

**The University of Melbourne
Semester 2 Assessment 2007**

**School of Agriculture and Food Systems
208-123
Agricultural Engineering**

Number of Student:
Reading Time: 10 minutes
Writing Time: 3 hours
Total Marks: 195 Marks

This paper has 7 pages in total.

Authorised Materials:

Students may use any calculators, rulers etc.

Instructions to Invigilators:

Students will require examination booklets in which to answer questions.

Instructions to Students:

Answer all questions
Answer all questions in the examination booklets provided EXCEPT for QUESTION 11
Read all questions carefully
No part of the examination material may be removed from the examination room

Paper to be held by Library: Yes

1. The domestic electrical system here in Australia is based on power supplied at 240 V_{RMS} (50 Hz) AC. It has been determined that an electrical heater to be installed in a piggery, which is effectively a large resistor, must produce 1 kW of heat.
 - (a) Determine the current that must flow through the heater and therefore the actual resistance of the heater elements.
 - (b) Three of these electrical heaters are to be installed in the piggery. The circuit from which these heaters are fed is rated at 15 Amps. Can the circuit support these heaters?

(8 + 2 = 10 Marks)

2. Using an appropriate diagram, describe the electrical generation system (ie. from coal to electrical power in the grid) used in Australia.

(10 Marks)

3. Identify 5 strategies, which are used to improve the performance of engines.

(10 Marks)

4. Convert the following SI units:
 - (a) 875 mm to metres.
 - (b) 158 centilitres to litres.
 - (c) 300 litres to cubic metres.
 - (d) 101,300 Pascals to Megapascals
 - (e) 1.2 kilohertz to Hertz

(5 Marks)

5. With the aid of appropriate diagrams explain in detail the operation of a 2 stroke, Diesel engine.

(10 Marks)

6. Given a cool room is operating at 1°C and the external temperature is 28°C , calculate the rate that heat travels through the walls of the store. Use the following information to assist you in your analysis. Surface area is 420 m^2 , the conductance (U) of the walls is $0.63 \text{ W}/(\text{m}^2 \text{ }^{\circ}\text{C})$, the heat transfer equation is $Q=UA\Delta T$ and the answer should be in watts.

(10 Marks)

7. Given the following information.

Task	Must Follow	Expected Time (in Days)
A	None	9
B	A	12
C	B	3
D	A and F	7
E	D	11
F	C and B	8
G	E	14
H	D	5

- (a) Draw a PERT chart.
- (b) Identify the Critical Path of this project
- (c) How long should the project take from start to finish?

(4 + 4 + 2 = 10 Marks)

8. Explain the concept of “reaction torque” and indicate its importance in tractor safety. As part of your answer, highlight ways in which tractor safety can be improved.

(10 Marks)

9. A "deep ripper" plough is to be pulled by a tractor. The blade of the ripper cuts at a depth of 1000 mm and is 50 mm wide. If it is to be used in medium soil with a resistance of approximately 70 kN m^{-2} :

- (a) What is the force acting on a single blade?
- (b) If the tractor has a drawbar power of 18 kW, how many individual blades can be mounted on a frame for the tractor to pull at a speed of 7 km/hr?

(5 + 5 = 10 Marks)

10. Describe and contrast “chilling injury” and “freezing injury” in agricultural produce.

(10 Marks)

11. Complete the following survey results table:

BS	IS	FS	Rise	Fall	RL	Remark
0.30						Bench Mark
	3.90					
	1.05					
0.80		2.70				Instrument Change
	1.80					
	1.30					
	3.00					
0.95		3.50				
	2.98					
		3.1				
						Totals
						Error =

(10 Marks)

12. Explain how satellite imagery can be used to monitor vegetative growth on a continental scale, highlighting the important features of different parts of the electromagnetic spectrum and how they can be combined to calculate how healthy plants are.

(10 Marks)

13. Explain how the global positioning system (GPS) works. Identify potential sources of error and estimate the usual level of error that could be expected from a single hand held receiver.

(10 Marks)

14. Using Apples as an example describe three of the processes that continue after harvest and are important in changing the quality of the produce. Include in your answer, for each process, what component/s of quality it changes.

(10 Marks)

15. Describe the recommended process of whole farm planning which is applied to dryland farming in Victoria. Your response should cover the classification of soils and types of land, paddock configurations and layout, laneways, land degradation and water supply.

(10 Marks)

16. You are required to assess a site for potential development as a small beef feedlot catering for less than 1000 head. If the feedlot is to be located between the College and Violet Town, what factors would you need to consider in planning the facility?

(10 Marks)

17. It is proposed to install an underground concrete water tank as part of a proposed winery development. The intended site is subject to high and fluctuating water tables. If the tank is a cylinder with a diameter of 4 m and a height of 3 m:

- (a) Will there be any concern with the rising water tables?
- (b) What depth of water should be maintained in the tank for stability?

