Roll No.

Candidate should write his/her Roll No. here.

Total No. of Questions : **7** No. of Printed Pages : **7**

SEM-2014(04)
AGRICULTURAL ENGINEERING
Paper – I
(Soil & Water Engineering)

Time : **3** Hours] [Total Marks : **300**

Instructions to the candidates :

1. Each question is of **60** marks.
2. Q. **1** is compulsory.
3. Attempt **five** questions in all.
4. All questions carry equal marks. The number of marks carried by part of a question is indicated against it.
5. Answer must be written ENGLISH only.
6. Neat sketches may be drawn, wherever required.
7. All parts and sub-parts of a question are to be attempted together in the answer book.

1. (a) What do you understand by ground water potential of an area ? 6

(b) After irrigation of a field, the application efficiency (E_a) was found as 85% but the storage efficiency (E_s) was found as 50%. If you agree with these findings, explain how it could be possible ? 6

(c) In a watershed of 100 ha, maximum length of flow path is 3 km and average slope of this channel is 5 percent. Compute the time of concentration. 6

(d) Trenching is needed on a irregular shaped hillock, what would you prefer a continuous contour trenching or staggered contour trenching and why ? 6

(e) For irrigating an area of 10 ha land, what should be the pump capacity, if net depth of water application is 5.0 cm, irrigation interval is 6 days, working hours per day is 4 hours and field application efficiency is 0.90 ? 6

(f) Calculate the pressure variation in lateral line of sprinkler system, if discharge at first and last sprinkler head are 0.05 m^3/s and 0.03 m^3/s respectively and pressure at first sprinkler is 25 m. 6

(g) Enlist agronomic measures for soil conservation. Explain any one. 6

(h) Describe 'Radiation' method of plane table survey. 6

(i) Sketch canal water distribution system from reservoir to field. 6

(j) Discuss pump characteristics curves. 6

2. (a) Design a parabolic shaped grassed waterway to carry a flow of 3 cum/sec down a slope of 4%. An excellent stand of dub grass is to be maintained in the waterway. Assume necessary dimensions and other related values. 20

(b) The following consecutive readings were taken with a dumpy level :

0.894	1.643	2.896	3.016	0.954	0.692
0.582	0.251	1.532	0.996	2.135	

The instrument was shifted after the fourth and the eighth readings. The first reading was taken on the staff held on the bench mark of R.L. 820.765. Calculate the reduced levels of the points and show the usual checks. What is the difference of level between the first and last points ? 15

(c) Discuss importance of PRA in watershed development programme. 15

(d) A farm pond is constructed in part of flat field by excavation. Another embankment type pond of the same size that of farm pond is constructed in a slopy field. Which type of pond may have higher tendency to breach and why ? Differentiate between water harvesting farm pond and a percolation pond. 10

(a) A stream of 135 litres per second was diverted from a canal and 100 litres per second was delivered to the field. An area of 1.6 ha was irrigated in eight hours. The effective depth of root zone was 1.8 m. The run-off loss in the field was 432 cum. The depth of water penetration varied linearly from 1.8 m at the head end of the field to 1.2 m at the tail end. Available moisture holding capacity of the soil is 20 cm per meter depth of soil. Determine the water conveyance efficiency, water application efficiency, water storage efficiency and water distribution efficiency. The irrigation was started at a moisture extraction level of 50 percent of the available moisture. 30

(b) How can an Agricultural Engineer increase water productivity in a canal command area ? 15

(c) Differentiate between a contour bund and a graded bund. 5

(d) Classify terraces. 10

4. (a) Discuss Drip irrigation on following points :

(i) Past, present and future need in India.

(ii) Crop suitability.

(iii) Automation in water application. 30

(b) Like 'Yantra Doot Yojna', what other scheme would you suggest as an Agricultural Engineer for rural upliftment programme ? 10

(c) Describe concept of 'command area'. 5

(d) Describe 'Gully control structure' under following head :

(i) requisites

(ii) construction site

(iii) safety 15

5. (a) Give detailed design consideration of sprinkler irrigation system. 30

(b) Discuss Ernst's drain spacing equation for two layered soil. 15

(c) What is Bio-drainage ? Explain with example. 15

6. (a) The topographic survey of a field gave the following elevation (in metre) at grid points : **20**

	1	2	3	4	5
A	10.65	10.43	10.07	9.68	9.67
B	10.47	10.42	9.95	9.84	9.75
C	10.32	10.08	9.92	9.65	9.48
D	9.89	9.48	9.67	9.41	9.13

Calculate the elevation of the centroid of the field. Stakes are to be put to guide the leveling of this field into a playground. Calculate cut or fill at the grid points. Compare the quantities of earthwork in cut and fill.

(b) A watershed has five non-recording rain gauges installed in its area. The annual rainfall recorded for one of the year is as follows :

Rain gauge station	I	II	III	IV	V
Annual rainfall (cm)	90.0	110.0	175.0	95.0	125.0

Determine the optimum number of non recording and recording rain gauges for this watershed. Assume an area of 10% in the estimation of mean rainfall. **15**

(c) Give a detailed designed consideration for water harvesting pond. **15**

(d) Give importance of irrigation in agriculture. **10**

7. (a) A drop structure is proposed for construction in the gully. The drop height of the gully is 2.0 m. The peak discharge is 25 m^3/s in 50 years duration. Rectangular weir is used for allowing the water with opening length may be taken as 8.5 m. The tail water depth is 0.55 m. Calculate the dimensions of following components of the structure :

