

SILABO

1 INFORMACIÓN GENERAL SOBRE LA ASIGNATURA						
CÓDIGO ASIGNATURA	1084-03-05-04		ASIGNATURA	Applied Hydrology	CARRERA(S)	Ingeniería en Ciencias del Agua
PERIODO ACADÉMICO	S1 2018 Abril - August		NIVEL	Quinto	MODALIDAD	Presencial
UNIDAD DE ORGANIZACIÓN CURRICULAR	Formación Profesional		ORGANIZACIÓN DEL APRENDIZAJE	2	TOTA DE CRÉDITOS	5
DISTRIBUCIÓN DEL APRENDIZAJE (HORAS SEMANALES)	TEORÍA	20	LABORATORIO / PRACTICA	2	APRENDIZAJE AUTÓNOMO	6
TUTORÍAS (HORAS SEMANALES)	PRESENCIALES		VIRTUALES		TOTAL DE HORAS (SEMESTRE)	192
PRE-REQUISITOS						
ASIGNATURA	CÓDIGO		ASIGNATURA	CÓDIGO		
Hydrometeorology	1084-02-04-03		Escriba aquí	Escriba aquí		
Escriba aquí	Escriba aquí					
2 INFORMACIÓN ESPECÍFICA SOBRE LA ASIGNATURA						
DESCRIPCIÓN				CONTEXTUALIZACIÓN DENTRO DEL PLAN DE ESTUDIOS		
<p>This course deepens topics covered during the 4 semester Hydrometeorology course, including, advanced aspects of water balance and watershed analysis, and expands on measuring, analyses and, modelling techniques that facilitates the understanding of the water cycle, hydrological phenomena, and applications for the use and management of water resources and aquatic ecosystems.</p>				<p>Applied hydrology is a continuation of the hydrometeorology course and together with the aquatic chemistry and the aquatic ecology courses set the basis for the understanding of aquatic ecosystems. It precedes and facilitates the development of basic and applied hydraulic courses, and more advanced courses like water governance, sensible design, and integrated management of water resources. It corresponds to a foundation course in the Water Sciences career.</p>		

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3 INFORMACIÓN ESPECÍFICA SOBRE LA ASIGNATURA					
OBJETIVO GENERAL			OBJETIVOS ESPECÍFICOS		
The goal of the course is to increase the understanding of the distribution and movement of water through ecosystems			The objectives of the course are to understand the concept of the catchment, to learn more advanced techniques for the analysis of hydrometeorological data, to know the basics and types of hydrological models and their applications and to gain quantitative, computational, spatial and statistical skills for the analysis of various water-related aspects.		
COMPETENCIAS GENÉRICAS			COMPETENCIAS ESPECIFICAS		
The main outcomes/skills to be gained during this learning experience will be: 9. Capacity to conduct research; 2. Capacity to apply conceptual aspects into practice; and 18. Interpersonal skills.			Specific outcomes/skills to be gained during this learning experience will be: 15. Ability to identify and solve problems; 11. Ability to search, process, and analyze information from diverse sources; 1. Capacity of abstraction, analysis and synthesis; 6. Oral and writing skills; 14. Creative capacity; and 17. Capacity to work in teams.		
METODOLOGÍA DE ENSEÑANZA					
<input checked="" type="checkbox"/>	Charlas magistrales	<input checked="" type="checkbox"/>	Proyecto de investigación	During the course several activities will be conducted to facilitate student learning, including lectures, class and home activities, short field trips near the school campus and two extended field trips to other areas. Further, student participation and presentations will be requested, together with directed reading, and research and innovation projects. Guidelines and instructions for the different tasks to be accomplished and class approach will be provided.	
<input type="checkbox"/>	Debate	<input checked="" type="checkbox"/>	Redacción científica y técnica		
<input checked="" type="checkbox"/>	Diseño y prototipo	<input checked="" type="checkbox"/>	Salida de campo Académica		
<input checked="" type="checkbox"/>	Evaluación final	<input checked="" type="checkbox"/>	Talleres		
<input checked="" type="checkbox"/>	Evaluación parcial	<input checked="" type="checkbox"/>	Tareas		
<input checked="" type="checkbox"/>	Exposiciones	<input checked="" type="checkbox"/>	Trabajo de campo		
<input checked="" type="checkbox"/>	Investigación bibliográfica	<input checked="" type="checkbox"/>	Trabajo grupal		
<input checked="" type="checkbox"/>	Lectura científica	<input checked="" type="checkbox"/>	Trabajo individual		
<input type="checkbox"/>	Mesas de discusión	<input checked="" type="checkbox"/>	Visitas		
<input checked="" type="checkbox"/>	Participación	<input type="checkbox"/>	---		
<input checked="" type="checkbox"/>	Prácticas de laboratorio	<input type="checkbox"/>	---		
<input type="checkbox"/>	Proyecto de aula	<input type="checkbox"/>	---		
DOCENTE(S)					
NOMBRE	TITULO	ROL	EMAIL	OFICINA	HORARIOS ATENCIÓN
Edgar Fabian Espitia Sarmiento	PhD (Candidate)	Water Sciences Researcher	edgar.espitia@ikiam.edu.ec	Room 8	By appointment

