

**ROYAL CIVIL SERVICE COMMISSION
BHUTAN CIVIL SERVICE EXAMINATION (BCSE) 2011
EXAMINATION CATEGORY: TECHNICAL**

**PAPER III: SUBJECT SPECIALIZATION PAPER for ELECTRICAL
ENGINEERING/ELECTRICAL & ELECTRONICS ENGINEERING GROUP**

Date : 30th October 2011
Total Marks : 100
Examination Time : 2.5 Hours
Reading Time : 15 Minutes (prior to examination time)

READ THE FOLLOWING INSTRUCTIONS CAREFULLY:

1. Write your Roll Number clearly on the Answer Booklet in the space provided.
2. **Do not write** for the first **15 minutes**. This time is to be spent in reading the question paper and to check if all questions and pages are correct and intact. Seek any clarifications, if necessary, during this time.
3. The **maximum time** allotted for writing this paper is **2.5 hours**.
4. All answers to the question must be written in the separate **Answer Sheet** provided. You are not allowed to write anything on this Question paper.
5. This paper consists of **TWO Sections – Section A and Section B**.
6. **Section A has two parts – Part I and Part II**. All questions under Section A are compulsory. Part I consists of 30 **Multiple Choice Questions** carrying one (1) mark each and Part II consists of 4 short answer type questions carrying five (5) marks each.

While answering the Multiple Choice Questions, write only the letter of the correct answer chosen against the question number, clearly and legibly {eg. Q1 – a); Q2 – b); and so on}. Any double writing or smudgy answers shall not be evaluated.

7. **Section B** consists of **TWO (2) Case Studies**, out of which you must answer only ONE (1). The Case Study question carries 50 marks and the marks are allocated beside the questions.
8. Marks for answers to the short answer questions under Part II of Section A will be awarded based on the knowledge of the subject, clarity and preciseness of the responses, while answers to questions under Section B will be evaluated based on the ability to comprehend the case, apply your knowledge and present the case with solutions.
9. The paper has **THIRTEEN (13)** printed pages in all, including the Instruction Page.

SECTION A – ANSWER ALL THE QUESTIONS

PART I – Multiple Choice Questions

Choose the correct answer and write down the letter of the correct answer chosen in the Answer Sheet against the question number. Each question carries ONE (1) mark.

1. The unit of magnetic flux is
- a) Tesla
 - b) Weber
 - c) Ampere meter
 - d) Siemens

Ans : b)

2. A $4\mu\text{F}$ and a $6\mu\text{F}$ capacitors are connected in series. The total capacitance is
- a) $2\mu\text{F}$
 - b) $2.4\mu\text{F}$
 - c) $10\mu\text{F}$
 - d) $24\mu\text{F}$

Ans : b)

3. One GWh is equal to
- a) 10^9 MWh
 - b) 10^6 MWh
 - c) 10^6 KWh
 - d) 10^3 KWh

Ans : c)

4.sector has the highest consumption of electricity in Bhutan
- a) Residential
 - b) Commercial
 - c) Industrial
 - d) Transport

Ans : c)

5. A logic circuit which converts an n-bit binary input code(data) into $m(2^n)$ output lines such that each output line will be activated for only one of the possible combination of inputs is called
- a) Demultiplexer
 - b) Decoder
 - c) Control sequencer

d) Data selector

Ans : b)

6. The 336 MW Chukhha hydropower project uses

- a) Pelton Turbine
- b) Francis Turbine
- c) Kaplan Turbines
- d) None of the above

Ans : a)

7. What is the relationship between current (I) and voltage (V) in a circuit consisting of a capacitor in series with a resistor?

- a) I and V are in phase across the capacitor.
- b) I leads V across the resistor.
- c) V leads I across the capacitor.
- d) I and V are in phase across the resistor.

Ans : d)

8. A diode performs the function of a

- a) filter
- b) amplifier
- c) rectifier
- d) inverter

Ans : c)

9. An alternator converts

- a) mechanical energy into electrical energy
- b) electrical energy into mechanical energy
- c) potential energy into thermal energy
- d) thermal energy into potential energy

Ans : a)

10. In a transformer which losses is the highest

- a) core losses.
- b) copper losses.
- c) stray losses.
- d) dielectric losses.

Ans : a)

11. A balanced 3-phase, 60 Hz voltage is applied to a 3-phase, 4 pole, induction motor. When the motor is delivering rated output, the slip is found to be 0.10. The speed of the rotor m.m.f. relative to the rotor structure is
- a) 1800 RPM
 - b) 1620 RPM
 - c) 100 RPM
 - d) 180 RPM

Ans : d)

$$N_s = 120f / P = 120 \times 60 / 4 = 1800 \text{ RPM}$$

$$N = N_s (1-s) = 1800 (1-0.10) = 1620 \text{ RPM}$$

$$\text{Therefore, relative speed} = 1800 - 1620 = 180 \text{ RPM}$$

12. The starting current and starting torque received by an induction motor will be reduced by about respectively when the motor is started using star delta starter instead of direct on line starter.
- a) 30% and 25%
 - b) 50% and 35%
 - c) 75% and 50%
 - d) 20% and 15%

