

**ROYAL CIVIL SERVICE COMMISSION
BHUTAN CIVIL SERVICE EXAMINATION (BCSE) 2019
EXAMINATION CATEGORY: TECHNICAL**

PAPER III: SUBJECT SPECIALISATION PAPER FOR AGRICULTURAL ENGINEERING

Date	: October 13, 2019
Total Marks	: 100
Writing Time	: 150 minutes (2.5 hours)
Reading Time	: 15 Minutes (prior to writing time)

GENERAL INSTRUCTIONS:

1. Write your Registration Number clearly and correctly on the Answer Booklet.
2. The first 15 minutes is to check the number of pages of Question Paper, printing errors, clarify doubts and to read the instructions. You are NOT permitted to write during this time.
3. This paper consists of **TWO SECTIONS**, namely SECTION A & SECTION B:
 - **SECTION A** has two parts: Part I - 30 Multiple Choice Questions
Part II - 4 Short Answer Questions

All questions under SECTION A are COMPULSORY.

 - **SECTION B** consists of two Case Studies. Choose only **ONE** case study and answer the questions of your choice.
4. All answers should be written on the Answer Booklet provided to you. Candidates are not allowed to write anything on the question paper. If required, ask for additional Answer Booklet.
5. All answers should be written with correct numbering of Section, Part and Question Number in the Answer Booklet provided to you. Note that any answer written without indicating the Section, Part and Question Number will NOT be evaluated and no marks will be awarded.
6. Begin each Section and Part in a fresh page of the Answer Booklet.
7. You are not permitted to tear off any sheet(s) of the Answer Booklet as well as the Question Paper.
8. Use of any other paper including paper for rough work is not permitted.
9. **You are required to hand over the Answer Booklet to the Invigilator before leaving the examination hall.**
10. This paper has **8 printed pages**, including this instruction page.

GOOD LUCK

SECTION A

PART I: Multiple Choice Questions (30 marks)

Choose the correct answer and write down the letter of your chosen answer in the Answer Booklet against the question number e.g. 31 (d). Each question carries ONE mark. Any double writing, smudgy answers or writing more than one choice shall not be evaluated.

1. An instrument whose telescope can be revolve in both horizontal and vertical directions to measure angles and distance is called
 - a) Telescope
 - b) Theodolite
 - c) Compass
 - d) Chain

2. The longest of the chain lines used in making a survey in generally regarded as
 - a) Tie line
 - b) Check line
 - c) Long line
 - d) Base line

3. For land development with modern earth moving equipment, the cut-fill ratio should be
 - a) equal to 1
 - b) equal to 0
 - c) less than 1
 - d) greater than 1

4. The equipment which can pump water to a higher elevation using water at low height but without the use of electrical power is called
 - a) Hydro ram
 - b) Wind pump
 - c) Solar pump
 - d) Electrical pump

5. What is the formula used by the Farm Machinery Corporation while calculating the value of depreciation for the machines?
 - a) $(\text{Machine Cost}-\text{Salvage value})/\text{life in years}$
 - b) $\text{Machine cost}/\text{life in years}$
 - c) $\text{Salvage value}/\text{life in years}$
 - d) $(\text{Machine cost} + \text{salvage value})/\text{life in years}$

6. The velocity of the paper floating on the water in the pipe is 2 m/min. The diameter of the water pipe is 4 m. Find out the approximate discharge in cubic meter/sec.
- 9 cubic m/ sec
 - 18/30 cubic m/sec
 - 33/30 cubic m/sec
 - 3 cubic m/sec
7. Cast iron are used in many of the rice mills as a cover over the main parts in Bhutan and is an example of
- Brittleness
 - Ductility
 - Malleability
 - Resilience
8. Medium carbon steel has a carbon content of
- less than 0.3%
 - range of 0.3% to 0.5%
 - range of 0.5% to 0.8%
 - range of 0.8% to 1.0%
9. The process where Bhutanese black smith practice by heating the metal to red hot and cooling rapidly in water is called
- Annealing
 - Normalising
 - Quenching
 - Tempering
10. The horse power available at crankshaft and measured using a dynamometer is called
- Crankshaft power
 - Brake horse power
 - Indicated horse power
 - Engine power
11. Among two valves (inlet valve and exhaust valve), the size of the inlet valve is
- bigger than the exhaust.
 - smaller than the exhaust.
 - same as the exhaust.
 - None of the above.

12. We cannot use antifreeze in our car in Samdrupjongkhar during summer for low engine performance since the water boiling point
- remains the same.
 - increases.
 - decreases.
 - None of the above.
13. Machines have not been feasible in Bhutan as many of the areas are of steep slopes. If machines are to be used in such areas, the critical design criteria for feasibility is
- machine quality.
 - tilt angle of the machine.
 - tilt angle of plough.
 - centre of gravity of the machine.
14. What is the machine design criteria while designing any types of threshers for use by the Bhutanese farmers?
- Peripheral velocity of the threshing drum.
 - The diameter of the threshing drum.
 - The length of the threshing drum.
 - The revolution of the threshing drum.
15. The three technical mandates of Agriculture Machinery Centre are technology generation, training on farm machines and
- sell of farm machines.
 - repair of farm machines.
 - standards and testing of farm machines.
 - hiring of farm machines.
16. Storage of grains is an important area of intervention needed in Bhutan. What is the primary factor for safe storage?
- Temperature and moisture content.
 - Temperature, moisture content and yield.
 - Temperature and grain quality.
 - Moisture content and rats.
17. Which of the following is the most important factor that will influence the quality of dried grains especially for paddy?
- Air flow rate
 - Moisture content
 - Temperature
 - Place of drying

