

This question paper contains 4+2 printed pages]

HPAS (Main)—2012

ELECTRICAL ENGINEERING

Paper I

Time : 3 Hours

Maximum Marks : 150

Note :— Attempt Five questions in all, taking at least one question from each part.

Part A

1. (a) For the circuit shown in Fig. 1, find out the expression of voltage $V(t)$ across $10 \mu\text{F}$ capacitor. 15

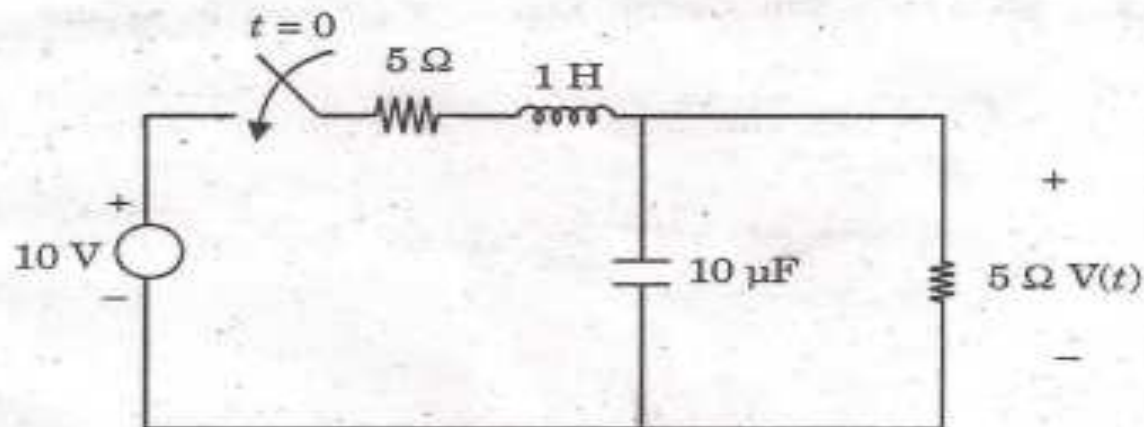


Fig. 1

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- (b) Find the Thevenin's equivalent of the circuit shown in Fig. 2. 15

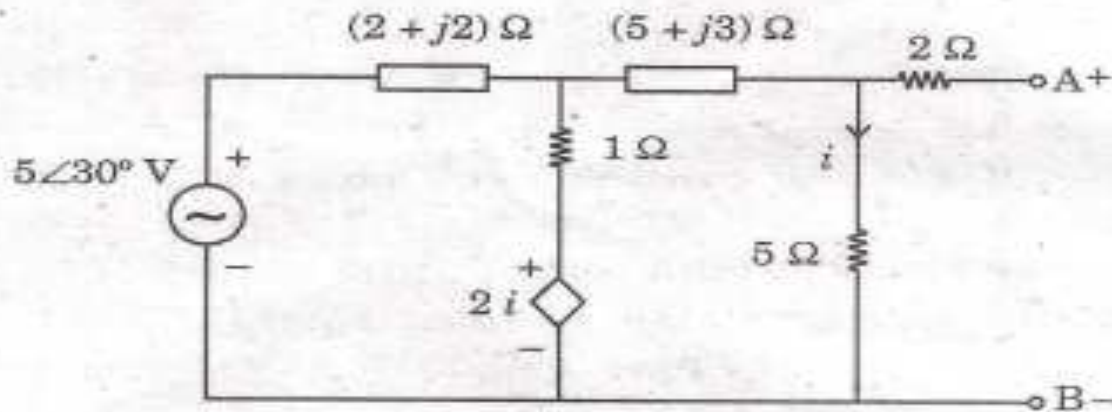


Fig. 2

2. (a) Consider the signal $X(t) = e^{-at} u(t)$, $a > 0$, where $u(t)$ is the unit step function. Find the Fourier transform of $X(t)$ and sketch its amplitude spectra. 6
- (b) State and prove 'Maximum Power Transfer Theorem' for a.c. circuits. 8

- (c) Obtain the Cauer realizations of the driving point admittance :

$$y(s) = \frac{s(s^2 + 9)}{(s^2 + 4)(s^2 + 25)} \quad 8$$

- (d) What are circuit elements ? Discuss their classification. 8

Part B

3. (a) Derive the expression of capacitance of a coaxial cable using Laplace's equation. 15
- (b) State and prove boundary conditions for an electromagnetic wave propagating through the medium. 15
4. (a) A digital voltmeter has a read out range from 0 to 9999 counts. Determine the resolution of the voltmeter in volts when full scale reading is 9.999 V. 3

- (b) A voltmeter reading 70 V on its 100 V range and an ammeter reading on its 150 mA range are used to determine the power dissipated in a resistor. Both these instruments are guaranteed to be accurate within $\pm 1.5\%$ at full scale deflection. Determine the limiting error of the power. 7
- (c) Calculate the unknown inductance and resistance measured by Hay's bridge. The bridge elements at balancing condition are :
- $R_1 = 5.1 \text{ k}\Omega$, $R_2 = 7.9 \text{ k}\Omega$, $R_3 = 790 \text{ }\Omega$ and $C_1 = 2 \text{ }\mu\text{F}$, the supply angular frequency is 1000 rad/sec. 5
- (d) What are the various methods of measurement of power in 3-phase circuits ? Discuss these in detail. 15

Part C

5. (a) What are multivibrators ? What are the various types of multivibrators ? Discuss the working and application of each. 15
- (b) Describe the principle of oscillator. Explain in detail, phase shift oscillator and Wein bridge oscillator, clearly highlighting their differences. 15
6. (a) Discuss CMOS technology and mention its merits and demerits. 7
- (b) Explain the race-round condition in a JK flip-flop. How is it overcome in a master-slave flip-flop ? 8
- (c) Discuss in detail, at least *five* applications of diode. 10
- (d) Differentiate between BJT and FET. 5

P.T.O.

Part C

5. (a) What are multivibrators ? What are the various types of multivibrators ? Discuss the working and application of each. 15

(b) Describe the principle of oscillator. Explain in detail, phase shift oscillator and Wein bridge oscillator, clearly highlighting their differences. 15

6. (a) Discuss CMOS technology and mention its merits and demerits. 7

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(c) Discuss in detail, at least *five* applications of diode. 10

(d) Differentiate between BJT and FET. 5

P.T.O.