4 INFORMACIÓN ESPECÍFICA SOBRE LA ASIGNATURA

SISTEMA DE EVALUACIÓN				
PARCIAL	COMPONENTE	PORCENTAJE (%)	PUNTUACIÓN	INSTRUMENTO DE EVALUACIÓN
PRIMERA EVALUACIÓN (APRENDIZAJE COLABORATIVO)	APRENDIZAJE ASISTIDO POR EL PROFESOR	10	1	Class and home works and activities reports
	PRACTICA DE APLICACIÓN Y EXPERIMENTACIÓN	20	2	Research and innovation reports and essays
	COMPONENTE DE APRENDIZAJE AUTÓNOMO	10	1	Participation, examinations and presentation rubrics
TOTAL PRIMERA EVALUACIÓN PARCIAL		40	4	
SEGUNDA EVALUACIÓN (APRENDIZAJE INDIVIDUAL)	APRENDIZAJE ASISTIDO POR EL PROFESOR	10	1	Class and home works and activities reports
	PRACTICA DE APLICACIÓN Y EXPERIMENTACIÓN	20	2	Research and innovation reports and essays
	COMPONENTE DE APRENDIZAJE AUTÓNOMO	10	1	Participation, examinations and presentations rubrics
TOTAL SEGUNDA EVALUACIÓN PARCIAL		40	4	
EVALUACIÓN FINAL		20	2	
TOTAL		100	10	
FUENTES DE CONSULTA / REFERENCIA				
DETALLE	TIPO DE BIBLIOGRAFÍA	TIPO RECUSO	UBICACIÓN	
1. Davie, T. 2008. Fundamentals of Hydrology. Routledge (2nd edition).	Basic	eBook	Pdf will be provided	
2. Raghunath, H. 2006. Hydrology. Principles, Analysis, Design. New Age International Limited Publishers (2nd edition)	Basic	eBook	Pdf will be provided	
3. Spiegel M. R., Schiller J., Srinivasan R. A. Probabilidad y estadística. Mc Graw Hill (4 edición)	Basic	Book	Library campus IKIAM	
4. Gutiérrez C., C. 2014. Hidrología Básica y Aplicada. Abya – Yala.	Complementary	Book	Library campus IKIAM	
5. Maidment D., Djokic D. 2000. Hydrologic and Hydraulic Modeling Support with Geographic Information Systems. ESRI Press.	Complementary	Book	Library campus IKIAM	
6. World Meteorological Organization. 2011. Guide to Climatological Practices.	Complementary	eBook	Free web resource: https://library.wmo.int/pmb_ged/wmo_100_en.pdf	
7. World Meteorological Organization. 2008. Guide to Hydrological Practices. Volumen I. Hydrology – From Measurement to Hydrological Information.	Complementary	eBook	Free web resource: http://www.whycos.org/hwrrp/guide/	
8. World Meteorological Organization. 2009. Guide to Hydrological Practices. Volumen II. Management of Water Resources and Application of Hydrological Practices.	Complementary	eBook	Free web resource: http://www.whycos.org/hwrrp/guide/	
9. World Meteorological Organization. 2012. International Glossary of Hydrology.	Complementary	eJournal	Free web resource: https://library.wmo.int/pmb_ged/wmo_385-2012.pdf	
10. Hydrology and Earth System Science.	Complementary	Web site	Hydrology and Earth System Sciences (HESS). An interactive open-access journal. https://www.hydrology-and-earth-system-sciences.net/	

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11. Teaching and Training Resources for the Geoscience Community (Comet MetEd)	Complementary	Web site	Free web site for learning: http://www.meted.ucar.edu
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5 CONTENIDOS

