

ELEKTR ZANJIR ELEMENTLARIGA DOIR MASALALAR YECHISH USULLARI

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ANNOTATSIYA

Ushbu maqolada elektr zanjir elementlariga doir murakkab masalalarni yechishda sxemalarni murakkab ko'rinishdan oddiy ko'rinishga aylantirish usullari ko'rsatilgan. O'quvchilar elektr bo'limiga doir masalalarni yechganlarida murakkab sxemalarga duch keladilar va ularni yechishga qiynaladilar. Sxemalarga doir masalalarni osongina tushunishlari uchun sxemalarni birin-ketin soddalashtirishni o'rgatsak ular qiynalmasdan masalalarni yechishlari mumkin.

Kalit so'zlar: Sxema, qarshilik, elektr, potensial.

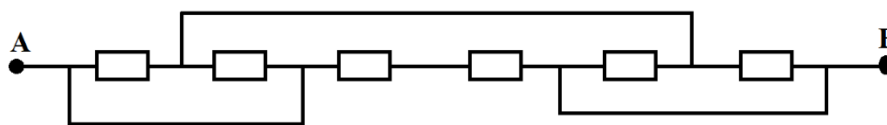
KIRISH

Murakkab sxemalarni soddalashtirishning har xil usullari bo'lib, shulardan ikkitasini ko'rib chiqamiz, birinchisi to'g'ridan-to'g'ri sxemani sodda ko'rinishga o'tish usuli, ikkinchisi birin-ketin soddalashtirish usuli.

ASOSIY QISM

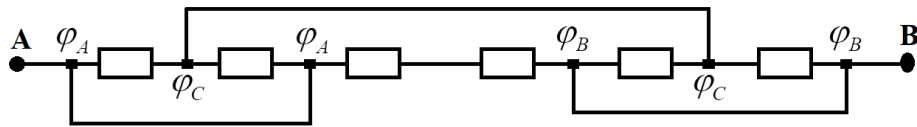
Murakkab sxemalarning soddalashtirishning birinchi usuliga doir masalalarni ko'rib chiqamiz.

1-masala: Oltita 1Ω qarshilikka ega rezistorlar 1-rasmda ko'rsatilgandek zanjirga ulangan. A va B nuqtalar orasidagi umumiy qarshilikni toping. ("2023-yil xalqaro olimpiadaning I-saralash bosqichi")



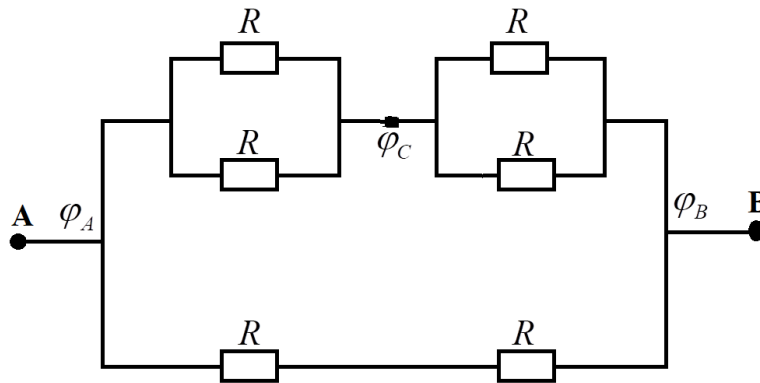
1-rasm

O'quvchilar 1-rasmdagi sxemani yechishda murakkab sxemani sodda ko'rinishga aylantirishni bilsalar, bu masalani osongina hisoblaydilar, buning uchun potentsiallari bir-xil bo'lgan nuqtalar aniqlanadi(2-rasm).



2-rasm

Potensiallari bir-xil bo'lgan nuqtalar tutashtirilgandan keyin sxema quyidagi sodda ko'rinishga o'tadi(3-rasm).



