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Family Name					
Given Name/s					
Student Number					
Teaching Period	Semester 1, 2019				

ENV313 – Hydrology and Catchment Processes	DURATION	
	Reading Time:	10 minutes
	Writing Time:	180 minutes
INSTRUCTIONS TO CANDIDATES		
Total marks for this examination: 100		
Section A: Suggested Time: 80 mins	Short Answer Questions: Answer ALL 10 questions. 4 marks per question. (Total marks = 40)	
Section B: Suggested Time: 100 mins	Short Essay Questions: Answer ANY 4 questions out of 6 questions. 15 marks per question (Total marks = 60)	
EXAM CONDITIONS		
<u>You may begin writing from the commencement of the examination session.</u> The reading time indicated above is provided as a guide only.		
This is a CLOSED BOOK examination		
No calculators are permitted		
One A4 sheet of handwritten single-sided notes permitted		
No dictionaries are permitted		
ADDITIONAL AUTHORISED MATERIALS	EXAMINATION MATERIALS TO BE SUPPLIED	

No additional printed material is permitted

2 x 16 Page Book
1 x 4-Multiple Choice Answer Sheet
2 x Scrap Paper

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DOUBLE-SIDED.**

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Section A

Short Answer Questions

Total Number of Marks for this Section: 40

ANSWER ALL 10 QUESTIONS IN THIS SECTION

This section should be answered in the Answer Booklet provided.

Marks for each question are indicated. Suggested time allocation for Section A: 80 mins

ANSWER ALL 10 QUESTIONS IN THIS SECTION

Question 1A

Using an annotated diagram, as well as additional text, describe the global hydrological cycle. Highlight the relative water volumes and relative rates of exchange in and between different parts of the system.

(Marks: 4)

Question 2A

a) Describe the concept of the water balance. b) Using annotated diagrams illustrate a conceptual water balance for Australia's "Top End" (e.g. Darwin), the arid interior and the temperate southeast coast. Your diagrams should focus on highlighting the differences in water balance between these 3 regions.

(Marks: 4)

Question 3A

- a) Describe the catchment hydrological system; b) Outline why the catchment concept is useful.

(Marks: 4)

Question 4A

A given parcel of water arriving at a stream channel may have taken a number of different paths. Using diagrams where appropriate, describe the possible paths water may take to the stream. Indicate the relative likely transport time associated with each pathway (e.g. by numbering the pathways from quickest to slowest).

(Marks: 4)

Question 5A

- a) Describe, using examples, the concept of connectivity in hydrology and ecohydrology.
b) Discuss, using examples, how this concept is useful in managing aquatic or riparian ecosystems.

(Marks: 4)

Question 6A

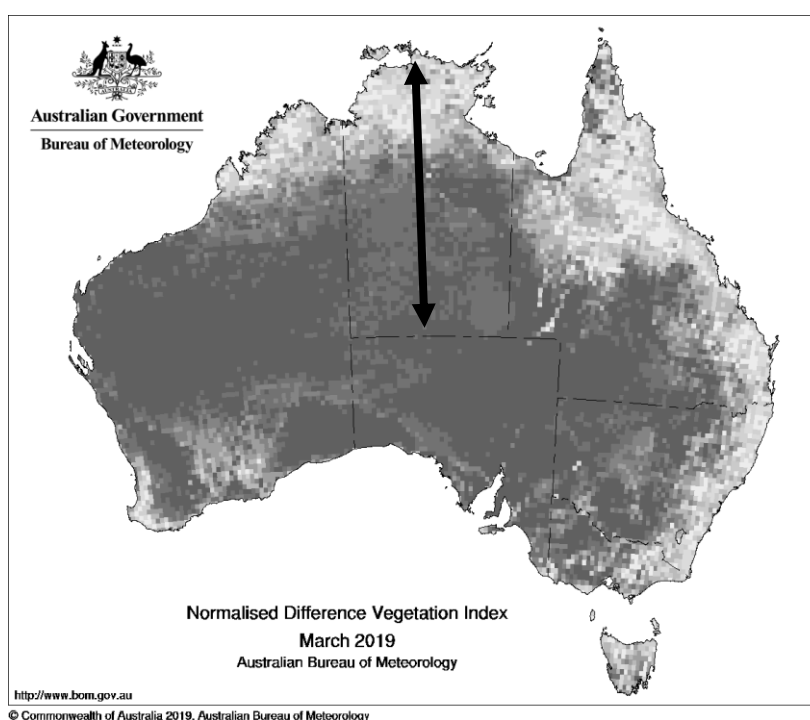
Together atmospheric, soil and surface water account for less than 1% of water on Earth, yet humans and other biota (often) have access to water when they need it. Why?

