BIRLA INSTITUTE OF TECHNOLOGY & SCIENCE, PILANI (RAJASTHAN)
First Semester 2023-2024
EEE F111: Electrical Sciences

Comprehensive Exam (Closed Book): Part A

Date: 07.12. 2023 Suggested Time: 45 Minutes Max Time: 1Hr. MM: 45

Note: Write your answers clearly in the blanks as per the unit given.
Q1-Q11 each correct blank carries 2 Marks and Q12-Q13 each correct blank carries 3 Marks.

Name: ID No: Sec. No.

Q1. In circuit given in Fig Q1, the value of V_{ab} is __________V and I is________ A.

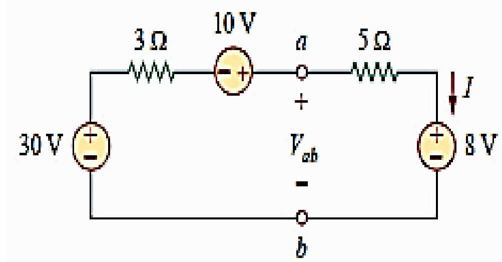


Fig Q1

Q2. A star connected load having 5 Ω in each phase is transformed to an equivalent delta connected load. The value of the equivalent resistance in each phase is _________Ω.

Q3. The current through a 10-mH inductor is shown in Fig Q3. The voltage across the inductor, at t=1 ms is __________V.

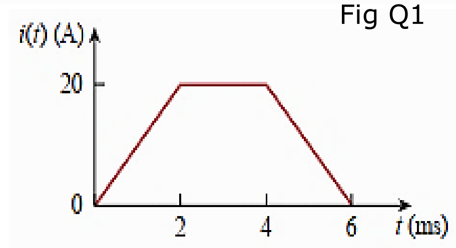
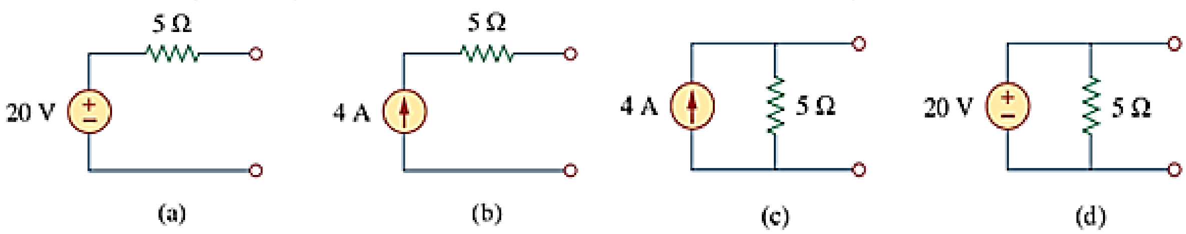


Fig Q3

Q4. A source supplies two loads which are connected in parallel. One load is of 300 kW at 0.6 pf (lag) and another is of 400 kW at 0.8 pf (lead). The total active power supplied by the source is____________W and total reactive power supplied by the source is___________VAR.

Q5. In the circuits (a,b,c,d) shown below , circuits __________are equivalent.



Q6. Generator converts mechanical energy into _____________energy (Mechanical/Electrical).

Q7. The current in the high voltage side of a 2kVA, 200V/100 V transformer is ___________A.

Q8. The total energy dissipated in resistor 'R' in the circuit shown in Fig Q8 if $v(0) = 5V$, R=1 MΩ and $C = 1\mu F$, is ____________J. The value of time (t) at which the current $i_R(t)$ reduces to the half of $i_R(0)$ value, is________sec.

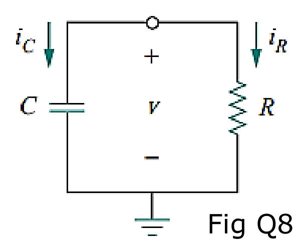


Fig Q8

Q9.For the circuit shown in Fig Q9, if the switch gets closed at t=0, the value of i(0) is _______ and $i(\infty)$ is __________.

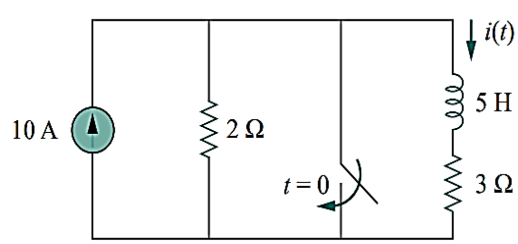


Fig Q9

PTO

Q10. In a parallel RLC circuit, the value of Resistance R= 100Ω, C=10μF. The resonant frequency is 1200 Hz. The value of the quality factor of this circuit is __________.

Q11. In a series RLC circuit, the Quality factor is 25.1, the bandwidth is 9424.77 rad/s, its resonance frequency will be __________KHz.

