

### 3. Međuispit iz Elektromagnetskih polja

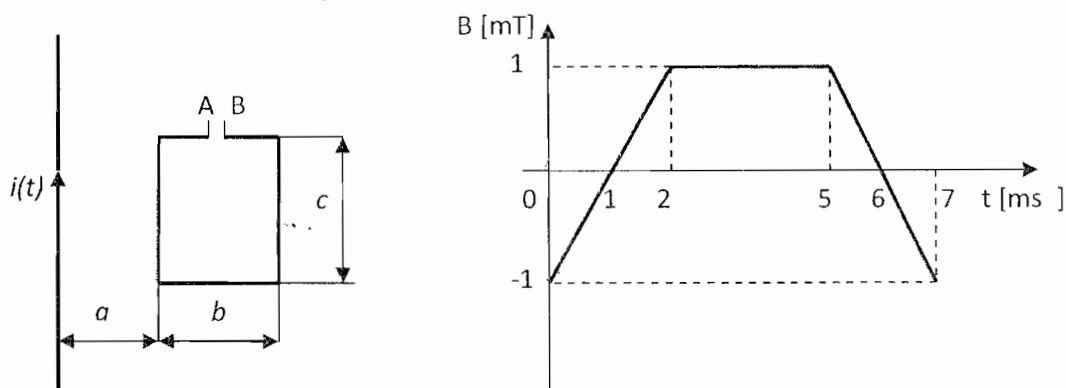
28.06.2010.

Ime i prezime \_\_\_\_\_ Matični broj \_\_\_\_\_

INAČICA **A**

Ispit se sastoji od pet cjelina, u kojima se točan odgovor na svako pitanje nezavisno boduje, te se sastoji od ukupno 20 pitanja. Ukoliko želite odgovoriti na neko pitanje, zacrnite odgovor na obrascu za test. Svaki točan odgovor donosi 1 bod, dok se neodgovorena pitanja ne boduju. Netočan odgovor donosi -0.2 boda. Napišite ime na svim papirima s postupcima i predajte ih na kraju ispita zajedno s primjerkom testa u košuljici, dok se Obrazac za test posebno predaje.

I Na udaljenosti 1m od beskonačno dugog vodiča kroz koji protječe struja  $i(t)$  izmjerena je magnetska indukcija prikazana slikom. Zadano je:  $a=2\text{m}$ ,  $b=1\text{m}$ ,  $c=2\text{m}$ .



1. Odredite struju u beskonačno dugom vodiču u trenutku  $t = 4 \text{ ms}$  u [kA].

A	1	B	6	C	4	D	3	E	2	F	5
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2. Odredite inducirani napon  $U_{AB}$  u petlji u trenutku  $t = 1 \text{ ms}$  u [V].

A	-4.2	B	-2.8	C	-2.1	D	-1.4	E	-0.4	F	-0.8
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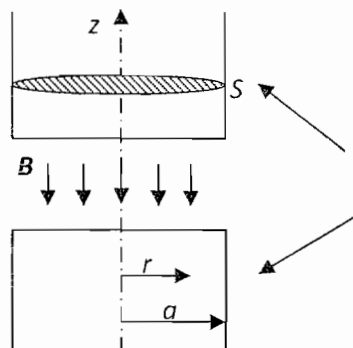
3. Odredite inducirani napon  $U_{AB}$  u petlji u trenutku  $t = 3 \text{ ms}$  u [V].

A	2.5	B	-0.9	C	0.3	D	1.9	E	-1.4	F	0
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4. Odredite inducirani napon  $U_{AB}$  u petlji u trenutku  $t = 5.5 \text{ ms}$  u [V].

A	2.1	B	0.8	C	0.4	D	1.4	E	4.2	F	2.8
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II Između dva pola cilindričnih magneta prema slici magnetska indukcija može se aproksimirati jednačbom:



$$B = \begin{cases} -B_0 \frac{a \cdot t}{\sqrt{a^2 + r^2}} \mathbf{a}_z & t > 0 \\ 0 & t < 0 \end{cases}, \quad a=0.1\text{m}, B_0 = 1\text{T}, \kappa=0, \epsilon_r = 1$$

Polovi magneta

5. Odredite primjenom Faradayevog zakona iznos jakosti električnog polja u prostoru između polova u trenutku  $t = 1\text{ms}$  za  $r = 0.05\text{ m}$  u  $[\text{mV/m}]$ .

A	23.6	B	55.8	C	97.3	D	0	E	118.0	F	70.8
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6. Odredite primjenom Faradayevog zakona iznos jakosti električnog polja u prostoru između polova u trenutku  $t = 3\text{ms}$  za  $r = 0.1\text{ m}$  u  $[\text{mV/m}]$ .

A	353.7	B	41.4	C	124.3	D	0	E	75.8	F	207.1
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7. Odredite primjenom Faradayevog zakona iznos jakosti električnog polja u prostoru između polova u trenutku  $t = -1\text{ms}$  za  $r = 0.05\text{ m}$  u  $[\text{mV/m}]$ .