18. If white smoke comes from farm machines while in operation, it may be because of
- heavy load.
 - injection nozzle clogging.
 - piston rings worn out.
 - air cleaner clogged.
19. What is the main function of alternator in cars and tractors?
- Start the machine.
 - Charge the battery.
 - Charge the dynamometer.
 - Provide alternate current.
20. Combine harvester has become popular in Bhutan especially for paddy farmers. The function of combine harvester is
- harvesting and threshing.
 - harvesting.
 - threshing.
 - reaping and harvesting.
21. Find the peripheral velocity of the rice mill shaft in m/sec, if the diameter of the shaft is 10 cm and the revolution of the shaft is 60 RPM.
- 4.0 m/sec
 - 0.314 m/sec
 - 3.14 m/sec
 - 0.40m/sec
22. The volume of one kg dry air and the water vapour present in the air is called
- specific volume.
 - air volume.
 - atmospheric volume.
 - calorific volume.
23. The recommended moisture content of the paddy for dehusking in Bhutanese condition to avoid cracks is
- 9-10 %
 - 10-12%
 - 13-15%
 - 16-18%

24. What is the recommended temperature of cooling tankers while transporting the milk?
- 1 degree Celsius
 - 2 degree Celsius
 - 3 degree Celsius
 - 4 degree Celsius
25. Which of the following is recommended to be used for holding low temperature for longer duration?
- Liquid Oxygen
 - Liquid Nitrogen
 - Liquid Carbon dioxide
 - Liquid Sulphur
26. Power tiller are very important for farmers in Bhutan. The permissible variation of diesel engine power when tested at Paro based on Bhutan National standard is
- up to 30%
 - up to 25%
 - up to 35%
 - up to 20%
27. The cam shaft is provided with fuel cam, intake cam and also exhaust cam. The function of the fuel cam is to
- release fuel.
 - actuate the injection pump.
 - mix air and fuel.
 - lubrication in the chamber.
28. Under which Department is the Agriculture Machinery Centre placed?
- Department of Agricultural Engineering
 - Department of Agricultural Production
 - Department of Agriculture
 - Department of Agricultural Marketing
29. What is the recommended oil extraction method to extract maximum oil from the oil seeds?
- Mechanical extraction
 - Solvent extraction
 - Impact extraction
 - Streaming extraction
30. The most popular fencing in Bhutan for the past few years is
- Bamboo fencing
 - Chain link fencing
 - Stone wall
 - Electric fencing

PART II – Short Answer Questions (20 marks)

This part has 4 Short Answer Questions. Answer ALL the questions. Each question carries 5 marks. Mark for each sub-question is indicated in the brackets.

1. Answer the following questions: (5 marks)
 - a) What is Annealing? (2 marks)
 - b) What is Tempering? (2 marks)
 - c) Which method our black smith practices in their daily work life while making patangs?
(1 mark)

2. Explain the following agricultural processing terms: (5 marks)
 - a) Paddy Thresher (1 mark)
 - b) Brown rice (1 mark)
 - c) Transplanter (1 mark)
 - d) Reaper (1 mark)
 - e) Flour mill (1 mark)

3. Find the head loss due to friction (F) in meter in a pipe of 10 cm in diameter, 500 m in length and the water flowing with a velocity of 2 m/sec. Take the value of $f = 0.005$ (5 marks)

4. Name the functions of the following which are important for the farmers in our country: (5 marks)
 - a) Reversible plough
 - b) Disc plough
 - c) Mouldboard plough
 - d) Tines
 - e) Rotavator

SECTION B: Case Study

Choose either Case I OR Case II from this section. Each case study carries 50 marks. Mark for each sub-question is indicated in the brackets.

Case I

1. A motion is to be transmitted by means of two spur wheels on parallel shafts with a velocity ratio of driven to driver of 8. The driven shafts with a velocity ratio of driven to driver of 8. The driven shaft has to rotate at 1200 rpm and the gear wheel on it has 24 teeth. How many teeth must the driver have and with what speed must it rotate. What is the spacing between the shafts, if the spur wheels have a module of 12.7 mm (12.7 mm of pitch circle diameter per tooth)
(10 marks)

2. Explain the following terms: (10 marks)
 - a) Minimum Tillage system
 - b) Zero tillage
 - c) Plough share
 - a) Landslide
 - b) Sub soiler

3. Explain the different types of oil expelling methods including the traditional method practised in Bhutan (15 marks)

4. What are the factors affecting storage of grains and the probable ideas to improve storage? (15 marks)

Case II

A farmer in Bhutan wants to hire out his tractor and make an income. He paid Nu 10 lakhs for the tractor and its implement. The life span of the machine is 10 years. Salvage value as 10% of the initial cost. Take interest as 1% of the total cost. Shelter as 0.5% of initial cost. He wants to operate his tractor for 100 days in a year. The repair cost is 10 % of the initial cost yearly. The repair cost per day be divided from total working days. The operator wage per day is Nu 700 per day. The machine operates for 8 hours daily. It consumes 15 litres per day and cost is Nu 60 /litre. The lubrication cost is 1% of the fuel cost. The total cost in a year be converted to total cost per day based on total operating days.

1. What should be the: (30 marks)
 - a) Depreciation cost
 - b) Salvage value
 - c) Fixed costs
 - d) Variable costs
 - e) Operation cost per day
 - f) If you add 15% to the operation cost. What is the rate to be charged to farmers?

2. What is a psychometric chart and the different parameters and their functions (20 marks)

TASHI DELEK