmetic Operators
- Formula Auditing
- The Average Function
- The Date & Time Function

Section Three - Microsoft spreadsheet Features

- Advanced Filters - Extracting Records with Advanced Filter; Using Formulas in Criteria
- Advanced Sorting - Sorting by Top to Bottom/Left to Right; Creating/Deleting Custom List; Sort by using Custom List
- How to Merge cells
- Data Import from Web, Text (Text to columns)
- Removing Duplicates
- How to use Auto fill in excel
- How to Sort data in excel
- Searching with MATCH and INDEX
- How to Create an Excel Template
- Data Forms in Excel
- Drop Down Lists in Excel
- Add your own Error Messages
- Array Formulas Intermediate Excel
- Frequency Distribution Intermediate Excel
- Hyperlinks in Excel

Section Four - Microsoft Excel Pivot Tables & Charts

- Excel Pivot Tables (Creating, Formatting Simple PivotTables), Creating / Modifying a PivotChart
- Create an excel chart
- Formatting Charts: Move and Resize your chart; Charts Styles and Layouts; Adding Chart Titles and Series Titles Legends / Lables
- Formatting / Renaming / Deleting Data Series; Changing the Order of Data Series; Chart Layout Panel in Excel
- Printing Charts
- Adding Data to a Chart;
- Create Pie chart in Excel
- Format Pie chart segments
- Create a 2D line Chart in Excel (Combo Charts – Secondary Axis)
- Format your Axis titles
- Predict the future with a Trendline chart
- Sparkline charts

- Section Five - Conditional Logic
- 'IF' Function
- Conditional Formatting in excel
- Statistical Functions:
- CountIF, Count IFS, SUMIF, SUMIFS, AverageIf, AverageIfs, Nested IF, IFERROR Statement, AND, OR, NOT; LARGER / SMALLER Functions (Colour coding & data rearrangement)
- Absolute Cell References

Section Six - Advanced Excel – Data Processing & LOOKUP Functions

- Reference other Worksheets
- LOOKUP Function: VLOOKUP/HLOOKUP Function in Excel; Index and Match; Creating Smooth User Interface Using Lookup; Nested VLookup; Reverse Lookup using Choose Function

Arrays Functions - Array Formulas, Use of the Array Formulas; Basic Examples of Arrays (Using ctrl+shift+enter); Array with if, len and mid functions formulas; Array with Lookup functions; Advanced Use of formulas with Array.

Module Outcomes: Upon completion of this module students will be able to:

1. Create & Edit worksheets
2. Process data sets using Outline, autofilter & pivot tables
3. Process data sets employing Excel Formulae & produce statistical results
4. Extract and modify data with search and replace, use conditional formatting to highlight specific data
5. Creates and format PivotTables & Charts

   Validate data using LOOKUP features

Assessment:

25% Formative assessment: 25marks

Formative assessment structure. (Plan1)*

Formative Assessment	Assignment	Practical/Skill based	Viva Voce	Max Marks/Total
IA1	10	10	5	25
IA2	10	10	5	25

Formative assessment structure (Plan2)*

Formative Assessment	MCQ	Quiz/Presentation/Discussion	Max Marks /Total
IA1	10	15	25
IA2	10	15	25

*Average of 2 internal assessment will be considered

75% Summative assessment*: *75marks

End term exam of 75 marks will be conducted to award total exam score. Question paper will be set as per the university rules applied to other courses. Exam Score: 40% passing criterion will be based on Formative assessment plus Summative assessment scores. Attendance, Participation and feedback. 80% attendance is compulsory to complete this course.

Summative assessment structure. (Plan1)

Summative Assessment	MCQ	Long essay	Short essay	Max Marks /Total
Final exam	15	20	10	45
Practical	1			25
Continuous Mode(CM) (Attendance, Interaction)				10
Total				75

Summative assessment structure. (Plan2)

Summative Assessment	MCQ	Long essay	Short essay	Max Marks /Total
Final exam	10	20	5	35
Presentation	1			15
Practical	1			15
Continuous Mode(CM) (Attendance, Interaction)				10
Total				75

Reference Books and websites:

1. A tool for training and promoting Good Laboratory Practice (GLP) Concepts in disease endemic countries by Dr Deborah Kioy, Preclinical Coordinator TDR/WHO E- Book.
2. ICH Quality Guidelines - An Implementation Guide by Andrew Teasdale, Astrazeneca, London, UK: 2018 John Wiley publisher. E-Book.
3. OECD Guideline for The Testing of Chemicals, Repeated Dose 90-day Oral Toxicity Study in Non-Rodents, 409, September 1998.
4. General guidelines for safety/toxicity evaluation of ayurvedic formulations Vol I & II published by Central Council for Research in Ayurvedic Sciences Ministry of Ayush, Govt. of India New Delhi.
5. Alternatives to Animals use in testing by Food and drug administrative: safety Evacuation Regulation of chemical by Karger Publisher: 1985
6. Fundamentals of Experimental Pharmacology, 6th edition by M.N Ghosh publisher Hilton and company
7. Methods of blood collections in the mouse: vol 29: by Jnet Hoff.
8. Preclinical toxicology guidance for industry – ICH Guidances by pacific biolabs.

Eligibility: Students of B Pharmacy, M Pharmacy (Pharmacology), PharmD, MBBS, MD (Pharmacology), MSc Clinical Research and other allied sciences.

Duration: 12 weeks

Fees/Charges: The course is offered to the students without any fee

Added Benefits for the Participating Students

- Certificates of Appreciation to the best students.
- Hands on Training in *Insilico* software, *Invitro* and *Invivo* toxicity studies andtechniques.

Career Prospects:

- Pre-clinical toxicologist
- Research associate in Pre-clinical Research Organization
- Research associate in Clinical Data Management
- Pre-clinical Data Associate
- Safety Pharmacologist
- Scientist

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Since 1968
Alchemizing Pharma Education

Highlights of the Course

- In-silico ADME Profiling of drugs
- Alternatives to Animal Testing's
- Protocol designing
- Specific Blood Withdrawal Techniques and various Routes of Drug Dosing