Note: density of water = 1000 kg/m^3 and the empty weight of the tank is 7.5 tonnes.

(5 + 5 = 10 Marks)

18. A tank, with a height of 10 m, provides reticulated water supply to a farm. If a 50 mm diameter polyethylene pipe, which is 200 m long, is connected to the tank and yields a flow of 2 litres/sec:

- (a) What pressure (or head) of water would be registered at the end of the pipe?
- (b) How could this pressure be increased?

(3 + 7 = 10 Marks)

19. A concrete channel of rectangular cross section is delivering water 0.5 m deep and 3 m wide. If the flow rate is 8 ML/day:

- (a) What velocity of flow would be registered?
- (b) If the depth of water was increased to 0.75 m, how would the discharge be impacted?

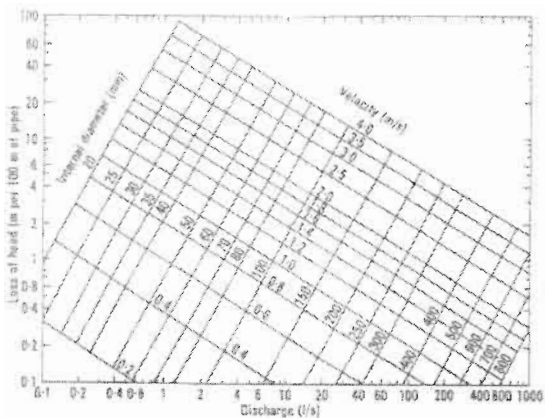
(3 + 7 = 10 Marks)

20. Answer the following:

- (a) Why do recent water reform projects in Victoria focus on the replacement of channels and dams with pipes and tanks despite the costs of infrastructure?
- (b) Under these reforms, what are the potential consequences to both irrigated and dryland farm development?

(5 + 5 = 10 Marks)

AGRICULTURAL ENGINEERING DEPARTMENT
HYDRAULICS SECTION
PIPE FLOW

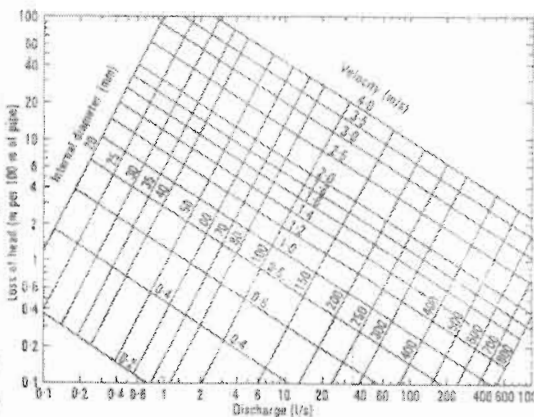


Friction loss in pipes with low friction
Approximate capacities of pipes of various sizes

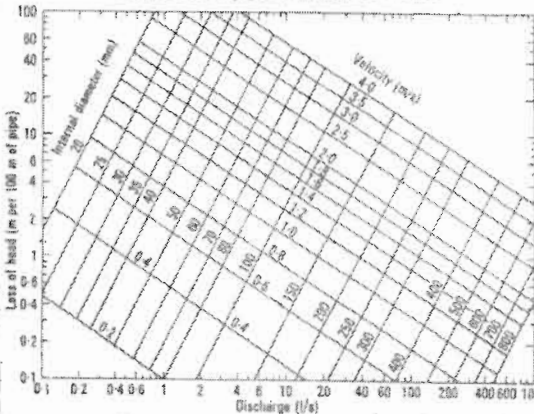
Metric sizes (flow not exceeding 2 m/s)		English sizes (flow not exceeding 6 ft/s)	
Diameter (mm)	Flow (l/s)	Diameter (in)	Flow (gal/min)
50	3	2	48
75	8	2 3/4	75
100	15	3	110
125	20	4	200
150	35	5	300
175	50	6	450
200	60	8	800
225	80	10	1250
250	100	12	1700
300	150	18	3700

Head losses in pipe fittings

Pipe size (mm)	Length of straight pipe with similar head loss (m)		
	50 mm	75 mm	100 mm
Elbows and bends	1.25	1.75	3.0
T-junctions	3.0	4.5	6.0
Quick couplers	1.50	1.5	1.5
Semi-quick couplers			



Friction loss in pipes with medium friction



Friction loss in pipes with high friction

Roughness characteristics of pipes of various materials

Roughness category	Material				
	Plastic	Asbestos/cement	Aluminium	Galvanized	Concrete
Low friction	No constriction at joints, for example, taper-fit or solvent-welded	With smooth joints	Permanent	New	
Medium friction	Some constriction at joints, for example, butt-welded		Portable		Spun concrete with gasket joints
High friction				Old	(a) Precast with gasket joints (b) Cast in situ

End of Examination