MAHARASHTRA AGRICULTURAL UNIVERSITIES EXAMINATION BOARD, PUNE
SEMESTER END THEORY EXAMINATION
B.Tech. (Agril. Engg.)

Semester	: **V (New)**	Term	: **First**	Academic Year	: **2022-23**
Course No.	: **FMPE 358**	Title	: **Farm Machinery and Equipment-I**		
Credits	: **2 (1+1)**				
Day & Date	: **Tuesday, 11.04.2023**	Time	: 14:00 to 16:00 hrs.	**Total Marks**	: **40**

Note :
1. Solve **ANY EIGHT** questions from **SECTION 'A'.**
2. All questions from **SECTION 'B'** are compulsory.
3. All questions carry equal marks.
4. Draw neat diagram wherever necessary.

SECTION 'A'

Q.1 a) State the benefits of farm mechanization and limiting factors in farm mechanization.

b) Enlist the factors to be considered while selection of farm machinery and explain any two of them.

Q.2 Draw a neat labeled diagram of disc plough and explain its different parts.

Q.3 a) Enlist the objectives of tillage.

b) Two bullocks weighing 400 kg each are pulling an implement with a speed of 3 km/h. Find the power developed by the bullocks.

Q.4 Enlist the items to be considered for estimation of fixed and operating cost of equipment. Explain the procedure for estimation of fixed cost.

Q.5 How much area can be covered by a spike tooth harrow of 1.5 m width in a day of 8 hours with bullock pair? If each spike of the harrow is giving 1 kg resistance, when there are 50 spikes. What power would be necessary for the bullocks to pull the harrow, if the travel speed is 4 km/h?

Q.6 What is seed drill? Explain the procedure of seed-cum-fertilizer drill calibration.

Q.7 What are the different types of furrow openers used on seed sowing equipment? Explain any three with neat diagrams.

Q.8 A seed plate of planter turns one revolution for two revolutions of ground wheel. The ground wheel has an effective circumference of 2 m and the seed plate has 16 cells. What will be the seed to seed distance in the row?

Q.9 What are the different types of forces that act on the tillage tool? Write the expression for draft, vertical force and side force acting on tillage tool.

Q.10 What is mole drainage? Explain about Tractor mounted mole drainer.

SECTION 'B'

Q.11 Fill in the blanks:

1) _____ is the angle at which the plane of cutting edge of disc is inclined to the direction of travel.

2) If the speed of travel of an animal drawn seed drill is doubled, then the seed rate will _____.

3) _____ is the force between soil and metal.

4) _____ is a miniature m.b. plough.

(P.T.O.)

Q.12 State True or False:

1) Gang angle helps the m.b. plough to cut the proper width of furrow slice.

2) In case of pneumatic planters, fluted roller type seed metering mechanism is used.

3) Landside helps to absorb the side thrust during ploughing.

4) Sweeps should be operated as deep as possible to prevent pruning the roots from the crop plants.

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Semester	: **V (New)**	Term	: **First**	Academic Year	: **2022-23**
Course No.	: **SWCE 355**	Title	: **Water Harvesting and Soil Conservation Structures**		
Credits	: **3 (2+1)**				
Day & Date	: **Wednesday, 12.04.2023**	Time	: 14:00 to 17:00 hrs.	**Total Marks**	: **80**

Note :
1. Solve **ANY EIGHT** questions from **SECTION 'A'.**
2. All questions from **SECTION 'B'** are compulsory.
3. All questions carry equal marks.
4. Draw neat diagram wherever necessary.

SECTION 'A'

Q.1 Explain in detail the design steps of permanent gully control structures.

Q.2 Explain in detail types of earthen dams.

Q.3 Explain chute spillway with respect to the following points:

a) Functional uses b) Adaptability c) Advantages d) Limitations

Q.4 What is hydraulic jump? Explain in brief loss of energy in hydraulic jump. Write any four applications of hydraulic jump.

