國立臺灣科技大學
九十學年度碩士班招生考試試題

系所組別： 電機工程系甲組
科　　目： 電路學

電路學總分 100 分，共五題，每題 20 分。

1. For the circuit shown in Fig.P.1, set up the mesh-current equation for the circuit, then solve the current flowing in every branch. Draw the circuit and write all the branch currents in polar form on the circuit. (20 %)

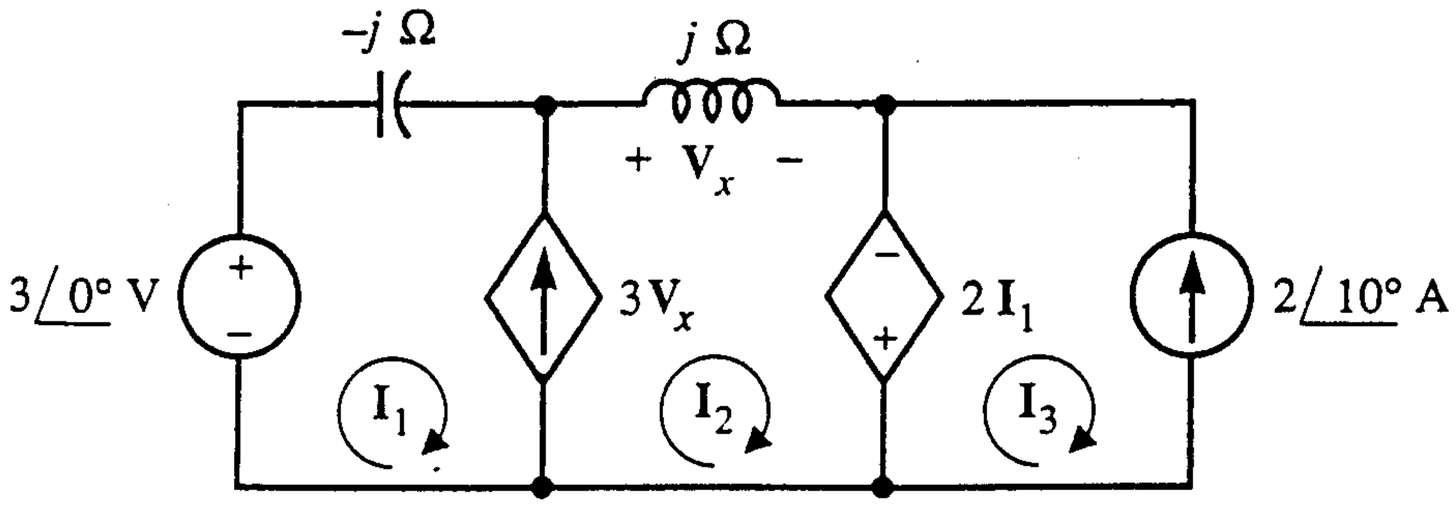
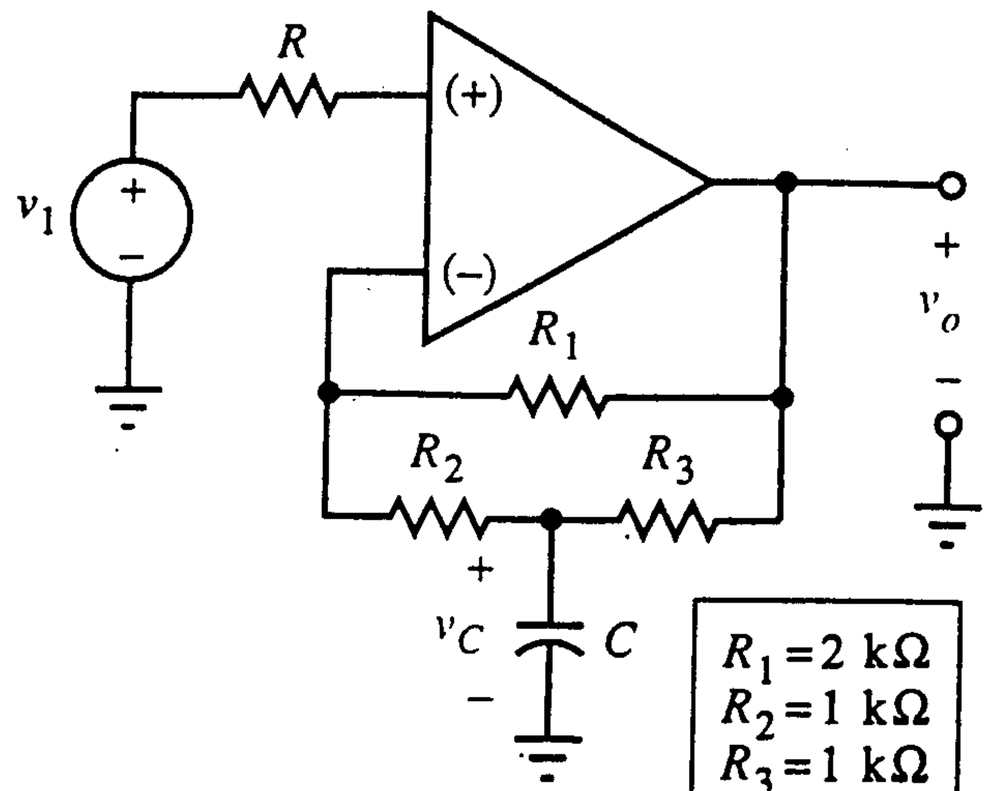


Fig.P.1

2. The ideal op-amp circuit shown in Fig.P.2, $v_c(0-) = 2V$ and $v_1 = 5u(t)$ V. Find and sketch $v_o(t)$ for $t \geq 0$. (20 %)



$R_1 = 2\ k\Omega$
$R_2 = 1\ k\Omega$
$R_3 = 1\ k\Omega$
$C = 1\ \mu F$

Fig.P.2

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3. A 2400-V (line-to-line) three-phase motor is operated at rated voltage and has a mechanical output of 50 horsepower. The motor is operating with an efficiency of 90% and a power factor of 0.8 lagging. (1 hp = 0.746 kW.) Find :
   (1) the complex power absorbed by the motor (5 %)
   (2) the line current (5 %)
   (3) the kVAR rating of a lossless three-phase capacitor that must be connected in parallel with the motor to obtain a combined power factor of 0.9 lagging (5 %)
   (4) the line current required for the combined load (5 %)

4. A series band-pass RLC filter uses a resistance R=2.2 kΩ. Let $H(j\varpi)$ be the transfer function of the band-pass filter.
   (1) Choose the value of L and C to pass the fifth harmonic of a 10-kHz input triangular wave without attenuation and $|H(j\varpi_7)| = 1/25$, where ϖ_7 is the angular frequency of the seventh harmonic. (14 %)
   (2) Make a rough sketch of the output to illustrate the predominant shape of the output waveform. (6 %)

5. A half-rectified cosine voltage with a peak of 1 V and period 1ms is input to a low-pass RC filter. (RC =10 ms)
   (1) Give the formula for the n-th complex Fourier coefficient of the output. (12 %)
   (2) Evaluate your answer to (1) for n = 0, ± 1, ± 2, ± 3. (8 %)

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