A	0	B	79.8	C	119.7	D	93.6	E	28.6	F	49.9
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8. Odredite iznos magnetskog toka koji prolazi plohom S magneta u  $t = 1\text{ms}$  u  $[\mu\text{Wb}]$ .

A	162.1	B	130.1	C	102.4	D	46.9	E	26.0	F	78.1
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III Smjer širenja vala frekvencije  $10\text{ MHz}$  u slobodnom prostoru prikazan je slikom. Smjer širenja vala čini kut od  $30^\circ$  s  $+z$  osi, a njegova projekcija na  $x$ - $y$  ravninu čini kut od  $45^\circ$  s  $+x$  osi. Jakost električnog polja nema  $z$  komponente, a u  $t=10^{-6}\text{ s}$  u točki  $(x=0, y=0, z=0)$  ima iznos  $10\cos(\omega \cdot t - \pi/6)\text{ V/m}$ . Odredite, uz pretpostavku  $E_{0x}>0$ :

9.  $E_{0x}$  u  $[\text{V/m}]$ .

A	7.1	B	9.7	C	1.5	D	-7.1	E	-9.7	F	-1.5
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10.  $E_{0y}$  u  $[\text{V/m}]$ .

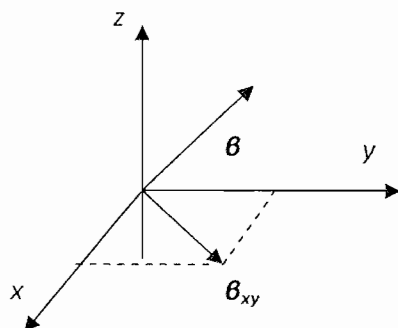
A	-9.7	B	1.5	C	9.7	D	-7.1	E	0	F	7.1
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11.  $H_{0x}$  u  $[\text{mA/m}]$ .

A	-4.1	B	-16.2	C	-8.1	D	4.1	E	8.1	F	16.2
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12.  $H_{0y}$  u  $[\text{mA/m}]$ .

A	4.1	B	8.1	C	0	D	16.2	E	-4.1	F	-16.2
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IV. Ravni je val u sredstvu ( $\mu_r = 1, \varepsilon_r = 2$ ) zadan jednažbom za jakost magnetskog polja:

$$\mathbf{H} = \mathbf{a}_y 10 \cos(\omega t - 3x) \text{ A/m}$$

13. Odredite faznu konstantu  $\beta$  u [ $\text{m}^{-1}$ ].

A	5	B	4	C	1	D	2	E	3	F	6
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14. Odredite brzinu širenja vala u [ $\text{m/s}$ ].

A	$0.87 \cdot 10^8$	B	$2.75 \cdot 10^8$	C	$1.50 \cdot 10^8$	D	$2.12 \cdot 10^8$	E	$0.31 \cdot 10^8$	F	$1.73 \cdot 10^8$
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15. Odredite jakost električnog polja u  $t = 10 \text{ ns}$  i  $x = 0.4 \text{ m}$  u [ $\text{kV/m}$ ].

A	-4.2	B	3.8	C	-1.8	D	1.2	E	-2.2	F	2.8
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16. Odredite smjer širenja vala.

A	$\mathbf{a}_x$	B	$-\mathbf{a}_x$	C	$\mathbf{a}_y$	D	$-\mathbf{a}_y$	E	$\mathbf{a}_z$	F	$-\mathbf{a}_z$
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V. U ishodištu sfernog koordinatnog sustava nalazi se izvor polja:

$$\mathbf{E} = 100 \sin(\vartheta) \cdot r^{-1} \cdot \cos(10^{10}t - r) \mathbf{a}_\vartheta \text{ V/m}$$

$$\mathbf{H} = \frac{100}{120\pi} \sin(\vartheta) \cdot r^{-1} \cdot \cos(10^{10}t - r) \mathbf{a}_\alpha \text{ A/m}$$

17. Odredite smjer prostiranja vala.

A	$\mathbf{a}_r$	B	$-\mathbf{a}_r$	C	$\mathbf{a}_\vartheta$	D	$-\mathbf{a}_\vartheta$	E	$\mathbf{a}_\alpha$	F	$-\mathbf{a}_\alpha$
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18. Odredite iznos Poyntingova vektora  $\mathbf{N}$  na udaljenosti  $r=2 \text{ m}$  u trenutku  $t = 1 \text{ ns}$  za  $\vartheta = \pi/6$  u [ $\text{mW/m}^2$ ].

A	418.8	B	148.7	C	64.0	D	243.3	E	35.1	F	320.1
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19. Odredite srednju vrijednost Poyntingova vektora  $\mathbf{N}_{sr}$  za  $r = 4 \text{ m}$  i  $\vartheta = \pi/4$  u [ $\text{mW/m}^2$ ].

A	265.3	B	414.5	C	340.6	D	515.0	E	646.1	F	736.8
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20. Odredite ukupnu srednju snagu izvora u [ $\text{W}$ ].

A	65	B	111	C	86	D	135	E	20	F	172
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