Q12. The p-side of a Germanium pn junction has conductivity of 50 mho/m and n-side has conductivity of 100 mho/m. Given, electron and hole mobilities are 0.38 m^2/V-s and 0.18 m^2/V-s respectively. For an intrinsic concentration of Germanium to be $2.5*10^{19}$ m^{-3}, the N_A is______________ and N_D is _________________. With these values of N_A and N_D, the barrier potential across junction at 300K is ______________V.

Q13. A cylindrical solenoid (cylinder over which coils are wound), the core has a mean radius of 10 cm, and a mean path length of 20 cm. A current of 5 A produces a magnetic flux density of 0.1 T in the core. The number of turns required for air core and iron core (relative permeability 1000), are _______________ and ____________respectively.

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Note: Attempt all the parts of a question in sequence.

Make neat solutions showing all the necessary steps

Q1(i) A resistance of 6Ω is connected in series with a coil of resistance R and Inductance L. This combination is supplied by a 240 Vrms, 50 Hz source as shown in Fig Q1(i). The voltage drop across 6 Ω resistance is 60 V and across the coil is 205 V. Calculate:

(a) resistance and inductance of the coil

(b) active power loss in the circuit.

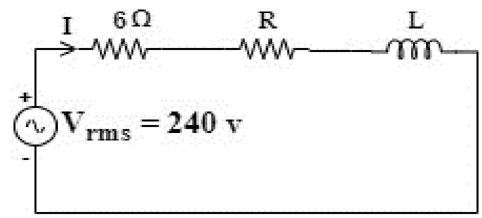


Fig.Q1(i)

(ii) In the circuit shown in Fig Q1(ii), determine current through 8Ω resistance applying Thevenin's Theorem. Also calculate power factor of the circuit. [7+8]

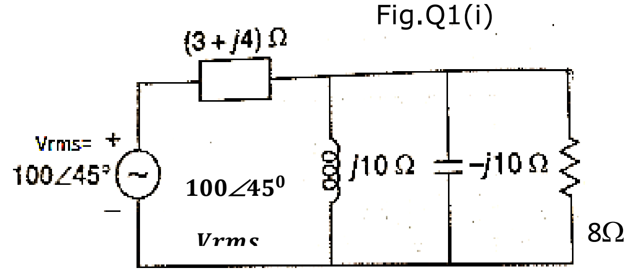


Fig.Q1(ii)

Q2 For the circuit shown in Fig Q2, find the expression of output voltage V_o and sketch its waveform for one cycle, if V_s = 15 sin(ωt) V. Assume loss-less (ideal) operation of the diode. [18]

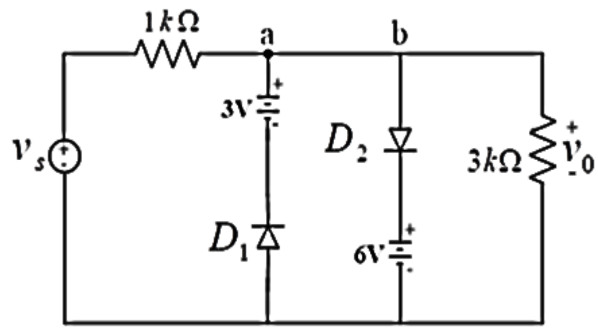


Fig.Q2

Q3 Both the transistors T1 and T2 have β=120 and biased with Vcc=12 V, as shown in the Fig Q3. Find VceT1 and VceT2. The transistors are in active region. [17]

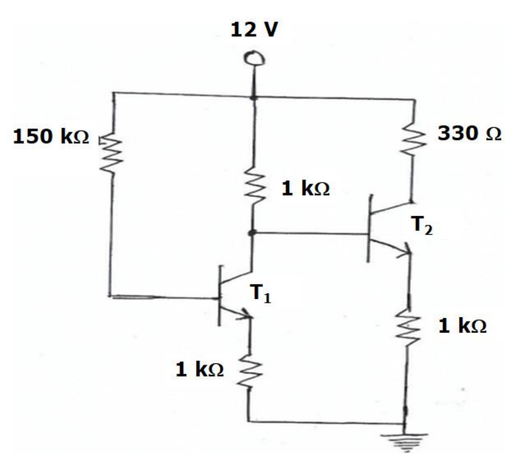


Fig.Q3

PTO

Q4(i) For the enhancement MOSFET shown in Fig Q4(i), V_{GS} = 8V and i_D = 9mA. For V_t = 2V and V_{GG} = 10V, find i_D and V_{DS} when R_D = 250Ω.

