Course Content and Outcome Guide for AQS 240

Course Number: AQS 240
Course Title: Life Support System Design and Operation
Credit Hours: 4
Lecture Hours: 30
Lecture/Lab Hours: 20
Lab Hours: 0

Course Description
Examines the role of life support systems in maintaining a balanced, stable aquatic environment. Covers how to design, construct, maintain, and troubleshoot semi-closed, closed and open systems.

Intended Outcomes for Course
1. Identify water quality parameters impacted by life support systems and relate the use of associated equipment to evaluate aquatic environments.
2. Identify the functions and the relationships of life support system components in maintaining a balanced aquatic system.
3. Size and select appropriate life support system components and equipment for an aquatic system.
4. Troubleshoot and remedy faulty life support system components.
5. Diagram the flow of water from its source to its discharge location.
6. Design and build an aquatic life support system.

Course Activities and Design
The format for this course is a combination of lecture, demonstration, and laboratory experience to provide necessary skills in how to properly design and operate life support systems for aquariums and their inhabitants. Laboratory instruction will be based at the OCCC Central Campus Aquarium Science building.

Outcome Assessment Strategies
- Laboratory activities and skill development sessions that utilize tools, materials and equipment for the construction and operation of life support systems.
- Construction and installation of a physical life support system.
- Term project utilizing information resources for the planning and design of a theoretical life support system for an exhibit, aquaculture or research application.
- Scheduled quizzes and examinations to evaluate knowledge of tools, materials, equipment, filtration components, water monitoring devices, and their associated selection, function and safe use within life support systems.
- Final comprehensive exam includes national certification with the Aquatic Animal Life Support Operators Level One Operator certification.

Course Content (Themes, Concepts, Issues and Skills)

Themes

- Design and operation of environmentally controlled life support systems.
- Tools and materials for life support installation and maintenance.
- Life support equipment and components.
- Filtration, flow dynamics, aeration and gas exchange in controlled aquatic environments.
- Water chemistry and the physical environment in aquatic life support systems.
- Safe construction, operation and troubleshooting life support systems.

Concepts

- Considerations and principles which influence the planning and design process as well as operation and maintenance of life support systems.
- Identification of open, closed and semi-closed life support systems and the water flow characteristics of each.
- Selection, application and safe use of tools and materials appropriate for construction and maintenance of life support systems and their components.
- Theory and modes of filtration (mechanical, chemical, biological) and disinfection/sterilization.
- Relationship between filtration, flow dynamics, aeration and gas exchange in life support systems and the components and devices which influence them.
- Principles of fluid dynamics and the role of pressure and energy within pumping systems for life support.
- Role and influence of life support systems and components on water chemistry and the physical environment (temperature, pressure, lighting) in aquatic systems.
- Identification and function of life support components and devices (pumps, filters, media, aerators, reactors, conditioners, monitors and controllers) and the size and selection criteria for each.
- Exploration of team dynamics, roles and project goals for life support projects.

Issues

- Permits and regulatory agencies that influence life support system design and operation.
- Safe practices when working with life support tools, equipment and materials.
- Working with members of a team to accomplish a common goal from distinct individual roles.
- Creating energy efficient and resource responsible life support systems.

Skills

- Map and trace direction of water flow through a life support system and its components.
- Read, interpret and create basic life support schematics (P&IDs, floor plans and elevations).
- Safely use manual and power driven tools for installing various types of life support equipment and material.

- Identify goals, schedules, costs for a life support system and its components.
- Install, operate and maintain life support equipment in a safe manner.
- Identify and select appropriate PVC pipe, fittings, valves and associated materials for use on life support systems.
- Use proper techniques in plumbing PVC pipe and fittings.
- Calculate system volumes, flow rates, total dynamic head and turnover of a life support system.
- Identify electrical components and requirements for life support equipment.
- Read and interpret performance curves for selecting pumps.
- Calculate and select properly sized biological filters and media surface area using bio-load and total ammonia-nitrogen.
- Identify parts and components of key life support equipment and how they operate such as; pumps, filters, heaters, chillers, aerators, foam fractionators, UV sterilizers, ozone generators, and lighting.
- Determine disinfection and sterilization agents and appropriate dosing levels for each.
- Identify water quality and flow monitoring, controlling and automation devices.
- Identify, select and control appropriate temperature devices (heaters and chillers) for aquatic systems.
- Trouble-shoot life support problems through the use of senses; sight, sound, smell and feel.
- Install a life support system with various components to include pumps, filters, plumbing, temperature control, aeration, and pipe and equipment supports.
- Source information on equipment and materials from industry suppliers and professionals.
- Communicate and coordinate life support system design and planning with project team members.