3-rasm

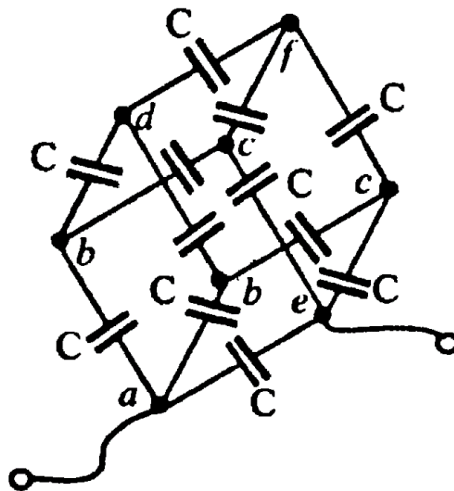
O'quvchilar 3-rasmdagi sxemani juda oddiy va juda osongina ketma-ket va parallel ulash formulalaridan foydalanib umumiy qarshilikni hisoblaydi.

$$\frac{1}{R_{AC}} = \frac{1}{R} + \frac{1}{R} \rightarrow R_{AC} = \frac{R}{2}; \quad \frac{1}{R_{CB}} = \frac{1}{R} + \frac{1}{R} \rightarrow R_{CB} = \frac{R}{2}$$

$$R_{ACB} = R_{AC} + R_{CB} = \frac{R}{2} + \frac{R}{2} = R; \quad R_{AB} = R + R = 2R$$

$$\frac{1}{R_{Um}} = \frac{1}{R_{ACB}} + \frac{1}{R_{AB}} = \frac{1}{R} + \frac{1}{2R} \rightarrow R_{Um} = \frac{2R}{3} = \frac{2}{3}\Omega$$

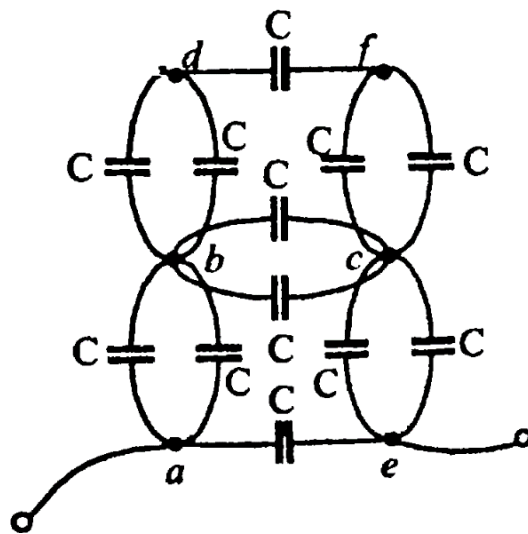
2-masala: Sxemaning umumiy sig'imini toping?



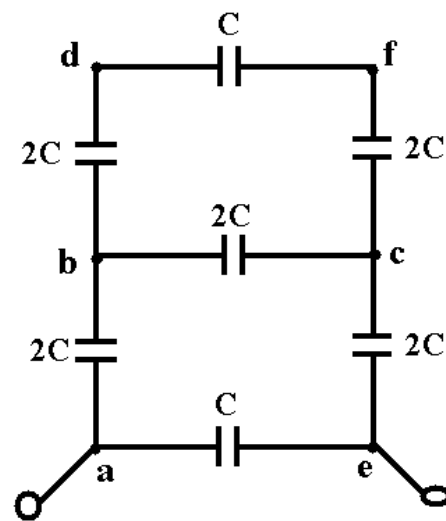
4-rasm

Sxemani quyidagicha soddalashtiramiz, ya'ni potentsiallari teng bo'lgan nuqtalarni topamiz va ularni tutashtiramiz. Potentsiallari teng bo'lgan nuqtalar b va c nuqtalar bo'lib ularni tutashtirganimizda 5-rasmdagi sodda sxema hosil bo'ladi, parallel turgan sig'implarni hisoblasak, sxema yanada soddalashib 6-rasm ko'rinishiga keladi.

Endi o'quvchilar 6-rasmdagi sxemani hisoblashda qiynalmasdan natijani chiqaradilar.



