FACULTY OF ENGINEERING TECHNOLOGY
UNIVERSITI MALAYSIA PAHANG

1	Course Code and Name	BTV4723 Water and Waste Water Monitoring
2	Semester and Year Taught	Semester 1 Year 4
3	Program Level/Category	Degree/Program Core
4	Unit	3 Credits
5	Prerequisite Course	Nil
6	Contact Hours	Lecture: 2 units (2 hours x 14 weeks) Tutorial: 0 unit (0 hour x 14 weeks) Laboratory: 1 units (2 hours x 14 weeks)
7	Course Synopsis	Water monitoring is an essential tool in the management of water resources and it comprehensively covers the entire monitoring operation including data sampling and analysis, statistics, sampling design, chemical monitoring, in-situ measurements, trace metals, nutrients, organic matter, organic carbon, and biological monitoring of watershed
8	Course Outcomes	By the end of semester, student should be able to: CO1 Examine the water quality assessment including physical, chemical and biological criteria and fundamentals of acceptability CO2 Design monitoring sampling program and conduct water measurement, collecting data and completing the data form CO3 Demonstrate technical communication skills by managing, interpreting and presenting data (written, table and graphs)
9	Learning References	1. Burden, Foerstner, McKelvie, and Guenther (2002) **Environmental Monitoring Handbook**, The McGraw-Hill Companies, Inc. 2. Jamie Bartram and Richard Balance (1996) **Water Quality Monitoring: A Practical Guide to Design and Implementation of Freshwater Quality Studies and Monitoring Programmes**, CRC Press.

Relationships between Program Outcomes (PO) and Course Outcomes (CO)

Domains	Course Outcomes	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
		C	C	C	P	P	A	A	A	A	A	A	A
CO1	Examine the water quality assessment including physic, chemical and biological criteria and fundamentals of acceptability **(C5)**	x											
CO2	Design monitoring sampling program and conduct water measurement, collecting data and completing the data form **(P)**				x								
CO3	Demonstrate technical communication skills by managing, interpreting and presenting data (written, table and graphs) **(A)**										x		

Assessment Methods

Learning Domains	Distribution (%)		CO1	CO2	CO3
Cognitive	Final Examination	40	x		x
	Test	15	x		
	Quizzes	5	x		
Psychomotor	Lab Test	20		x	
	Lab Report	10		x	
Affective	Project (Presentation)	10			x
	Total	100			

Module	Week	Activity	Topic Outcomes (TO)	CO	PO	Level in Bloom`s Taxonomy	Delivery Methods	SLT		
								Contract Hour	Learning Hour	Total SLT
1	1	Introduction ▪ Elements of water quality monitoring program ▪ Monitoring for management ▪ Monitoring and assessment ▪ Water quality (surface and ground water) characteristics ▪ Natural processes affecting water quality ▪ Water use and water quality deterioration ▪ Water and human health	Define the element of water quality monitoring	CO1	PO1	C1	Lecture	1	1	2
			Explain the monitoring for management	CO1	PO1	C2	Lecture	1	1	2
			Define water quality and differentiate surface and ground water characteristics	CO1	PO1	C4	Lecture	1	1	2
			Explain the natural process affecting water quality	CO1	PO1	C1	Lecture	1	1	2
			Illustrate the relationships between water and human health	CO1	PO1	C3	Lecture	0.5	0.5	1
2	2	Designing a monitoring program ▪ Purpose of monitoring, the need for information, objectives of water quality monitoring ▪ Preliminary surveys, description of the monitoring area ▪ Selecting sampling sites and sampling stations, frequency and timing of sampling ▪ Monitoring media and variables	Point out the purpose of monitoring, the needs for information and the objectives of water quality monitoring	CO1	PO1	C5	Lecture	1.5	3.5	4
			Explain the preliminary survey and describe the monitoring area	C01	PO1	C5	Lecture	1	2	3
			Decide the sampling sites and sampling stations, frequency and timing of sampling	CO2	PO1	C5	Lecture	1	2	3
			Decide the monitoring media and variables	CO2	PO1	C5	Lecture	1	2	3

Module	Week	Activity	Topic Outcomes (TO)	CO	PO	Level in Bloom`s Taxonomy	Delivery Methods	SLT		
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3	3	Resources for a monitoring program ▪ Laboratory facility, transport, staffing and human resources development and training ▪ Communication ▪ Inventory of sampling stations and schedules for sampling expeditions	Review the laboratory facility, transport, staffing and human resource development and training	C01	PO1	C2	Lecture	1	1	2
			Explain how the needs of communication during monitoring	CO1	PO1	C1	Lecture	1	2	3
			Decide the inventory of sampling stations and schedules for sampling expeditions	CO2	PO4	C5	Lecture	2	2	4
4	4	Field work and sampling ▪ Sample containers, type of sample, water sample, manual sampling procedures ▪ Recording field observations ▪ Sample preservation ▪ Transportation and storage of samples ▪ Safety during field work	Prepare the sample containers, type of sample, water sample, manual sampling based on the procedures	CO2	PO4	C5	Lecture	0.5	0.5	1
			Preserve sample based on the requirements	CO2	PO4	C4	Lecture	1	1	2
			Design transportation and how to store the samples	CO2	PO4	C5	Lecture	1	2	3
			Operate the safety protocols during field works	CO2	PO4	P	Laboratory	1.5	2.5	4
5	5	Field testing methods ▪ Temperature ▪ Transparency ▪ pH and conductivity ▪ Dissolve oxygen ▪ Thermo-tolerant (faecal) coliforms ▪ Quality assurance in the field	Explain the method for analyzing water sample on site	CO1	PO4	C1	Lecture	1	2	3
			Measure temperature, transparency, pH, conductivity, dissolve oxygen, thermo-tolerant coliforms and quality assurance in the field	CO2	PO4	P	Laboratory	2	3	5

