

## VALUE ADDED COURSES

## KU3VACCHE101 SAFE LABORATORY PRACTICES IN CHEMISTRY

| Semester | Course Type | Course Level | Course Code         | Credits | Total Hours |
|----------|-------------|--------------|---------------------|---------|-------------|
| 3        | VAC         | 100          | <b>KU3VACCHE101</b> | 3       | 45          |

| Learning Approach (Hours/ Week) |                       | Marks Distribution |     |       | Duration of ESE (Hours) |
|---------------------------------|-----------------------|--------------------|-----|-------|-------------------------|
| Lecture/<br>Tutorial            | Practical/ Internship | CE                 | ESE | Total |                         |
| 3                               | 0                     | 25                 | 50  | 75    | 1.5                     |

**Course Description:** The course provides necessary guidelines on proper handling of equipment and chemicals, precautions to be taken for avoiding accidents and first aids in case of emergency to maintain a secure environment for experimentation.

**Course Prerequisite:** NIL

**Course Outcomes:**

| CO No. | Expected Outcome                                                      | Learning Domains |
|--------|-----------------------------------------------------------------------|------------------|
| 1      | Understand safety measures in laboratory and professional ethics      | U                |
| 2      | Understand the scientific importance of personal protective equipment | U                |
| 3      | Safely handle, store, use and dispose waste in scientific way         | A                |
| 4      | Develop good laboratory practices                                     | C                |

**\*Remember (R), Understand (U), Apply (A), Analyse (An), Evaluate (E), Create (C)**

**Mapping of Course Outcomes to PSOs**

|      | PSO 1 | PSO 2 | PSO 3 | PSO 4 | PSO 5 | PSO 6 | PSO 7 |
|------|-------|-------|-------|-------|-------|-------|-------|
| CO 1 | 2     | 2     | 3     | 2     | 2     | 3     | 2     |
| CO 2 | 3     | 2     | 3     | 2     | 2     | 3     | 1     |
| CO 3 | 1     | 2     | 3     | 1     | 2     | 3     | 2     |
| CO 4 | 2     | 2     | 3     | 2     | 2     | 3     | 1     |

**Course Contents for Classroom Transaction:**

| <b>M<br/>O<br/>D<br/>U<br/>L<br/>E</b> | <b>U<br/>N<br/>I<br/>T</b> | <b>DESCRIPTION</b>                                                                                                                                                                                                                              | <b>HOURS</b> |
|----------------------------------------|----------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------|
| <b>1</b>                               |                            | <b>SAFETY ASPECTS IN CHEMICAL LABORATORY</b>                                                                                                                                                                                                    | <b>12</b>    |
|                                        | 1                          | Introduction to laboratory safety–safety guidelines, common chemistry laboratory practices; safety and hazard symbols.                                                                                                                          |              |
|                                        | 2                          | Material Safety Data Sheet (MSDS)- What is MSDS? MSDS of frequently used laboratory chemicals                                                                                                                                                   |              |
|                                        | 3                          | Regulatory framework – Overview of safety regulations and standards (OSHA, EPA) – Laboratory safety manual – Policies and Procedures – Action Plan for implementing safety practices                                                            |              |
|                                        | 4                          | Safe handling & storage and waste management — Chemical storage and handling - Strategies to reduce the amount of toxicity of chemical waste generated in the laboratory - Proper waste disposal- how to deal with accidents; DON'Ts in the lab |              |

|          |   |                                                                                                                                                                       |          |
|----------|---|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------|
| <b>2</b> |   | <b>Personal protective equipment</b>                                                                                                                                  | <b>6</b> |
|          | 1 | Eye protection, Protective apparel, Respirators, Laboratory hoods, Fire extinguishers, Safety showers and Eyewash facilities, other first aid at chemistry laboratory |          |

|          |  |                                                      |           |
|----------|--|------------------------------------------------------|-----------|
| <b>3</b> |  | <b>PROCEDURES FOR WORK WITH HAZARDOUS SUBSTANCES</b> | <b>11</b> |
|----------|--|------------------------------------------------------|-----------|

|          |                                                                         |                                                                                                                                                                                                              |          |
|----------|-------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------|
|          | 1                                                                       | Hazards in the laboratory – Types of hazards in laboratory– Chemical hazards, Physical hazards, biological hazards, Radiation hazards - Factors determining the impact of hazards.                           |          |
|          | 2                                                                       | Classes of hazardous substances - Carcinogens, Reproductive Toxins, Corrosive Substances, Irritants, Sensitizers (allergen),                                                                                 |          |
|          | 3                                                                       | Flammable and explosive substances - General procedures for work with flammable and explosive substances.                                                                                                    |          |
|          | 4                                                                       | General procedures for work with toxic substances                                                                                                                                                            |          |
|          | <b>SPECIAL HANDLING PROCEDURES FOR SOME COMMON HAZARDOUS SUBSTANCES</b> |                                                                                                                                                                                                              | <b>7</b> |
| <b>4</b> | 1                                                                       | Special handling procedure for some common hazardous substances in chemistry laboratory - Benzene, Carbon Monoxide, Carbon Tetrachloride, Chlorine, Chloroform, Hydrogen Sulfide, Nitrogen Dioxide, Mercury. |          |
|          | 2                                                                       | Prior approval requirements - Restricted chemicals requiring prior approval                                                                                                                                  |          |

|          |                                  |                                                                                                                                                                                                                                                                                                                                                                        |          |
|----------|----------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------|
|          | <b>TEACHER SPECIFIC MODULE</b>   |                                                                                                                                                                                                                                                                                                                                                                        |          |
|          | <b>LABORATORY DEMONSTRATIONS</b> |                                                                                                                                                                                                                                                                                                                                                                        | <b>9</b> |
| <b>5</b> | 1                                | Laboratory demonstration of safe handling & storage and waste management — Chemical storage and handling- Proper waste disposal-how to deal with accidents-Special handling procedure for some common hazardous substances in chemistry laboratory - Benzene, Carbon Monoxide, Carbon Tetrachloride, Chlorine, Chloroform, Hydrogen Sulfide, Nitrogen Dioxide, Mercury |          |

**Essential Readings:**

1. Prudent Practices for Handling Hazardous Chemicals in Laboratories, National Academy Press, Washington, D.C
2. Improving Safety in the Chemical Laboratory, Young, J. A. Ed., Wiley,
3. Fire Protection Guide on Hazardous Materials. National Fire Protection Association, Quincy, MA (adopted edition).
4. Laboratory Safety: Principles and Practices. Fleming, D. O. et al. American Society for Microbiology. Washington, D.C. (latest edition)
5. Chemical Hazards of the Workplace. Proctor, N. and J. Hughes. J.B. Lippincott Co., Philadelphia, PA (latest edition).
6. CRC Handbook of Laboratory Safety, Steere, N. ed. CRC Press, Inc., Boca Raton, FLA (latest edition)

**Assessment Rubrics:**

| Evaluation Type               |                    | Marks     |
|-------------------------------|--------------------|-----------|
| End Semester Evaluation (ESE) |                    | <b>50</b> |
| Continuous Evaluation (CCA)   |                    | <b>25</b> |
| <b>Theory (CCA)</b>           |                    | <b>25</b> |
| a)                            | Test Paper*        | 10        |
| b)                            | Assignment         | 5         |
| c)                            | Seminar, Viva-Voce | 10        |
| Total                         |                    | 75        |