5-rasm



6-rasm

$$\frac{1}{C_{bdfc}} = \frac{1}{2C} + \frac{1}{C} + \frac{1}{2C} = \frac{4}{2C} \rightarrow C_{bdfc} = \frac{C}{2}; \quad C_{bc} = C_{bdfc} + 2C = \frac{C}{2} + 2C = \frac{5C}{2}$$

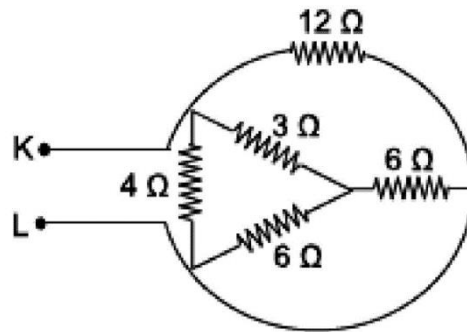
$$\frac{1}{C_{abce}} = \frac{1}{C_{ab}} + \frac{1}{C_{bc}} + \frac{1}{C_{ce}} = \frac{1}{2C} + \frac{2}{5C} + \frac{1}{2C} \rightarrow C_{abce} = \frac{10C}{14} = \frac{5C}{7}$$

$$C_{Um} = C_{abce} + C = \frac{5C}{7} + C = \frac{12C}{7}$$

Murakkab sxemalarni soddalashtirishning ikkinchi usuli birin-ketin soddalashtirish usuli bo'lib, bu usulda sxemani ulab bo'ladigan elementlarni birlashtirib boramiz va

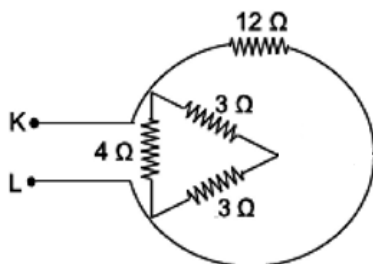
oxirida murakkab sxema sodda sxemaga o'tib qoladi. Ikkinchi usulga doir quyidagi masalalarni ko'rib chiqamiz.

3-masala : Zanjirning K va L nuqtalari orasidagi umumiy qarshilikni toping ?

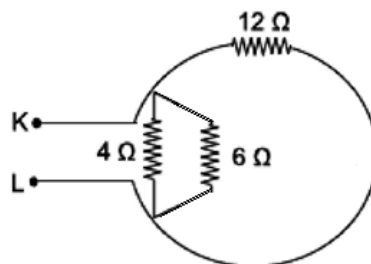


7-rasm

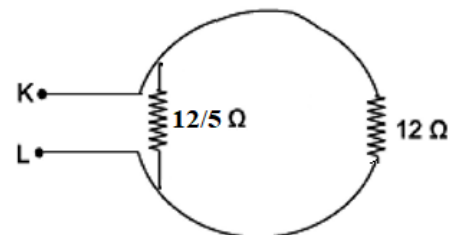
Sxemani soddalashtirish uchun dastlab 7-rasmdan boshlaymiz, 6Ω bilan 6Ω qarshiliklarni parallel ulaymiz va sxemamiz 7.1-rasmdagi ko‘rinishga keladi. Undan keyin 3Ω bilan 3Ω qarshiliklarni ketma-ket ulaymiz va sxemamiz 7.2-rasmdagi ko‘rinishga keladi. Undan keyin esa 6Ω bilan 4Ω qarshiliklarni parallel ulaymiz va sxemamiz 7.3-rasmdagi ko‘rinishga keladi va oxirgi sodda sxemadan natijaga erishamiz.



7.1-rasm



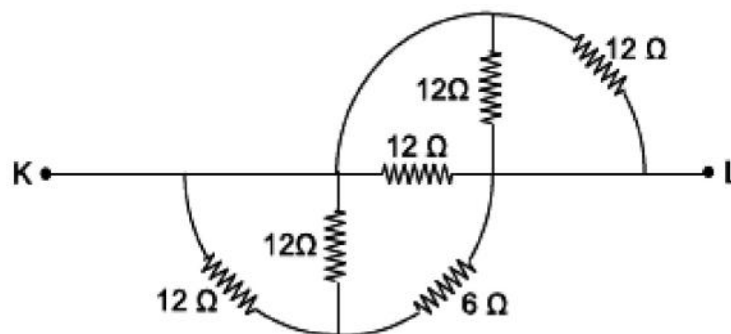
7.2-rasm



7.3-rasm

$$\frac{1}{R_{Um}} = \frac{5}{12} + \frac{1}{12} = \frac{6}{12} \rightarrow R_{Um} = 2 \Omega$$