Module	Week	Activity	Topic Outcomes (TO)	CO	PO	Level in Bloom`s Taxonomy	Delivery Methods	SLT		
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6	6-7	Physical and chemical analyses ▪ Preparation and use of chemical reagents ▪ Alkalinity ▪ Aluminium ▪ Biochemical oxygen demand ▪ Chemical oxygen demand ▪ Boron ▪ Calcium ▪ Chloride ▪ Chlorophyll a ▪ Fluoride ▪ Iron and magnesium ▪ Manganese ▪ Nitrogen (ammonia, Kjeldahl, nitrate and nitrite) ▪ Phosphorus ▪ Potassium ▪ Selenium ▪ Reactive silica ▪ Sodium ▪ Sulphate ▪ Total dissolved solids ▪ Total suspended solids	Explain the method for analyzing physical and chemical characteristics of water sample	CO1	PO4	C1	Lecture	2	2	4
			Measure the physical and chemical analyses of water sample in the laboratory	CO2	PO4	P	Laboratory	6	6	12

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7	8	Advanced instrumental analysis ▪ Atomic absorption spectrophotometry (AAS) ▪ Gas chromatography ▪ Flame photometry ▪ Total, organic and inorganic carbon	Explain the procedure of water quality analysis by AAS, gas chromatography, flame photometry, total, organic, and inorganic carbon	CO1	PO1	C2	Lecture	2	2	4
			Measure the water sample by one selected instrumental analysis	CO2	PO4	P	Laboratory	2	3	5
8	9	Microbiological analyses ▪ Characteristic of indicator organisms ▪ Selecting bacteriological analytical technique ▪ Multiple fermentation tube technique ▪ Membrane filter technique ▪ Quality assurance (internal and external quality control)	Express the characteristic of indicator organisms	CO2	PO4	P	Laboratory	1	2	3
			Review bacteriological analytical technique	CO2	PO4	P	Laboratory	0.5	3.5	4
			Apply multiple fermentation tube technique	CO2	PO4	P	Laboratory	1	2	3
			Apply the membrane filter technique	CO2	PO4	P	Laboratory	1	2	3
			Examine the internal and external quality control	CO2	PO4	P	Laboratory	1	2	3
9	10-11	Biological monitoring ▪ Selection of appropriate methods and organisms ▪ Ecological methods ▪ Measurement of chlorophyll a ▪ Physiological techniques control test ▪ Contaminants in biological tissues ▪ Site selection and sampling frequency ▪ Quality assurance	Review the appropriate methods and organisms	CO2	PO4	C2	Lecturer	0.5	2.5	3
			Evaluate the ecological methods	CO2	PO4	P	Laboratory	1	2	3
			Measure the chlorophyll a	CO2	PO4	P	Laboratory	1	2	3
			Examine the physiological and bio-test control	CO2	PO4	P	Laboratory	1	2	3
			Measure the contaminants in biological tissues	CO2	PO4	P	Laboratory	2	3	5
			Design the site selection and sampling frequency	CO2	PO4	P	Laboratory	1.5	1.5	3
			Examine the quality assurance	CO2	PO4	P	Laboratory	1.5	3.5	5

Module	Week	Activity	Topic Outcomes (TO)	CO	PO	Level in Bloom`s Taxonomy	Delivery Methods	SLT		
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10	12	Hydrological measurements ▪ Rivers ▪ Lake and reservoirs ▪ Mass flux computation ▪ Groundwater	Measure the discharge (volume of water passing through a cross-section of the river in a unit of time), the velocity of flow, turbulence and depth of river water	CO2	PO4	P	Laboratory	2	3	5
			Measure water flow taken tributaries and outflowing streams and water from lake or reservoir itself	CO2	PO4	P	Laboratory	1.5	3.5	5
			Calculate the mass flux of water	CO2	PO4	C5	Lecture	1	3	4
			Measure the groundwater flow and, estimate the speed and spread movement of contaminant after the polluting event	CO2	PO4	P	Laboratory	1.5	3.5	5
11	13	Sediment measurements ▪ Type of sediment transport ▪ Sediment measurement ▪ Sampling for sediment ▪ Measuring suspended sediment ▪ Sediment quality	Describe the material that is transitional between bedload and suspended load	CO2	PO4	C2	Lecture	1	2	3
			Measure the particle of size, composition of sediment and hysteresis effects	CO2	PO4	P	Laboratory	2	3	5
			Design sampling sites that address the minimum disturbance to avoid the lose the fine material	CO2	PO4	C5	Lecture	0.5	2.5	3
			Measure the sediment concentration and estimate the suspended sediment concentration	CO2	PO4	P	Laboratory	2	3	5
			Examine the sediment quality	CO2	PO4	P	Laboratory	1.5	3.5	5

Module	Week	Activity	Topic Outcomes (TO)	CO	PO	Level in Bloom`s Taxonomy	Delivery Methods	SLT		
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12	14	Use and reporting of monitoring data ▪ Quality assurance of data ▪ Data handling and management ▪ Basic statistical analysis ▪ Use of data and the need for supporting information ▪ Simple graphical presentation of results ▪ Reporting	Identify outlying values and ensure the data fall within the limits of detection of a particular method	CO3	PO10	C5	Lecture	1	1	2
			Analyze the data by descriptive statistics or inferential statistics	CO3 CO3	PO10 PO10	C4 A	Lecture Presentation	1 1	1 1	2 2
			Decide the type of report and manage the structure of report by providing the understandable and relevant results to program controller	CO3 CO3	PO10 PO10	C5 A	Lecture Presentation	1 1	1 2	2 3

Prepared by	Checked by	Approved by
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