(d) Draw the phasor diagram of transformer for lagging p.f., unity p.f. and leading power factor loads. Discuss the losses in a transformer. 20

6. (a) Draw the fixed bias circuit and derive an expression for stability factor. 20

(b) A common emiter amlplifier with voltage divider bias circuit is designed to establish the quiescent point at $V_{CE} = 12V$, $III_C = 2mA$, stability factor ≤ 5.1.

If $V_{cc} = 24$ V, $V_{BE} = 0.7$ V, $\beta = 50$, $R_c = 4.72$ Ω determine R_E, R_1 and R_2. 20

(c) Describe with necessary derivations, the effect of negative feed back on the bandwidth and distortion in an amplifier. 20

7. (a) Draw the circuit diagram of Colpitt's oscillator. Derive the condition to maintain the oscillations. 20

(b) Design the following counters using 7492 as divide by 12 counter :

(i) Mod 7 counter

(ii) Mod 11 counter 20

(c) Derive emf equation of dc generator. State the assumption for derivation. Discuss critical field resistance. 20

8. (a) Explain the concept of rotating magnetic field produced when 3 phase balanced currents are fed to 3 phase balanced distributed winding. 20

(b) Explain how Sumpner's test is conducted for transformers. What is the significance of this test ? 20

(c) A -3-phase, 8-pole, 750 rpm synchronous generator has 72 slots. Each slot has 12 conductors and winding is short pitched by 2-slots. If the flax/pole is 0.06 wb, find induced emf/phase. 20

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Electrical Engineering–I

(09)

Time : Three Hours] [Maximum Marks : 300

INSTRUCTIONS

(i) Answers must be written in English.

(ii) The number of marks carried by each question is indicated at the end of the question.

(iii) The answer to each question or part thereof should begin on a fresh page.

(iv) Your answer should be precise and coherent.

(v) The part/parts of the same question must be answered together and should not be interposed between answers to other questions.

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

(vii) If you encounter any typographical error, please read it as it appears in the text-book.

(viii) Candidates are in their own interest advised to go through the General Instructions on the back side of the title page of the Answer Script for strict adherence.

(ix) No continuation sheets shall be provided to any candidate under any circumstances.

(x) Candidates shall put a cross (x) on blank pages of Answer Script.

(xi) No blank page be left in between answer to various questions.

(xii) No programmable Calculator is allowed.

(xiii) No stencil (with different markings) is allowed.

SECTION–A

1. Answer any **three** of the following :

(a) Determine $V_o(t)$ in the following circuit : 20
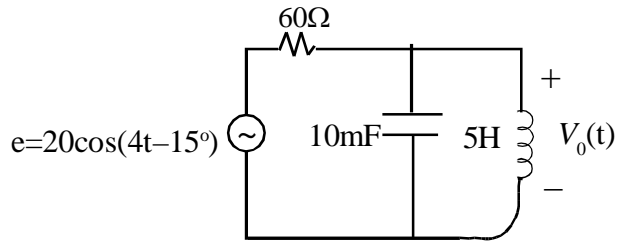
(b) Given the potential $V = \dfrac{10}{r^2} \sin\theta \cos\theta$. Find electric flux density D at $\left(2, \dfrac{\pi}{2}, 0\right)$. Also calculate the work done on moving a 10-μC charge from point A (1, 30°, 120°) to B (4, 90°, 60°). 20

(c) Explain two wattmeter method of measurement of 3 phase power. 20

(d) Derive emf equation of dc generator from first principles. 20

2. (a) Planes $z = 0$, $z = 4$ carry current $I = -10\overline{a}_x$ and $I = 10\overline{a}_x$ A/m respectively. Determine A/m $_H$ at (1, 1, 1) 20

(b) Explain the working of a moving Iron Instrument. Derive the expression for deflecting torque. 20

(c) Draw the small signal model of Bipolar Junction transistor. Write down describing equation relating the parameters. 20

3. (a) A parallel plate capacitor with plate area 5 cm² and plate separation 3 mm has a voltage 50 sin (10^3t) volts is applied assuming $\in = 2\in_o$. 20

(b) The electric field free space is given by

$\overline{E} = 50 \cos\left(10^8 t + \beta x\right) a_y$ V/m.

Find direction of wave propagation. Calculate β and time it takes to travel a distance of $+ \lambda / 2$. 20

(c) A uniform plane wave in air with

$\overline{E} = 8 \cos (wt - 4x - 3z) \overline{a}_y$ V/m.

is incident on a dielectric slab (z ≥ 0) with $\mu_r = 1.0$, $\in_r = 2.5$, $\sigma = 0$. Find polarization of the wave, and the angle of incidence. 20

4. (a) An unbalanced Y-load has balanced set of voltages 100V and 'acb' sequence. Calculate line currents and neutral current.

$Z_A = 15\Omega$ $Z_B = (10+j^5)\Omega$

$Z_C = (6-j^8)\Omega$ 20

(b) State superposition theorem. Explain how is it verified in alternating current circuits with the help of an example. 20

(c) Explain the principle of operation of electrodynamometer-type wattmeter with the help of a diagram. 20

SECTION–B

5. Answer any **three** :

(a) Derive an expression for ripple factor in full wave rectifier with resistive load. 20

(b) A transistor has $I_E = 10$ mA and $\alpha = 0.98$. Determine I_c and I_B. Derive the equation used. 20

(c) Sketch the speed-torque characteristics of different types of dc motors. Explain the variation of torque with load current. 20