

This question paper contains 6 printed pages]

Code No. : 09(I)

Roll No.

0(CCEM)9

ELECTRICAL ENGINEERING

Paper : I

Time Allowed : 3 hours]

[Maximum Marks : 300

Note : (i) Answers must be written in English.

(ii) Number of marks carried by each question are indicated at the end of the question.

(iii) Part/Parts of the same question must be answered together and should not be interposed between answer to other questions.

(iv) Each questions or part thereof should begin on a fresh page.

(v) Your answers should be precise and coherent.

(vi) Candidates should attempt Q. Nos. 1 and 5 which are compulsory and any three out of the remaining questions, selecting at least one question from each Section.

(vii) Notations have their usual meaning.

P. T. O.

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SECTION – A

1. Answer any *three* of the following :
 - (a) For lossy dielectric material having $\mu_r = 1$, $\epsilon_r = 48$, $\sigma = 20 \text{ S/m}$, calculate the attenuation constant and intrinsic impedance at a frequency of 16 GHz. 20
 - (b) Discuss applications of Cathode Ray Oscilloscope in electrical measurements. 20
 - (c) Explain how a two-winding transformer can be converted into an autotransformer. List the application of an autotransformer. 20
 - (d) Describe the methods used for starting of 3-phase squirrel-cage induction motors. 20

2. (a) Differentiate between absolute and secondary instruments. Discuss the classification of secondary instruments with examples. 20
- (b) Describe the construction and working of dynamometer type instruments. 20
- (c) A parallel plate capacitor with plate area of 5 cm^2 and plate separation of 3mm has a voltage $50 \sin(10^3 t)$ volt applied to its plates. Calculate the displacement current assuming $\epsilon = 2 \epsilon_0$ 20

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3. (a) Describe the construction, working principle, advantages and disadvantages of a single phase AC energy-meter. 20
- (b) A 4-pole, 3 phase, 50 Hz induction motor supplies a useful torque of 160 N-m at 5% slip, calculate (i) Motor speed, (ii) gross output of the motor, (iii) efficiency of the motor. Friction and windage losses 500 W and stator losses 1000W. 20
- (c) Compare the working of a BJT with MOSFET in a tabular form. 20
4. (a) Describe a general form of Resonant Circuit Oscillator and discuss its specific cases. 20
- (b) A 110V dc shunt generator delivers a load of 50 A. The armature resistance is 0.2Ω , and the field circuit resistance is 55Ω . The generator rotating at a speed of 1800 r.p.m. has 6 poles, is lap wound and has a total of 600 conductors. Calculate (i) the no load voltage at the armature, and (ii) the flux per pole. 20
- (c) The resistors used in the bridge circuit of a Wien bridge Oscillator are $50 \text{ K } \Omega$ each. If the capacitors are changed from 500 pF to 1000 pF , between what limit does the frequency generated varies. 20

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SECTION – B

5. Answer any *three* of the following :

- (a) Discuss ideal voltage and current-sources. 20
- (b) Discuss different types of Flip- Flop (FF) or bistable multivibrators. 20
- (c) Discuss torque-slip characteristics of an induction-motor with increasing value of rotor resistance. 20
- (d) What are (i) Discrete Fourier Transform(DFT), (ii) Inverse Discrete Fourier Transform (IDFT), and (iii) What are the advantages of Fast Fourier Transform (FFT). 20

6. (a) Find the magnetic field intensity at a point (r, ϕ, z) due to an infinitely long straight filament carrying a current I in the $+z$ direction. 20
- (b) The following test data obtained on a 5 KVA 220/400 V single phase transformer.
- O. C. test : 220V, 2A, 100W (on LV side)
- S. C. test : 40 V ,11.4 A, 200W (on HV side)
- Determine the percentage efficiency and regulation at full load 0.9 p.f. lagging. 20

(4)

- (c) What are the main current components in a p-n diode and under what conditions do they become important? 20
7. (a) Explain the need for conducting Sumpner's or back to back test. With the help of neat diagram, discuss Sumpner's test. 20
- (b) Find the Laplace transform of the signal $e^{-a|t|}$. 20
- (c) Calculate phase e.m.f. induced in a 4-pole, 3-phase, 50 Hz star connected alternator with 36 slots, and 30 conductors per slots. The flux per pole is 0.05 wb. Assume winding factor of 0.95. 20
8. (a) Find the current in the $10\ \Omega$ resistance of the circuit shown in Fig.-1 using Thevenin's theorem and confirm the result by Norton's theorem. 20

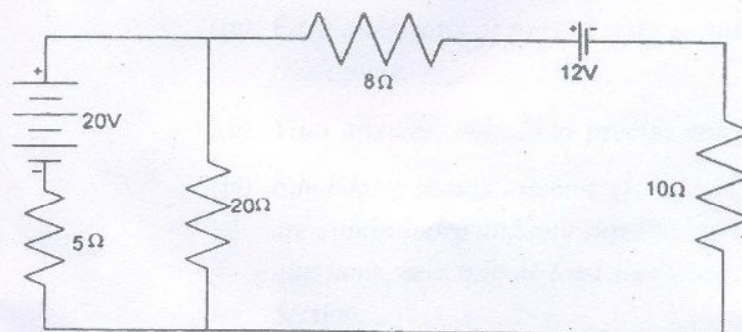


Figure - 1

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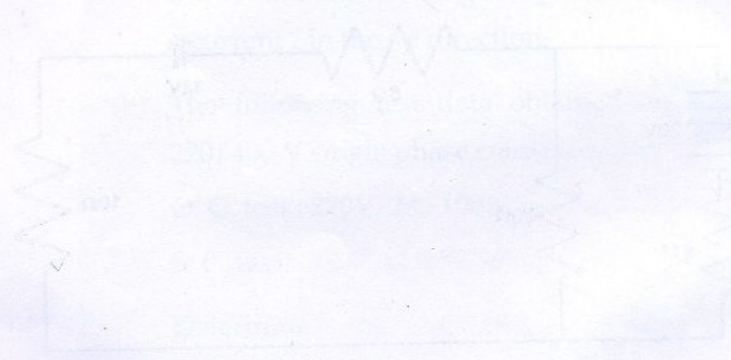
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(b) A transistor has an $\alpha_o = 0.98$ and the alpha cut-off frequency (f_α) is 5 MHz. Find the β cut-off frequency and the value of β at this frequency. Also determine α and β at a frequency of 1 MHz.

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(c) The coil of a 250V moving iron voltmeter has a resistance of 500Ω , and an inductance of 1 Henry. The current taken by the instrument, when placed on 250 V dc supply is 0.05 A. Determine the percentage error, when the instrument is placed on 250V ac supply at 100 Hz.

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(6)

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