Q.5 A masonry dam is 5 m high, 1.0 m wide at the top and 4.0 m at the bottom and has a vertical water face. The dam impounds water to a height of 4.0 m. Calculate the magnitude of the resultant force and its point of application with the base, when the reservoir is full and when it is empty. Given the density of masonry as 2.2 g/cc and that of water is 1.0 g/cc.

Q.6 Determine the capacity of a 762 mm diameter corrugated culvert 18.29 m long with a square edged entrance. Elevation of the inlet invert is 127.92 m and the elevation of the outlet invert is 127.71 m. Headwater elevation is 129.54 m and tail water elevation is 126.80 m. Assume K_e= 0.5 and K_c = 0.112.

Q.7 Calculate following dimensions for a drop spillway for 4 m crest length and 1.0 m height of crest. The drop is 2 m ;

1. Minimum length of head wall extension, E
2. Length of apron or basin, L_B
3. Height of wing wall and side wall at junction, J
4. Parameters M and K for side wall

Q.8 a) Explain in brief types of farm ponds.

b) Calculate the volume of excavation required to construct a dugout type farm pond, if ;

1. Average depth of pond is 4.5 m
2. Bottom width is 12 m
3. Bottom length is 25 m
4. Side slope to be used as 2:1

(P.T.O.)

Q.9 a) Define long term runoff harvesting and write the design criteria for constructing the structures.

b) Calculate the ratio of catchment area to cultivated area for design of water harvesting structure, if the essential information of the catchment are given as below:

1. Crop - Sorghum or maize, water requirement = 575 mm.
2. Design rainfall = 380 mm (equal to or less than) at 33% probability level.
3. Runoff coefficient of the catchment = 0.13

Q.10 Discuss in brief short term runoff harvesting techniques.

SECTION 'B'

Q.11 State True or False:

1) Saint Anthony Falls type of outlet is mostly preferred in chute spillway.
2) To avoid tension within the structure, the eccentricity should not be more than b/6 on either side of middle of the base ('b' base width).
3) Structural design involves the determination of strength and stability of different parts of structure.
4) Reynolds number is a ratio of inertia force to viscous force.
5) If slope of conduit of a culvert is greater than the neutral slope and outlet is not submerged, orifice flow condition will prevail.
6) Vertical walls extending into soil foundations under the inlet to prevent the seepage under the structure are known as toe walls.
7) Drop inlet spillway is an open channel with a steep slope, in which flow is carried at supercritical velocities.
8) When Fraude number, F = 1, flow is said to be in super critical state.

Q.12 Fill in the blanks:

1) _____ is the component of hydraulic structure to provide more stability to outlet.
2) _____type of an earthen dam does not include core wall.
3) Design of permanent gully control structure is done for the return period of _____ years.
4) In SAF stilling basin, the width and spacing of chute block is _____.
5) Farm pond is a structure used for _____.
6) Continuous flow of seepage water through the body as well as foundation of the dam is the main reason for _____.
7) Drop spillway is an efficient structure for controlling relatively low heads normally up to _____ m.
8) In case of F ≥ _____, a strong hydraulic jump will take place.

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Semester	: **V (New)**	Term	: **First**	Academic Year	: **2022-23**
Course No.	: **IDE 353**	Title	: **Groundwater, Wells and Pumps**		
Credits	: **3 (2+1)**				
Day & Date	: **Thursday, 13.04.2023**	Time	: 14:00 to 17:00 hrs.	**Total Marks**	: **80**

Note :
1. Solve **ANY EIGHT** questions from **SECTION 'A'.**
2. All questions from **SECTION 'B'** are compulsory.
3. All questions carry equal marks.
4. Draw neat diagram wherever necessary.

SECTION 'A'

Q.1 a) Explain how performance of centrifugal pump varies due to speed and diameter of impeller.

b) Explain in detail recovery method of estimation of aquifer parameters.

