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Ex/ETECH/EE/T/A/2017(Old)(S)

BACHELOR OF ENGINEERING IN PRODUCTION ENGINEERING EXAMINATION, 2017

(1st Year, 1st Semester, Supplementary)

ELECTRICAL TECHNOLOGY - A (OLD)

Time : Three hours | Full Marks : 100

(50 marks for each part)

Use a separate Answer-script for each Part

PART-I

Answer any three questions

(Two marks are reserve for neatness and well organized answers)

1. a) Explain leakage and fringing in a magnetic circuit. 3

   b) Mention the similarity and dissimilarity between electric and magnetic circuit. 6

   c) An iron ring has a mean diameter of 25 cm and a cross sectional area of 3 cm^2. An air gap of 0.4 mm has been cut across the section of the ring. The ring is wound with a coil of 200 turns through which a current of 2A is passed. If the total magnetic flux is 0.24 mWb, find the relative permeability of iron, assuming no magnetic leakage. 7

2. a) Derive the relation between i) line and phase current, ii) line and phase voltage and three phase power of balanced three phase network connected in delta. Also draw the relevant phasor diagram. 8

   b) A delta connected balanced 3-phase load is supplied from a 3-phase, 400V supply. The line current is 20A and power taken by the load is 10 kW. Find i) impedance in each branch ii) the line current, power factor and power consumed if the same load is connected in star. 8

3. a) State and explain the condition of resonance in a series R-L-C circuit and also explain the main characteristics of the circuit under this condition. 8

   b) A series R-L-C circuit consists of resistance R = 1Ω, inductance L = 0.1H and capacitance C = 100 μF. Determine the frequency at which resonance will take place. If the applied voltage be 220 V at 50 Hz, determine the current and voltage drops across R, L and C. 8

4. a) State Superposition theorem. Illustrate the application of theorem with reference to an appropriate electrical network. 8

   b) Using Star – Delta transformation, find the value of total resistance between the nodes A and B of the circuit given in Fig. 1. 8

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PART-II

Answer *any three* questions

Two marks are reserved for neat and well organized answer script

1. a) Draw and label the different parts of a DC generator. Mention the function of commutator in a DC machine. 10

   b) Derive the equation of induced e.m.f. in the case of a DC generator. Hence explain how the induced emf of a DC generator can be changed. 6

2. a) The induced emf in a DC generator is 250V at 1000 rpm. Calculate the percentage change in the field flux if the generator has to generate the same induced voltage at half speed. 4

   b) Derive the expression of back e.m.f. in case of a motor. From this expression, derive the generalized expression of torque developed in a DC motor. Draw suitable armature current vs. torque characteristics. 12

3. a) A dc motor draws an armature current of 5A. If the induced volt is 500V at 950 rpm, calculate its torque. 6

   b) Derive the e.m.f. equation of a transformer. Give the relationship between the voltage, current and the turns ratio of a two winding transformer. Give necessary illustrations for clear representation. 10

4. a) Draw the approximate equivalent circuit of a transformer as referred to secondary side and hence find the expression of the equivalent impedance. 10

   b) A 100 kVA distribution transformer supplying only lamp loads has full-load copper loss and core-loss of 1.5 and 2kW respectively. During 24 hour a day, the transformer is loaded as follows:
   6AM to 10AM: Half-load
   10AM to 6PM: One-fourth load
   6PM to 10PM: Full-load
   10PM to 6AM: Negligible load
   Calculate the all-day efficiency of the transformer. 6

P.T.O.

5. a) The primary winding of a 6600/250V, 50Hz single phase transformer has resistance and reactance of 0.21Ω and 1.0Ω respectively. The corresponding values of the secondary winding are $2.72\times10^{-4}\Omega$ and $1.3\times10^{-4}\Omega$ respectively. Calculate the current and the power input when the high voltage winding is connected to a 400V, 50Hz supply, the secondary winding being short circuited. 10

b) 'Induction motor can never run at synchronous speed'—Explain or justify the comment. 6

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