

ROYAL CIVIL SERVICE COMMISSION
BHUTAN CIVIL SERVICE EXAMINATION (BCSE) 2021
EXAMINATION CATEGORY: TECHNICAL

PAPER III: SUBJECT SPECIALISATION PAPER FOR AGRICULTURAL ENGINEERING

Date	: October 31, 2021
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 QuestionsAll 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 on 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 must hand over the Answer Booklet to the Invigilator before leaving the examination hall.**
 10. This paper has **7 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. The inlet and exhaust valves in tractor and power tiller are operated by the action of the
 - a) Crankshaft
 - b) Camshaft
 - c) Valve shaft
 - d) Spring shaft

2. Right angles are conveniently laid out using the following methods, EXCEPT
 - a) Three-four-five method
 - b) Chord Method
 - c) Semi-circle method
 - d) Rope method.

3. The full form of ROPS is
 - a) Rough Outer Protection Structure
 - b) Roll Over Protection Structure
 - c) Real Outer Protection System
 - d) Real Over Protection System

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

5. 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

6. The equipment which can pump water to a higher elevation without the use of electrical or petroleum power is called
 - a) Hydro ram
 - b) Wind pump
 - c) Solar pump
 - d) Electrical pump

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
 - a) Brittleness
 - b) Ductility
 - c) Malleability
 - d) Resilience

8. All steel in construction of farm houses contains carbon. Medium-carbon steel has a carbon content of
 - a) less than 0.3%
 - b) range of 0.3% to 0.5%
 - c) range of 0.5% to 0.8%
 - d) 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
 - a) Annealing
 - b) Normalising
 - c) Quenching
 - d) Tempering

10. The horse power available at crankshaft and measured using a dynamometer is called
 - a) Crankshaft power
 - b) Brake horse power
 - c) Indicated horse power
 - d) Engine power

11. Among two valves (inlet valve and exhaust valve), the size of the inlet valve is
 - a) bigger than the exhaust.
 - b) smaller than the exhaust.
 - c) the same as the exhaust.
 - d) None of the above.

12. We cannot use antifreeze in our tractor or car in Samtse Dzongkhag during summer for low engine performance since the water boiling point
 - a) remains the same.
 - b) increases.
 - c) decreases.
 - d) None of the above.

13. The critical design criteria for feasibility of farm machines in steep slopes of Bhutan is
 - a) machine quality.
 - b) tilt angle of the machine.
 - c) tilt angle of plough.
 - d) centre of gravity of the machine.

14. The total arable land in Bhutan is
- 8.83%
 - 6.83%
 - 4.83%
 - 2.83%
15. The engines need to be tested for its power and the commonly used equipment to do the test is
- Dynamometer
 - Fuel flow meter
 - Power flow meter
 - Hydromometer
16. Paddy is important as the rice is the main staple food for the Bhutanese. What is the primary factor affecting the safe storage of paddy?
- 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 oil expeller shaft in m/sec, if the diameter of the shaft is 10 cm with its revolution 60 RPM.
- 4.0 m/sec
 - 0.314 m/sec
 - 3.14 m/sec
 - 0.40m/sec
22. In 2 stoke petrol engines, the engine oil and fuel are mixed.
- True
 - False
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. The bearing designed to resist axial loads is called
- Ball bearing
 - Thrust bearing
 - Journal bearing
 - Sleeve bearing
27. Pasteurization may be defined as heating every particle of milk at least _____ temperature and holding it at that temperature for 30 minutes.
- 100 degree Celsius
 - 81 degree Celsius
 - 71 degree Celsius
 - 61 degree Celsius
28. Lubricating oils are usually marked as SAE. What is the full form of SAE?
- Society of Agriculture Engineers
 - Society of Automotive Engineers
 - Society of Agronomic Engineers
 - Society of Avionics Engineers

29. The oil extraction method to extract maximum oil from the oil seeds is
- Mechanical extraction
 - Solvent extraction
 - Impact extraction
 - Streaming extraction
30. Which of the following is the most popular fencing in Bhutan for the past few years?
- 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. The marks for each sub-question is indicated in the brackets.

- Answer the following questions:
 - What is Annealing? (2 marks)
 - What is Tempering? (2 marks)
 - What method our blacksmith practices in their daily work life while making patang? (1 mark)
- Explain the following agricultural processing terms:
 - Paddy Thresher (1 mark)
 - Brown rice (1 mark)
 - Transplanter (1 mark)
 - Flour mill (1 mark)
 - Combine harvester (1 mark)
- Water flows through a 10 cm diameter pipe, 65 m long with a velocity of 3 m/sec. Find the head lost in friction, if the value of f is assumed to be 0.0056. (5 marks)
- Name the functions of the following which are important for the farmers in our country.
 - Primary tillage and examples. (1.5 marks)
 - Secondary tillage and examples. (1.5 marks)
 - Mouldboard plough. (2 marks)

SECTION B: Case Study [50 marks]

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 shaft runs at 80rpm and drives another shaft at 150 rpm through belt drive. The diameter of the driving pulley is 600 mm. Determine the diameter of the driven pulley in the following cases:
(a) Neglecting belt thickness (b) Taking belt thickness at 5 mm. (10 marks)
2. Explain the different types of oil expelling methods including the traditional method practised in Bhutan. (15 marks)
3. A four cylinder gas engine has a cylinder 25 cm diameter, 50 cm stroke and runs at 154 revolutions per minute, if the engine fires once per two revolutions and shows an indicated mean effective pressure of 7.5 kg/cm², Calculate (i) IHP, (ii) BHP. Assume the mechanical efficiency of the engines as 86.4%. (IHP formula is $PLAN/4500$) (10 marks)
4. What are the factors affecting storage of grains and 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 20 lakhs for the tractor and its implement. The life span of the machine and the implements are 10 years. Salvage value as 10% of the initial cost. Take interest as 1% of the total cost. Shelter as 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 wage for operator Nu 1000 per day. The machine operates for 8 hours daily. It consumes 15 litres per day and cost is Nu 80 per 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 per year and day
 - d) Variable costs per day
 - 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? What are its different parameters and their functions? (20 marks)

TASHI DELEK