(i) Head wall

(ii) Side wall

(iii) Wing wall

(iv) Apron

(v) Cut-off wall

Assume coefficient of discharge = 1.77 and weighted creep ratio as 4.0. **30**

(b) Enlist engineering / mechanical measures for soil conservation. Describe any two in detail. **30**

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Total No. of Questions : **5** No. of Printed Pages : **7**

SEM-2014(04)
AGRICULTURAL ENGINEERING
Paper – II

Time : **3** Hours] [Total Marks : **300**

Instructions to the candidates :

1. There will be ***two*** descriptive type papers, each of ***300*** marks.
2. The candidate has to attempt ***five*** questions from each paper.
3. Each question will be of ***60*** marks.
4. Question number **1** in each paper is compulsory.
5. Question number **1** is of short answer type having ***10*** questions (from (a) to (j)) each of **6** marks.
6. Question number **2, 3, 4** and **5** have internal choice.
7. Calculator is allowed.

1. Each question carries **6** marks. **All** questions are compulsory.

(a) What is concept of farm mechanization ? Give the benefits of farm mechanization.

(b) Explain planetary type final drive with neat sketch.

(c) Give comparison between compression ignition and spark ignition internal combustion engines.

(d) A chaff cutter having two knives, cuts dry hay at 60 revolutions/minute, giving 480 kg/h. If the throat size is 18×6 cm, find the effective density of dry hay in kg/m^3 for theoretical length of cut of 2.5 cm.

(e) What is brake ? Enlist different types of brakes.

(f) Enlist different methods of preservation of fruits and vegetables.

(g) Determine the fineness modulus, uniformity index and average particle size from the following observations.

IS sieve No.	100	70	50	40	30	20	15	Pan
Weight of material retained (g)	0.0	1.4	16.7	36.7	82.2	96.0	8.0	9.0

(h) For a research project on grain storage, 8000 kg of paddy with 12% moisture content (dry basis) is required. It was decided that freshly harvested paddy available with 20% moisture content (wet basis) should be procured and after drying to 12% (dry basis) be used for research purpose. How much of freshly harvested paddy be procured for the research project ?

(i) What are the mechanical models to interpret the rheological behaviour of linear viscoelastic materials ? Give the electrical equivalence of these mechanical models.

(j) What is Hazard Analysis and Critical Control Point (HACCP) ? Explain in brief the principles of HACCP.

Solve any **four** out of **five** sub-questions given below. Each sub-question carries **15** marks.

(a) What are the steps to be followed in calibration of seed drill ?

(b) Explain in brief the procedure to estimate the cost of tractor power.

(c) Explain in brief the working principle of power thresher with well labelled diagram.

(d) A diesel tractor has three cylinder, four stroke engine. The cylinder diameter is 88.9 mm, length of stroke is 127 mm, compression ratio is 16:1, brake horse power is 32 and engine speed is 2000 rpm.

Calculate :

(i) Stroke bore ratio,

(ii) Piston displacement,

(iii) Piston speed in m/s,

(iv) Displacement volume in litre,

(v) Mean effective pressure.

(e) What basic operations are carried out by Harvesting combines ? What are the points to judge the performance of harvesting combines ?

3. Solve any **four** out of **five** sub-questions given below. Each sub-question carries **15** marks.

(a) What are the main parts of steering system ? Describe in brief the working of mechanical steering system.

(b) Explain in brief the working of differential system in a tractor with neat sketch.

(c) Draw a neat sketch of hydraulic brake system and explain the operation and working of hydraulic brake system.

(d) Which engine parts need lubrication ? Explain the splash system of lubrication in brief.

(e) Why do we need a gear box in tractor ? Explain in brief the sliding mesh type gear box.

4. Solve any **four** out of **five** sub-questions given below. Each sub-question carries **15** marks.

(a) What are the objectives of par boiling of paddy ? Describe in brief the advantages and disadvantages of par boiling of paddy.

(b) Describe the methods used in size reduction machines. Explain in brief the construction and working of Hammer mill.

(c) Explain with neat sketch the construction and working of vibratory air screen cleaner. During evaluation of an air screen grain cleaner with two screens the following observations were recorded. Compute the cleaning efficiency of the cleaner.

Observations :

(i) The impurities present in feed – 6.5%

(ii) The impurities present in clean grain – 0.5%.

(iii) The overflow of blower contained 0.2% clean seed.

(iv) The overflow of first screen contained 1% clean seed.

(v) The underflow contained 0.5% clean seed.

(d) Explain the Rittinger's and Kick's law. The power required was 8 kW for milling 4.33 mm sized wheat grain to IS sieve 35 (0.351 mm opening) in the experiment. Calculate the power requirement for milling wheat by same mill to IS sieve 15 (0.157 mm opening) using (i) Rittinger's law and (ii) Kick's law if the feed rate of milling is 200 kg/h.

(e) Draw the flow process chart for wet milling of pulses. What are the problems faced by pulse milling industries ? What are the factors affecting the out turn of pulse milling ?

Solve any **four** out of **five** sub-questions given below. Each sub-question carries **15** marks.

(a) Describe in detail the thermal properties of biological material.

(b) Describe the storage losses and damages to the stored products. Explain in short the controlled atmospheric system with its merits and demerits.

(c) What is aeration ? State the benefits of aeration. What are basic design parameters for cooling of grains by aeration ? Enlist the aeration systems and explain with neat sketch the central vertical aeration system in Silos.

(d) What is meant by moisture content, equilibrium moisture content and critical moisture content ? Enlist the methods of moisture content determination and describe any one of them.

(e) What is food spoilage ? Describe in brief the causes of food spoilage.