Q4(ii) In the Fig Q4(ii), find V_{DS} and V_p if the JFET is in the active region at $I_{DSS} = 8mA$. [8 +12]

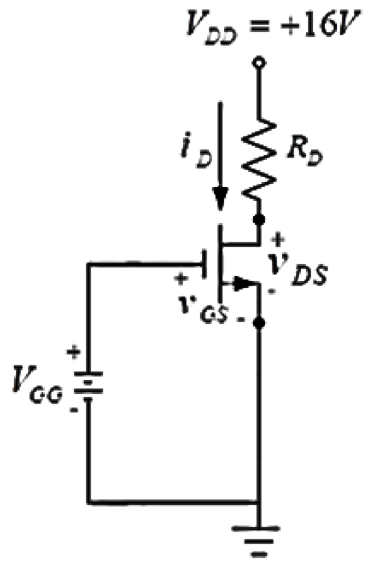


Fig Q4(i)

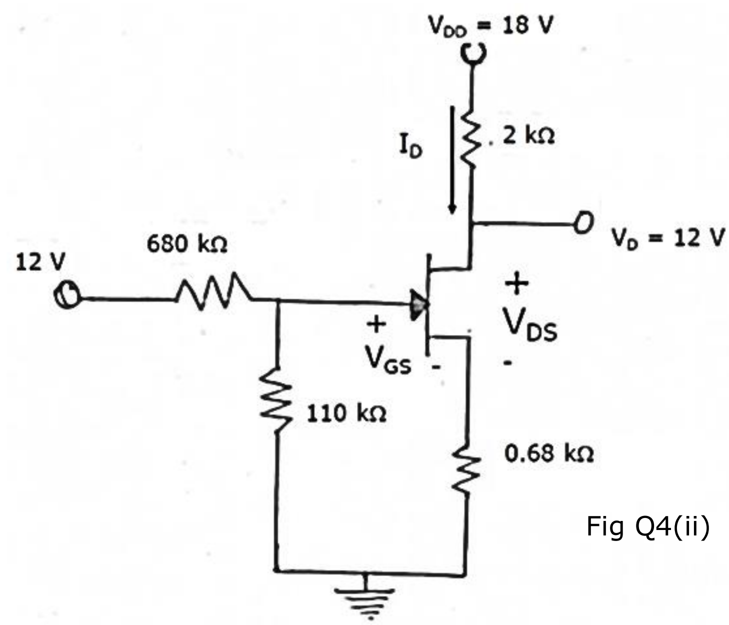
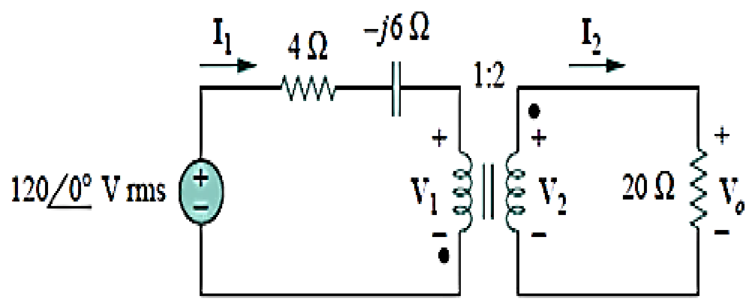


Fig Q4(ii)

Q5 (i) An Ideal Transformer circuit feeding to a resistive load as shown in Fig Q5(i). Find (a) The source current I_1 (b) the output voltage V_o (c) the complex power supplied by the source.



(ii) In the circuit shown in Fig Q5(ii), find the output voltage V_0. Assume all OP AMPs to be ideal. [14+6]

Fig Q5(i)

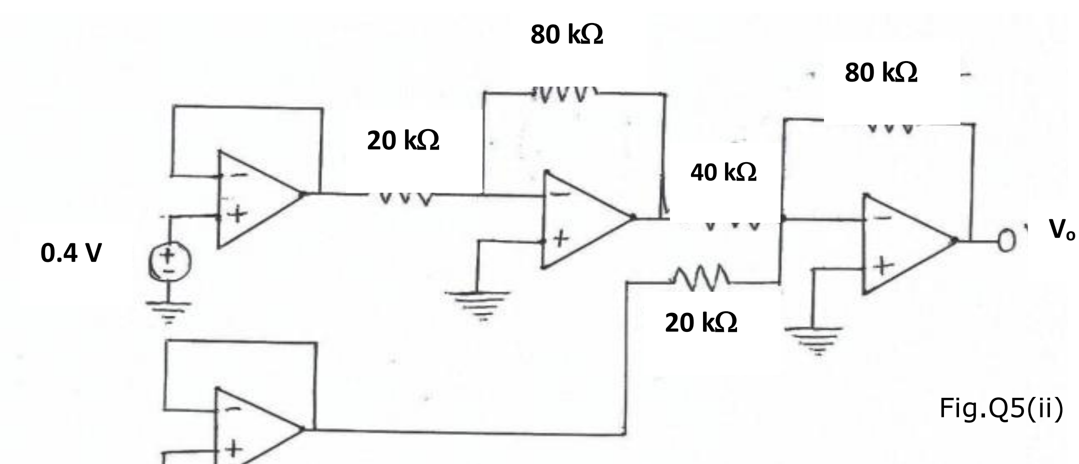


Fig.Q5(ii)