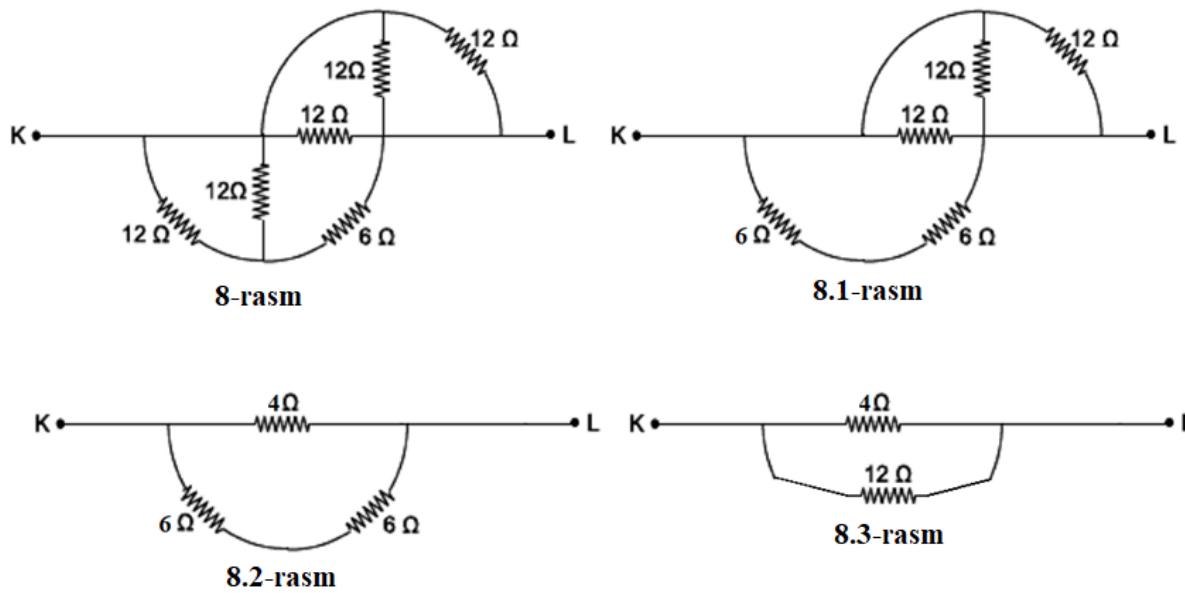
4-masala: Zanjirning K va L nuqtalari orasidagi umumiy qarshilikni toping?



8-rasm

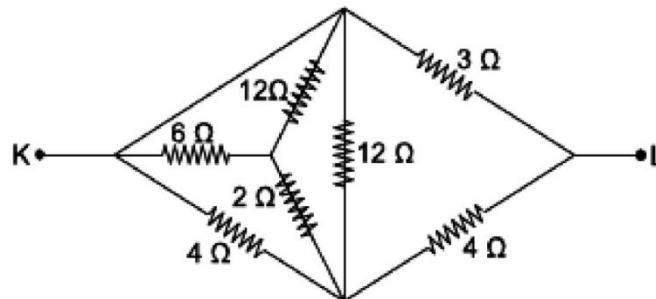
Sxemani soddalashtirish uchun dastlab 8-rasmdan boshlaymiz, 12Ω bilan 12Ω qarshiliklarni parallel ulaymiz va sxemamiz 8.1-rasmdagi ko‘rinishga keladi. Undan keyin 12Ω qarshilikli 3 ta rezistorni parallel ulaymiz va sxemamiz 8.2-rasmdagi ko‘rinishga keladi. Undan keyin esa 6Ω bilan 6Ω qarshiliklarni ketma-ket ulaymiz va

sxemamiz 8.3-rasmdagi ko‘rinishga keladi va oxirgi sodda sxemadan natijaga erishamiz.



$$\frac{1}{R_{Um}} = \frac{1}{4} + \frac{1}{12} = \frac{4}{12} \rightarrow R_{Um} = 3\Omega$$