Ans : a)

13. The generation voltage at any of the large power plants in Bhutan is
- a) 11 kV to 33 kV
 - b) 66 kV to 132 kV
 - c) 132 kV to 400 kV
 - d) 400 kV to 700 kV

Ans : a)

14. As the voltage of transmission increases, the volume of effective conductor decreases due to
- a) skin effect
 - b) corona loss effect
 - c) copper loss effect
 - d) magnetization effect

Ans : a)

15. The boundary of the protective zone is determined by the sensitivity of relay used in the power system. If the relay is more sensitive, the protective zone will
- a) be decreased
 - b) be increased

- c) remain same
- d) be zero

Ans : b)

16. If a transformer's primary winding is connected in star and the secondary winding in delta, the angle difference between phase voltages in the two cases will be that the
- a) delta side will lag by 30°
 - b) star side will lag by 30°
 - c) delta side will lead by 30°
 - d) star side will lead by -30° .

Ans : c)

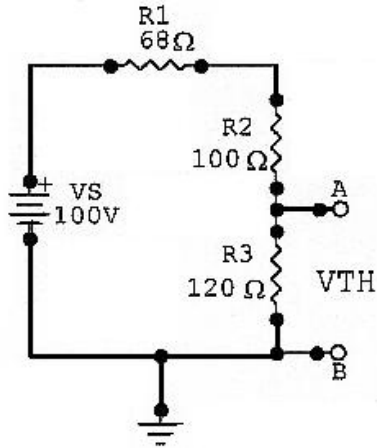
17. The maximum resistance value for a brown, red, yellow, gold colour band resistor is
- a) 126,000 Ω
 - b) 126,600 Ω
 - c) 114,000 Ω
 - d) 132,000 Ω

Ans : a)

18. A 12 V source is connected across an 8 ohm resistor. How much energy is used in five minutes?
- a) 15 Wh
 - b) 1.5 Wh
 - c) 18 Wh
 - d) 0.018 Wh

Ans : b)

19. The Thevenin equivalent (V_{th} and R_{th}) between terminals A and B of the given circuit will be



- a) 4.16 V, 120 Ω
- b) 41.6 V, 120 Ω
- c) 4.16 V, 70 Ω
- d) 41.6 V, 70 Ω

Ans : d)

20. A law that gives the intensity of the magnetic field due to a wire carrying a constant electric current is called
- a) Lenz's law
 - b) Faraday's law
 - c) Biot-Savart's law
 - d) Joule's law

Ans : c)

21. Any linear current network which may be viewed from two terminals can be replaced by a current-source equivalent circuit comprising a single current source I and a single shunt admittance Y , where, the current I is the short-circuit current between the two terminals and the admittance Y is the admittance of the network viewed from the terminals with all current sources replaced by their internal admittances. This is called
- a) Superposition Theorem
 - b) Reciprocity Theorem
 - c) Compensation Theorem
 - d) Norton's Theorem

Ans : d)

22. Table 1 below represents the truth table for a 2-input logic gate.

Table 1:

Inputs		Output
0	0	1
1	0	0
0	1	0
1	1	0

- a) NAND
- b) NOR
- c) AND
- d) OR

Ans : b)

23. The symbolic representation of a two input logic gate shown in Figure 1 below is a

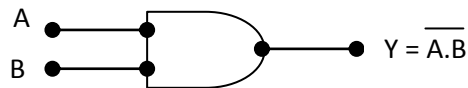


Figure 1.

- a) NOR gate
- b) NOT gate
- c) AND gate
- d) NAND gate

Ans : d)

24. If a series *RLC* circuit is operating above the resonant frequency, the current will

- a) lag the applied voltage
- b) lead the applied voltage
- c) be in phase with the applied voltage
- d) be zero

Ans : a)

25. The present installed capacity of Bhutan's hydropower is about

- a) 1800 MW
- b) 2000 MW
- c) 2500 MW
- d) 1488 MW

Ans : d)

26. The smallest analog output change which occurs as a result of an increment in the digital input is called the
- a) resolution of a digital-to-analog converter
 - b) resolution of a analog-to-digital converter
 - c) comparison between the actual output of the converter and its expected output
 - d) deviation between the ideal straight-line output and the actual output of the converter

Ans : a)

27. The decimal number equivalent of binary number 1001.0010 is
- a) 125
 - b) 12.5
 - c) 90.125
 - d) 9.125

Ans : d)

28. If a power plant is operating with a five percent (5%) speed droop at full-load speed of 100%, its no load speed will be
- a) 95%
 - b) 105%
 - c) 80%
 - d) 110%

Ans : b)

29. The ratio of sum of the individual non-coincident maximum demands of various subdivisions of the system to the maximum demand of the complete system is called
- a) Load factor
 - b) Capacity factor
 - c) Power factor
 - d) Diversity factor

Ans : d)

30. If one of the wattmeters reads zero during the measurement of power by using two wattmeter method, then it can be deduced that
- a) Power factor is unity
 - b) Power factor is zero
 - c) Power factor is 0.5 lagging
 - d) Power factor is 0.5 leading

Ans : c)