#	FECHA	UNIDAD	# HORAS	TEMA	SESIÓN	RESULTADOS DE APRENDIZAJE	RECURSOS DIDÁCTICOS Y/O ACADÉMICOS	INSTRUMENTOS DE EVALUACIÓN	BIBLIOGRAFÍA
1	April 9	1. Catchment hydrology: Land-atmosphere interactions	2	Introduction to the class Course outline Hydrology in civil and environmental engineering Water resources in Ecuador Scope of hydrology	T	A knowledge of study aims of hydrology as science. An understanding of importance of the hydrology in civil and environmental studies.	Lectures, readings, home work	Summary of readings	1, 2, 4
2	April 9	1.1. Introduction to hydrometeorological monitoring	2	Review of hydrometeorological concepts The water cycle Hydrometeorological data Water balance	T, P	A thorough review of main topics covered in former hydrometeorology class and to be addressed in applied hydrology.	Lectures, readings, home work	Summary of readings	1,2, 4
3	April 10, 2017	1.2. Geomorphology	4	Catchment and stream characteristics Horton's Laws: Stream Order	T, P	An understanding of catchment as unity of analysis. A knowledge of how to delimit a catchment. A knowledge of how to calculate the main geomorphological characteristics of the catchment.	Computer work, lectures, reading	Summary of readings	1, 2, 4, 5
4	April 11	1.3. Precipitation	4	Precipitation formation Types of precipitation Rainfall measurement Canopy interception Spatialization of precipitation Rainfall intensity Analysis of rainfall data Curves intensity-duration-frequency (IDF)	T, P	A knowledge of how to analyze rainfall data spatially and for intensity/duration of a storm. A knowledge of some of the methods used to estimate rainfall at the large scale. An understanding of the process of precipitation interception by a canopy.	Computer work, lectures, reading	Summary of readings	1, 2, 4
5	April 12	1.4. Transpiration and evapotranspiration	2	Basics of Evaporation and evapotranspiration Temperature, solar radiation, sunshine, humidity Methods of measurement Methods of estimation	T, P	An understanding of the process of evaporation and what controls its rate A knowledge of the techniques for measuring evaporation. A knowledge of the methods used to estimate evaporation and evapotranspiration.	Computer work, lectures, reading	Summary of readings, homework, report of practice	1, 2, 4
6	April 12	1.5. Infiltration and storage	2	Basic soil physical properties Soil water properties and measurements Principles of soil water movement and infiltration Infiltration models	T, P	An understanding the water dynamic in the ground (in both the saturated and unsaturated zones). A knowledge of the techniques used to estimate the amount of water stored as soil moisture and groundwater.	Computer work, lectures, reading	Summary of readings	1, 2, 4

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7	April 13	1.6. Runoff and streamflows	4	Runoff mechanisms Definition of streamflows Streamflows measurement Computation of streamflow data Streamflow hydrograph	T, P	An understanding of the runoff process. A knowledge of the techniques for direct measuring streamflow.	Computer work, lectures, reading, field practice	First project report, summary of reading	1, 2, 4, 5
8	April 16	1.7. GIS applications	4	Dealing with cartographic projections Source of geographical information Working with data elevation models (DEM) Catchment delimitation Making a map for hydrological purposes	T, P	An understanding of geographical information systems applied to hydrology. A knowledge of catchment delineation and catchment characteristics computations.	Computer work, lectures, reading, practical work	Summary of readings	1, 2, 4, 5
9	April 17	2. Catchment hydrology: streams, floods and droughts	2	Water balance basics Components of water balance Water balance for different water bodies	T	A knowledge of element of hydrological budget.	Computer work, lectures, reading, homework	Summary of readings	1, 2, 4
10	April 17	2.1. Hydrograph analysis	2	Hydrograph components Separation of streamflow components	T, P	An understanding different hydrological techniques used for. A knowledge of hydrograph meaning and uses.	Computer work, lectures, reading, homework	Second project report, summary of readings	1, 2, 4
11	April 18	2.2. Flood analysis	4	Description of floods Flood routing Estimation of floods Peak flows (Floods and droughts)	T, P	An understanding of flood phenomena. A knowledge of how to derive and interpret flow duration curves.	Computer work, lectures, reading	Summary of readings	1, 2, 4
12	April 19	2.3. Unit Hydrograph	4	Unit Hydrograph theory Derivation of unit hydrograph Synthetic Unit Hydrograph Flow routing	T, P	An understanding of basic principles of unit hydrograph. A knowledge of implementation the unit hydrograph.	Computer work, lectures, reading, homework	Summary of readings	1, 2, 4
13	April 20	3. Mathematical models in hydrology	2	Introduction to mathematical modelling in hydrology Types of mathematical models The basic problem in modelling	T, P	A knowledge of process of modeling. An understanding of the aims of hydrological modelling and different strategies to achieve those aims.	Computer work, lectures, reading	Summary of readings	1, 2, 5
14	April 20	3.1. Modelling approaches	2	Modelling protocol Parameterization, validation, sensitivity analysis and simulation Efficiency criteria	T, P	A knowledge of process of modeling. An understanding of the aims of hydrological modelling and different strategies to achieve those aims.	Computer work, lectures, reading	Reports of practice, summary of readings	1, 2, 5
15	April 23	3.2. Computer models in hydrology	4	Computer models in hydrology Tools for modelling	T, P	An understanding of basic principles of computer models. To meet the most common models used.	Computer work, lectures, reading	Summary of readings	1, 2