Q.2 a) A masonry well is to be constructed in a fine sand subsoil formation. The discharge of a well is anticipated to be 15 m^3/hr under depression head of 4 m. Determine the diameter of the well. The specific yield for fine sand subsoil formation is 0.5.

b) Enlist and explain with neat diagram the performance curves of centrifugal pump.

Q.3 Derive the equation for steady state flow to wells in unconfined aquifer.

Q.4 a) Enlist different methods of surface and subsurface investigation of ground water.

b) Differentiate between Volute centrifugal pump and Diffuser centrifugal pump.

Q.5 a) Give principle of operation and classification of centrifugal pump.

b) Explain in detail the concept of well interference.

Q.6 a) A pump lifts 1,00,000 liters of water per hour against a total head of 20 m. Compute the water horse power. If pump has an efficiency of 75 %, what size of prime mover is required to operate the pump? If a direct drive electric motor with an efficiency of 80 % is used to operate the pump, compute the cost of electrical energy in a month of 30 days. The pump is operated for 12 hours daily for 30 days. The cost of electrical energy is Rs. 2 per unit.

b) Explain about counter poise bucket lift.

Q.7 a) A well in a confined aquifer is pumped at a constant rate of 1500 lit/min. The drawdowns were measured in the piezometer after 60 min of pumping. The tests work as follows:

Distance of piezometer from center of the well, m	3	9	40	90
Drawdown	6.5	4.75	3.0	1.5

Using the test results, calculate transmissibility values of different sections and the average transmissibility.

b) Explain the principle of operation and construction of submersible pump.

(P.T.O.)

Q.8 a) Enlist and explain types of impeller used in centrifugal pump.

b) Enlist different properties of aquifer and explain any one.

Q.9 Write short notes on (Any Two):

a) Hydraulic direct rotary drilling

b) Multiple well system

c) Priming of centrifugal pump

Q.10 a) How can we determine the age of ground water?

b) Explain how gravel pack for the tube well is selected.

SECTION 'B'

Q.11 State True or False:

1) Priming is essential in submersible pump.

2) If two pumps are connected in series, their discharge will increase.

3) If piezometric head and phreatic head lower simultaneously, the well is called well with prompt yield.

4) Head and discharge are inversely proportional in centrifugal pump.

5) Hoop stress developed in well lining is the maximum and twice the radial stress.

6) Leakage factor is the property of confined aquifer.

7) Weep holes in the well lining are for entry of water into the well.

8) Gravel pack is essential in hard rock formation.

Q.12 Fill in the blanks:

1) Water which is out of contact of atmosphere is called as _____.

2) _____ is saturated; but cannot transmit water.

3) _____ type impeller is used for water containing considerable amount of small solids.

4) Minimum thickness of the gravel pack is _____.

5) Well lining should be designed for _____ stress.

6) The per cent open area for well screen should be_____%.

7) Depth of shallow tube well is _____.

8) Ratio of mean grain size of pack to mean grain size of formation is called _____.

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Semester	: **V (New)**	Term	: **First**	Academic Year	: **2022-23**
Course No.	: **PFE 355**	Title	: **Dairy and Food Engineering**		
Credits	: **3 (2+1)**				
Day & Date	: **Saturday, 15.04.2023**	Time	: 14:00 to 17:00 hrs.	**Total Marks**	: **80**

Note :
1. Solve **ANY EIGHT** questions from **SECTION 'A'**.
2. All questions from **SECTION 'B'** are compulsory.
3. All questions carry equal marks.
4. Draw neat diagram wherever necessary.

SECTION 'A'

Q.1 Explain in brief physical and chemical properties of milk.

Q.2 Enlist methods of milk pasteurization and explain in detail HTST pasteurization.

Q.3 Skim milk is prepared by the removal of some of the fat from whole milk. This skim milk is found to contain 90.5% water, 3.5% protein, 5.1% carbohydrate, 0.1% fat and 0.8% ash. If the original milk contained 4.5% fat, calculate its composition assuming that fat only was removed to make the skim milk and that there are no losses in processing.

