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Question Paper Code : 20451

B.E./B.Tech. DEGREE EXAMINATION, NOVEMBER/DECEMBER 2018.

Third Semester

Electronics and Communication Engineering

EE 6352 — ELECTRICAL ENGINEERING AND INSTRUMENTATION

(Regulations 2013)

Time : Three hours

Maximum : 100 marks

Answer ALL questions.

PART A — (10 × 2 = 20 marks)

1. Explain the term "back emf" in DC motor.
2. Draw the internal characteristics of DC generator.
3. The number of turns on the primary and secondary windings of a $1-\phi$ transformer is 350 and 35 respectively. If the primary is connected to a 2.2 kV, 50-Hz supply, determine the secondary voltage on no-load.
4. Write some applications of auto-transformer.
5. Define the term slip in Induction motor.
6. What are the uses of damper windings in synchronous machine?
7. State static and dynamic characteristics of instruments.
8. What are Piezo-electric transducers?
9. Distinguish between Analog and digital instruments.
10. Draw the schematic diagram of a Maxwell bridge used for unknown inductance measurement.

PART B — (5 × 13 = 65 marks)

11. (a) (i) Explain the working principle of DC motor with a sketch. (8)
- (ii) Find the load and full-load speeds for a four-pole, 220-V, and 20-kW, shunt motor having the following data : Field-current = 5 amp, armature resistance = 0.04 ohm, Flux per pole = 0.04 Wb, number of armature conductors = 160, Two-circuit wave-connection, full load current = 95 amp, No load current = 9 A. Neglect armature reaction. (5)

Or

- (b) (i) Classify DC Generators based on their method of excitation; draw the circuit diagram of each types and write the relationship between armature current and load current. (8)
- (ii) The magnetization curve of a DC shunt generator at 1500 rpm is
- | | | | | | | | | | |
|-------------|---|-----|-----|-----|-----|-----|-----|-----|-----|
| I_f (A) : | 0 | 0.4 | 0.8 | 1.2 | 1.6 | 2.0 | 2.4 | 2.8 | 3.0 |
| E_0 (V) : | 6 | 60 | 120 | 172 | 202 | 221 | 231 | 237 | 240 |

For this generator find no load e.m.f. for a total shunt field resistance of 100 Ω and the critical field resistance at 1500 r.p.m.

(5)

12. (a) (i) Derive the emf equation of a Transformer from first principle. (8)
- (ii) A single-phase transformer with a ratio of 440/110-V takes a no-load current of 5 A at 0.2 power factor lagging. If the secondary supplies a current of 120 A at a p.f. of 0.8 lagging, estimate the current taken by the primary. (5)

Or

- (b) (i) Explain in brief various losses present in the Transformer; Efficiency of a transformer and write the condition for maximum efficiency. (8)
- (ii) A-100 kVA transformer has 400 turns on the primary and 80 turns on the secondary. The primary and secondary resistances are 0.3 Ω and 0.01 Ω respectively and the corresponding leakage reactances are 1.1 and 0.035 Ω respectively. The supply voltage is 2200 V. Calculate the equivalent impedance referred to primary. (5)

13. (a) (i) A 4-pole, 3-phase induction motor operates from a supply whose frequency is 50 Hz. Calculate
- (1) The speed at which the magnetic field of the stator is rotating.
 - (2) The speed of the rotor when the slip is 0.04
 - (3) The frequency of the rotor currents when the slip is 0.03.
 - (4) The frequency of the rotor currents at standstill. (6)
- (ii) Classify single phase induction based on method of starting and write the principle of making single phase induction motor self starting. (7)

Or

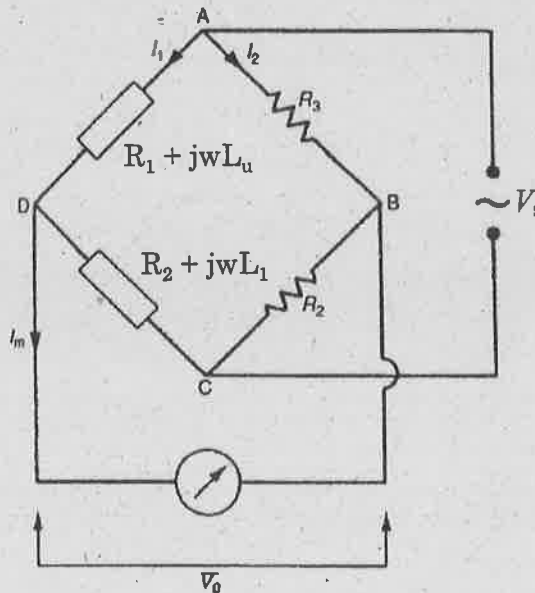
- (b) (i) Define the voltage regulation in alternator and draw the phasor diagram of a loaded alternator. (7)
- (ii) Explain the construction of V-curves of synchronous motor. (6)
14. (a) (i) Define Transducer and classify different types of transducers. (8)
- (ii) What is strain gauge, explain its working principle. (5)

Or

- (b) (i) Explain the working of variable capacitance transducer with neat diagram. (7)
- (ii) With a schematic diagram, explain the working of Linear Variable Differential Transformer (LVDT). (6)
15. (a) (i) Compare analog and digital modes of operation in measurements. (8)
- (ii) Derive and explain the measurement of resistance using Wheatstone bridge. (5)

Or

- (b) (i) An unknown inductance L_u is measured using a deflection type of bridge as shown in figure. The components in the bridge have the following values :



$$V_s = 10 \text{ V}_{\text{r.m.s.}}, L_1 = 20 \text{ mH}, R_2 = 100 \Omega, R_3 = 100 \Omega$$

If the output voltage V_0 is 1 V r.m.s., calculate the value of L_u . (6)

- (ii) Explain with circuit the measurement of frequency of the AC signal using Wien bridge. (7)

PART C — (1 × 15 = 15 marks)

16. (a) Discuss various methods used for controlling the speed of D.C. motor with neat sketch. (15)

Or

- (b) Draw the equivalent circuit of transformer. Also explain, how the circuit parameters are estimated using open circuit and short circuit tests. (15)