5 CONTENIDOS

16	April 24	4. Statistical and Probability Analysis	4	Elements of statistics Elements of probability	T	A review of key elements of statistics and probability for hydrology.	Computer work, lectures, reading, homework	Summary of readings	1, 3,
17	April 25	4.1. Basis of statistical analysis in hydrology	4	Graphical display of data Characterization of hydrological variable	T, P	An understanding of the physical meaning of streamflow statistic characteristics.	Computer work, lectures, reading, homework	Report of practice, summary of readings	1, 3
18	April 26	4.2. Frequency analysis	4	Return period Probability distributions Probability plots	T, P	A knowledge of frequency analysis for a gauged catchment.	Computer work, lectures, reading, homework	Summary of readings	1, 2
19	April 27	5. Selected topics of hydrology 5.1. Ecological flows	4	Definition of ecological flow Measures for achievement of ecological flows Methodologies for estimating ecological flows	T, P	An understanding of environmental flow and the basics of methods for calculating.	Computer work, lectures, reading, homework	Summary of readings	1, 7
20	May 1	5.2. Hydrological forecasting systems and Internet resources for hydrology	4	Flood Forecasting and Early Warning elements Internet resources for hydrological modelling	T, P	An understanding of the importance, the main components and the basic operation of hydrological forecasting system. A knowledge of internet source of data for hydrological studies.	Computer work, lectures, reading, homework and fieldwork	Final project report, reports of practice, summary of readings, homework	7, 8, 11
21	May 3 and 4	Field trip: Limoncocha	10	A review of hydrological concepts in the field. An analysis of water balance elements for a lake.	P	A knowledge of how to analysis the components of water cycle in the field.	Lectures and fieldwork	Report of field work	1, 2, 4, 7, 8, 9, 11
22	May 5 to 7	Field trip: Chone	16	A review of hydrological concept in the field. An analysis of water balance for river section.	P	A knowledge of how to analysis the components of water cycle in the field.	Lectures and fieldwork	Report of field work	1, 2, 4, 7, 8, 9, 11
23	May 8	Visit INAMHI institute	6	A review a concepts of monitoring system in hydrometeorology.	P	An understanding of surface water monitoring network.	Lectures and fieldwork	Report of visit	1, 2, 4, 7, 8, 9, 11
24	May 9	Field work in Tena River	16	Practical work: hydrometeorological characterization of catchment and Flow measurement.	P	A knowledge of key hydrological processes and how they are measured.	Lectures and fieldwork	Report of field work	1, 2, 4, 7, 8, 9, 11

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6 COMPONENTE DE INVESTIGACIÓN			
UNIDAD Y TEMA DEL SILABO AL QUE CORRESPONDE		Unit 1. Catchment hydrology: land-atmosphere interactions	
NOMBRE DEL PROYECTO DE INVESTIGACIÓN		Comparative hydrology of rivers and creeks of the Upper Napo River Basin (UNRB) or proposed catchment	
CARÁCTER DEL PROYECTO	PROCESO DEL CONOCIMIENTO	DESCRIPCIÓN	PRODUCTO EVALUABLE
<input checked="" type="checkbox"/> Exploratorio <input checked="" type="checkbox"/> Descriptivo	Indagación	Are there main differences in the hydrological features of rivers and creeks of the UNRB? What are the main factors that control these differences? The goal of this project is to apply concepts learned in class to assess the different components of the hydrological regime of diverse catchments in the selected catchment.	Research proposal, filed notes, databases, and data sheets with analysis, and reports.
	Exploración	Conduct data gathering and field work to assess the diversity of environments of the catchment. Classify aquatic ecosystems into different categories base on their hydrological features. During this stage of the project students will search hydrometeorological data, do map reviews and field work to determine potential types of ecosystems in the basin. Then, they will develop a research proposal that focusses on a particular question of their choice.	
	Organización	During this stage of the project students will obtain main evidence to answer the questions proposed in the former stages. For that purpose they will get organized to systematically and accurately gather information relevant to the question and with appropriate methods learned in class or from additional literature research.	

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7 INFORMACIÓN ESPECÍFICA SOBRE LA ASIGNATURA		
ELABORADO POR: (DOCENTE)	REVISADO POR:	APROBADO POR: (COORDINADOR ACADÉMICO)
NOMBRE: Edgar Fabían Espitia Sarmiento	NOMBRE:	NOMBRE:
FECHA: jueves, 12 de Octubre de 2017	FECHA:	FECHA: