

Code : 100101/100201

B.Tech 2nd Semester Special Exam., 2020

(New Course)

BASIC ELECTRICAL ENGINEERING

Time : 3 hours

Full Marks : 70

Instructions :

- (i) The marks are indicated in the right-hand margin.
- (ii) There are **NINE** questions in this paper.
- (iii) Attempt **FIVE** questions in all.
- (iv) Question No. 1 is compulsory.

1. Choose the correct alternative from any seven of the following : 2×7=14

(a) The full-load copper loss and iron loss of a transformer are 6400 W and 5000 W respectively. The copper loss and iron loss at half load will be respectively

- (i) 3200 W and 5000 W
- (ii) 3200 W and 2500 W
- (iii) 1600 W and 2500 W
- (iv) 1600 W and 5000 W

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(Turn Over)

(b) In a 100 kVA 1100/220 V, 50 Hz 1- ϕ transformer with 2000 turns on the HV side, the open circuit test result gives 220 V, 91 A, 5 kW on LV side. The core-loss component of current is approximately

- (i) 9.1 A
- (ii) 22.7 A
- (iii) 45 A
- (iv) 91 A

(c) A 4-pole d.c. generator is running at 1500 r.p.m. at no load, the frequency of current in the armature winding is

- (i) 150 Hz
- (ii) 50 Hz
- (iii) 0 Hz
- (iv) 25 Hz

(d) What is the load at which maximum efficiency occurs in case of a 3 kVA transformer with iron loss of 20 W and full-load copper loss of 100 W?

- (i) 6.70 kVA
- (ii) 1.54 kVA
- (iii) 1.34 kVA
- (iv) 1 kVA

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(e) In two-wattmeter method of power measurement, if both the wattmeters show positive and equal readings, then it can be concluded that the load

- (i) power factor is unity
- (ii) power factor is zero
- (iii) power factor is 0.5 leading
- (iv) power factor is 0.5 lagging

(f) Which among these is the least expensive protection for over current in low voltage system?

- (i) Rewirable fuse
- (ii) Isolator
- (iii) Circuit breaker
- (iv) Air breaker switch

(g) A circuit breaker is

- (i) power factor correcting device
- (ii) a device to neutralize the effect of transients
- (iii) a waveform correcting device
- (iv) a current interrupting device

(h) Which three-phase connection is used to in a transformer to introduce a phase difference of 30° between its output and corresponding input line voltage?

- (i) Star-Delta
- (ii) Star-Star
- (iii) Delta-Delta
- (iv) Delta-Zigzag

(i) Two transformers operating in parallel will share the load depending upon their

- (i) ratings
- (ii) leakage reactance
- (iii) efficiency
- (iv) per unit impedance

(j) A d.c. shunt generator is supplying a load of 1.8 kW at 200 V. Its armature and field resistances are 0.4Ω and 200Ω respectively. What is the generated e.m.f. ?

- (i) 190 V
- (ii) 196 V
- (iii) 204 V
- (iv) 210 V

2. (a) Open and short circuit tests performed on a 500 kVA, 6600 V/2300 V, 50 Hz transformer yielded the following data :

No-load loss = 3 kW

Full-load short circuit loss = 4 kW

Calculate the load at which the transformer efficiency would be maximum for a given power factor. Calculate the efficiency for a p.f. of 0.85.

7

(b) Draw the neat and exact phasor diagram of the 1- ϕ transformer on load condition.

7

3. (a) A 3- ϕ , 4-pole 50 Hz, star-connected induction motor running on full-load develops a useful torque of 300 N-m. The rotor e.m.f. is completing 120 cycles per minute. If torque lost in friction is 50 N-m, calculate—

(i) slip;

(ii) net output power;

(iii) rotor copper losses/phase;

(iv) rotor resistance per phase if rotor current is 60 A in running condition.

7

(b) Explain the characteristics (i) T vs. I_a , (ii) N vs. I_a and (iii) N vs. T of DC shunt motor.

7

4. (a) A 250 V d.c. shunt motor has a shunt resistance of 200 Ω and an armature resistance of 0.3 Ω . For a given load, motor runs at 1500 r.p.m. drawing a current of 22 A from the supply. If a resistance of 150 Ω is added in series with the field winding, find the new armature current and the speed. Assume load torque constant and magnetization curve to be linear.

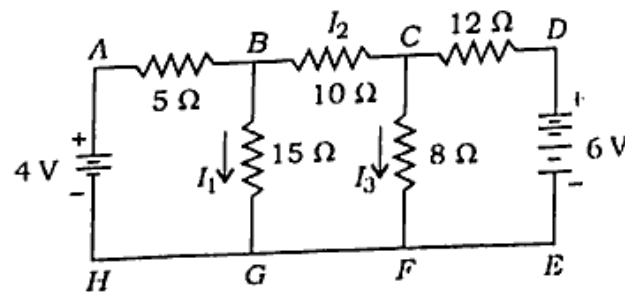
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(b) Draw the speed torque characteristics of (i) DC series motor, (ii) DC shunt motor and (iii) DC differentially compound motor.

6

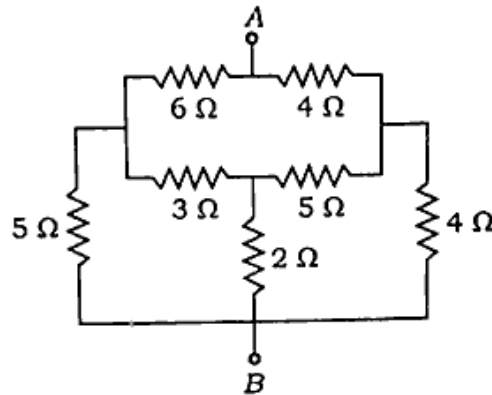
5. (a) Find the current I_2 in the following circuit by applying Thevenin's theorem :

7



(7)

- (b) Determine the resistance between the terminals A and B in the circuit below : 7



6. (a) Explain the AC circuits containing only inductance and capacitance clearly with equations. 7
- (b) A three-phase balanced delta-connected load of $(4 + j8) \Omega$ is connected across a 400 V, 3- ϕ balanced supply. Determine the phase currents, line currents and power drawn by the load. Assume the phase sequence to be RYB. 7
7. (a) Write the comparison between electric circuits and magnetic circuits. 6
- (b) What do you understand from the following terms? 8
- (i) Silicon steel
 - (ii) Magnetostriction
 - (iii) Statically induced e.m.f.
 - (iv) Dynamically induced e.m.f.

(8)

8. (a) What do you understand by earthing? Explain a single-phase a.c. circuit connection with earthing. 8
- (b) Explain the procedure to improve the power factor in a.c. circuits. 6
9. (a) What are the various DC motors available based on the excitation? Draw their equivalent circuit. 7
- (b) A single-phase transformer with a ratio of 440 V/110 V takes a no-load current of 5 A at 0.2 p.f. 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 and draw the phasor diagram. 7

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