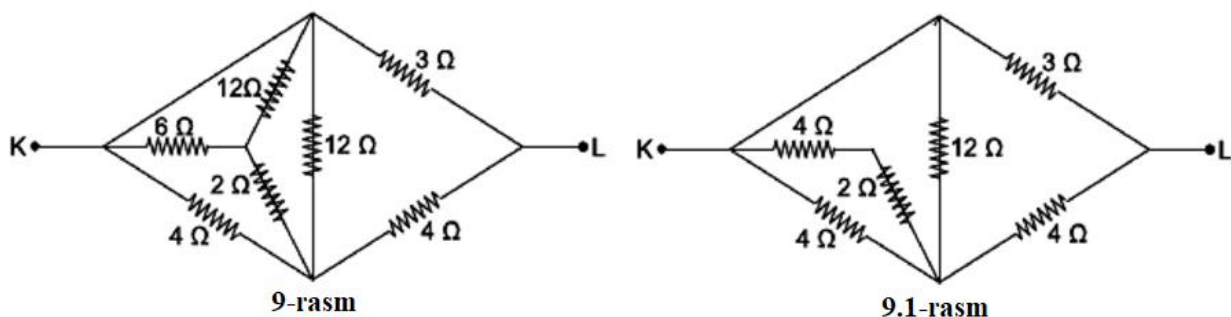
5-masala: Zanjirning K va L nuqtalari orasidagi umumiy qarshilikni toping ?

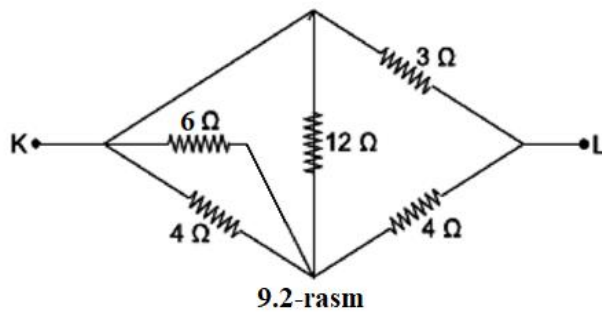


9-rasm

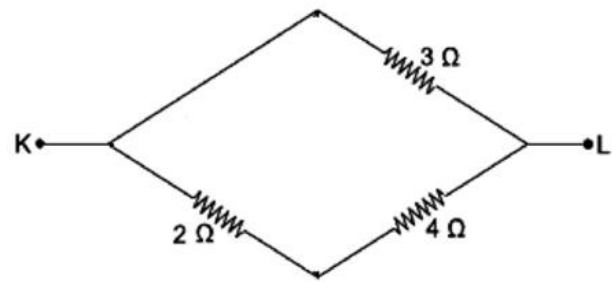
Sxemani birin-ketin soddalashtirish usulini quyidagi rasmlarda ko‘rishimiz mumkin.

O‘quvchi bu usulda 3-4 ta masala yechsa keyingi masalalarni xayoliga hisoblab sxemani 9.1-9.2-9.3-rasmlardagi ko‘rinishga o‘tib umumiy qarshilikni topa oladi.





9.2-rasm



9.3-rasm

$$R_{23} = R_2 + R_3 = 2 + 4 = 6\Omega; \quad \frac{1}{R_{Um}} = \frac{1}{R_1} + \frac{1}{R_{23}} = \frac{1}{3} + \frac{1}{6} = \frac{3}{6}; \quad R_{Um} = 2\Omega$$

Yuqoridagi ko‘rib chiqqan usulimizning oddiy usullardan afzalligi shundaki, o‘quvchi har bir qiladigan amalini ham nazariy hisoblab ketadi va chiqqan natijaga qarab sxemani murakkab ko‘rinishini soddalashtirib boradi.

XULOSA

Murakkab sxemalarni soddalashtirishning to‘g‘ridan-to‘g‘ri sxemani sodda ko‘rinishga o‘tish usuli, ikkinchisi birin-ketin soddalashtirish usullari murakkab tuzilishga ega bo‘lgan sxemalarni yechishning eng sodda yechimi bo‘lib, o‘quvchilar yuqoridagi usullardan foydalansa, sxemalar murakkab ko‘rinishdan sodda ko‘rinishga o‘tadi. Sodda ko‘rinishdagi sxemalarni o‘quvchi ketma-ket va parallel ulash yordamida osongina natija chiqaradi.

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