Q.4 Write process flow chart of following (Any Two):

a) Butter b) Ice cream c) Cheese

Q.5 Describe the term homogenization. Give the function and operation of poppet valve with neat diagram.

Q.6 a) Enlist basic factors affecting rate of evaporation process.

b) Write short note on vacuum evaporation.

Q.7 Explain distillation process with the help of boiling temperature diagram.

Q.8 Write short notes on (Any Two):

a) Membrane separation b) Cleaning-in-place c) Filtration

Q.9 If a slab of meat is to be frozen between refrigerated plates with plate temperature -34°C, how long will it take to freeze, if the slab is 10 cm thick and the meat is wrapped in cardboard 1 mm thick on either side of the slab? Assume that for the plate freezer, the surface heat transfer coefficient is 600 J m^{-2} s^{-1} $°C^{-1}$, the thermal conductivity of cardboard is 0.06 J $m^{-1}s^{-1}°C^{-1}$, the thermal conductivity of frozen meat is 1.6 J m^{-1} s^{-1} $°C^{-1}$, and its latent heat is 2.56 x 10^5 J kg^{-1} and density 1090 kg m^{-3}. Assume also that meat freezes at -2°C.

Q.10 Classify various methods of food preservation in detail.

(P.T.O.)

SECTION 'B'

Q.11 Fill in the blanks:

1) The _____ has two principal functions, to exchange heat and to separate the vapour that is formed from the liquid.
2) Liquid and vapour coexist in equilibrium only under the conditions along the line called as _____ line.
3) Rate of filtration = _____.
4) In filtration, if the filter resistance is large to the resistance of the filter cake, the filtration is called as _____.
5) The force producing to flow of water from a dilute solution to the more concentrate one is called as _____ pressure.
6) The homogenization of ice-cream mix is satisfactory, if _____ per cent of the globules are under 2 micron in diameter.
7) The fat globules in normal milk are usually in sizes varying from _____to _____ micron.
8) In thermal processing, the most commonly used indicator organism is _____.

Q.12 State True or False:

1) In typical Indian butter, the per cent of butter fat is 80%.
2) Molar concentration is the number of molecular weight of the solute expressed in kg in one cubic meter of the solution.
3) The average specific gravity of milk may be taken as 1.302.
4) Added water lowers the freezing point of milk.
5) Adding citric acid to milk in cheese making is commonly known as setting.
6) Filtration is a separation process separating components in a mixture by making use of the fact that some components vaporize more readily than others.
7) The object of sterilization is to destroy all microorganisms i.e. bacteria, yeasts and moulds.
8) The heat exchanger in evaporator is called as calandria.

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Semester	: **V (New)**	Term	: **First**	Academic Year	: **2022-23**
Course No.	: **REE 354**	Title	: **Renewable Power Sources**		
Credits	: **3 (2+1)**				
Day & Date	: **Monday, 17.04.2023**	Time	: 14:00 to 17:00 hrs.	**Total Marks**	: **80**

Note :
1. Solve **ANY EIGHT** questions from **SECTION 'A'.**
2. All questions from **SECTION 'B'** are compulsory.
3. All questions carry equal marks.
4. Draw neat diagram wherever necessary.

SECTION 'A'

Q.1 What are the impacts of fuel properties on gasification?

Q.2 a) What are the basic components of a WECS (Wind Energy Conversion System)?

b) Explain in detail about the power in the wind.

Q.3 a) Explain the four different stages of gasification process.

b) What is fluidized bed gasification? Write about two main types of fluidized bed gasification.

Q.4 a) Enlist the basic components of biogas plants.

b) Explain the working of KVIC biogas plant with diagram.

Q.5 a) Give the classification of photovoltaic system.

b) Explain efficiency of solar cells.