(Marks: 4)

Question 7A

The map below (BOM, 2019) shows the Normalised Difference Vegetation Index (NDVI – which is a measure of relative vegetation “greenness”) for the Australian continent. On the map light colours indicate relatively greater greenness and darker colours relatively less greenness.

Describe, using diagrams where appropriate: a) the hydrological characteristics; and b) the underlying climate influences, responsible for the change in vegetation greenness along the gradient indicated by the arrowed line.



(Marks: 4)

Question 8A

Describe the concept of antecedent moisture. Using diagrams where appropriate, describe the state of a catchment experiencing: a) high antecedent moisture; and b) low antecedent moisture.

(Marks: 4)

Question 9A

Using diagrams where appropriate, describe the relative volumes and connectivity of catchment water stores for: a) a perennial stream: and b) an ephemeral stream.

(Marks: 4)

Question 10A

Using diagrams and accompanying text as appropriate, explain the different timescales of streamflow variability.

(Marks: 4)

Section B

Short Essay Questions

Total Number of Marks for this Section: 60

ANSWER **ANY 4** OUT OF 6 QUESTIONS IN THIS SECTION

This section should be answered in the Answer Booklet provided.

Marks for each question are indicated. Suggested time allocation for Section B: 100 mins

ANSWER ANY 4 OUT OF 6 QUESTIONS IN THIS SECTION.

Clearly indicate the question number alongside your answer.

Question 1B

You have been asked to produce a sustainable yields assessment for a catchment in Northern Australia that is targeted for agricultural development.

Explain how you would go about conducting the assessment (describe your approach and methods). Discuss any limitations of your approach and their potential implications.

(Marks: 15)

Question 2B

You have been asked to assess whether recent low flows which resulted in negative ecological impacts in a southern Australian catchment are “natural” or are the result of extracting water from the system for consumptive uses such as agriculture.

Explain how you would go about conducting your assessment (describe your approach and methods). Discuss any limitations of your approach.

(Marks: 15)

Question 3B

Using diagrams where appropriate describe: a) the broad spatial pattern of water availability across the Australian continent; and b) the climate factors driving water availability in different parts of the continent.

(Marks: 15)

Question 4B

In March, a member of the Australian parliament, claimed that the only way to meet the needs of both the environment and irrigators in the Murray-Darling Basin was to introduce a “new water source”.

The member of parliament was referring to the Bradfield scheme, a scheme to turn back the rivers of the Queensland coast, through inland Australia and into the Darling River.

Explain the potential hydrological and ecological impacts and benefits of the scheme.

(Marks: 15)

Question 5B

A recent paper (Freund et al. 2017) argued that the droughts which have affected southern Australia over the past ten years are without precedent in the past 400 years, while at the same time demonstrating northern Australia is wetter than it has been for the past 800 years.

Explain how studies like this are able to reconstruct hydroclimate patterns prior to the advent of stream gauge records, that is, how can we develop hydroclimate records that are up to 800 years long when stream flow records in Australia are only approximately 100 years long. Discuss the advantages and limitations of such approaches.

(Marks: 15)

Question 6B

The Tallowa Dam on the Shoalhaven River supplies water for the city of Sydney. Following its construction, fish communities downstream of the dam have become more fragmented and once common species have declined in abundance.

Explain the possible causal mechanisms of the changes to the fish communities downstream of the dam. In addition, explain how you would go about testing which of your identified possible mechanisms was the most likely cause.

(Marks: 15)