Q.6 a) What are the applications of solar photovoltaic system?

b) Enlist the various advantages of solar photovoltaic system.

Q.7 a) Give the classification of small hydro power stations.

b) What are the components of hydroelectric scheme?

Q.8 Explain three types of OTEC systems that can be used to generate electricity.

Q.9 What are the benefits of Ocean Thermal Energy Conversion (OTEC)?

Q.10 What is energy? Describe three types of energy sources.

SECTION 'B'

Q.11 Define the following terms:

1) Bulk density
2) Fuel cell
3) Dulong's formula
4) Retention time
5) Swept area
6) Coefficient of performance (Cp)
7) Tip speed ratio
8) Capacity factor

(P.T.O.)

Q.12 Fill in the blanks:

1) Solar drying and solar heating are economical applications, when _____ methods are used.

2) The heating value of producer gas varies from _____to 6 MJ/m^3.

3) The normal temperature in the primary pyrolysis zone is _____to _____^oC.

4) The conversion of DC power to AC power can be achieved using a device called_____.

5) Solar photovoltaic technology is the direct conversion of sunlight into_____.

6) Solar cells are _____that convert sunlight into direct current electricity.

7) A typical silicon PV cell produces about _____under open circuit, non-load conditions.

8) The theoretical maximum power that may be captured by a wind machine was shown by Betz, is _____.

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Semester	: **V (New)**	Term	: **First**	Academic Year	: **2022-23**
Course No.	: **FS 355**	Title	: **Agricultural Structures, Storage Engineering and Environmental Control**		
Credits	: **3 (2+1)**				
Day & Date	: **Tuesday, 18.04.2023**	Time	: 14:00 to 17:00 hrs.	**Total Marks**	: **80**

Note :
1. Solve **ANY EIGHT** questions from **SECTION 'A'.**
2. All questions from **SECTION 'B'** are compulsory.
3. All questions carry equal marks.
4. Draw neat diagram wherever necessary.

SECTION 'A'

Q.1 What are the objects of treatment of water? Explain water treatment process.

Q.2 a) What are the factors to be considered while planning of dairy barn?

b) What are the various types of dairy barn? Explain in detail about stanchion barn.

Q.3 a) What is farm fencing? Explain electric fencing in detail.

b) Calculate the cost of fencing a square farm of 25 hectare fenced by barbed wire using angle iron posts. Make necessary assumptions.

Q.4 Enlist the types of poultry house. Explain in detail about cage type poultry house with neat sketch.

Q.5 a) State and explain various heads on which rural sanitation is being carried out.

b) What is septic tank? Explain factors which govern the design of septic tank.

Q.6 a) What are the requirements of good storage structures?

b) Enlist the types of storage structures. Explain Morai type storage structure.

Q.7 a) Explain various rooms of improved farm house with plan.

b) What is farmstead? Explain size and arrangement of farmstead.

Q.8 Explain design procedure for pit silo and trench silo.

Q.9 a) Explain in detail the temperature and moisture changes in storage structures.

b) What are the functions of ventilation system in building?

Q.10 Write short notes on:

a) Sheep housing

b) Farm machinery storage structures

(P.T.O.)

SECTION 'B'

Q.11 Fill in the blanks:

1) The _____ are the most important from the public health point of view.
2) Capacity of Kothar type storage structure ranges from _____ tonnes.
3) _____ poultry houses are generally built-in warm regions, where birds needs no protection from cold winds.
4) Farmstead area usually varies from _____% of the farm area.
5) Disinfection of drinking water involves removal of _____.
6) To prevent spoilage, silage should be removed at the rate _____ per day.
7) For potable water, the permissible pH value is _____.
8) Open air barn type of dairy barn, is also called as_____.

Q.12 Define the following terms:

1) Feed alley
2) Rural sanitation
3) Milking parlour
4) Aeration
5) Sensible heat
6) Bore hole privy
7) Homoeothermic
8) Humidity

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