**112**

**A**

نام:
نام خانوادگی:
محل امضا:

دفترچهٔ شمارهٔ (۱)

صبح پنج‌شنبه
۹۵/۰۲/۱۶

«اگر دانشگاه اصلاح شود مملکت اصلاح می‌شود.»
امام خمینی (ره)

جمهوری اسلامی ایران
وزارت علوم، تحقیقات و فنّاوری
سازمان سنجش آموزش کشور

## آزمون ورودی دوره‌های کارشناسی‌ارشد ناپیوستهٔ داخل ـ سال ۱۳۹۵

## مجموعهٔ مهندسی برق ـ کد ۱۲۵۱

تعداد سؤال: ۵۴          مدت پاسخگویی: ۱۰۵ دقیقه

### عنوان مواد امتحانی، تعداد و شمارهٔ سؤالات

| تا شماره | از شماره | تعداد سؤال | مواد امتحانی | ردیف |
|---|---|---|---|---|
| ۳۰ | ۱ | ۳۰ | زبان عمومی و تخصصی(انگلیسی) | ۱ |
| ۴۲ | ۳۱ | ۱۲ | ریاضیات (معادلات دیفرانسیل، ریاضیات مهندسی، آمار و احتمالات) | ۲ |
| ۵۴ | ۴۳ | ۱۲ | مدارهای الکتریکی ۱ و ۲ | ۳ |

این آزمون نمرهٔ منفی دارد.

استفاده از ماشین حساب مجاز نیست.

زبان عمومی و تخصصی(انگلیسی):

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**PART A: Vocabulary**
<u>Directions:</u> Choose the word or phrase (1), (2), (3), or (4) that best completes the blank. Then mark the correct choice on your answer sheet.

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1- In spite of the considerable effort ---------, many questions still remain unanswered, thus justifying continuous research in this field of inquiry.
   1) taken          2) wasted          3) invested          4) intended

2- The fact that "innovation" is frequently alluded to not only ---------- the importance of the topic but also generates much confusion, because its meaning depends strongly on the context in which it is used.
   1) highlights     2) circumvents     3) alleges          4) cites

3- He was stopped by the police for transgressing the law; he had actually been driving faster than the speed ----------.
   1) calculation    2) permit          3) monitoring       4) limit

4- I thought he was really hurt and became worried but later I realized that he was just ---------- it.
   1) emerging       2) faking          3) revealing        4) deserving

5- Irene's arguments in favor of his client's innocence were so ---------- that no jury member could resist them.
   1) colloquial     2) enthusiastic    3) cogent           4) competitive

6- Believe it or not, laughing is considered to be one of the easiest ---------- exercises that can cure many diseases.
   1) transparent    2) benevolent      3) provocative      4) therapeutic

7- While Alex is very spendthrift and spends money recklessly, his brother Stew is quite ---------- and spends only when it is necessary.
   1) thrifty        2) assiduous       3) gregarious       4) grumpy

8- Chronic illness can ---------- people in hospital. But what if they could access all the care they needed at home in virtual wards?
   1) suffer         2) necessitate     3) trap             4) involve

9- The underlying message of the film is that love can transcend all ----------.
   1) impacts        2) barriers        3) analogies        4) interjections

10- It is no use arguing over such a trifling matter; instead we should discuss the matters of importance and ----------.
   1) pragmatism     2) facility        3) priority         4) jeopardy

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**PART B: Cloze Passage**
<u>Directions:</u> Read the following passage and decide which choice (1), (2), (3), or (4) best fits each space. Then mark the correct choice on your answer sheet.

---

Genetically modified superhumans. Babies born with made-to-order characteristics. The idea has been explored in everything from academic journals (11) ---------- movies. CRISPR technology could make it (12) ----------.

The ability to alter human genes in a way that can be passed onto offspring, (13) ---------- germline engineering, has long been possible. But (14) ---------- genetically modify animals were so inefficient and crude (15) ---------- no sane biologist

would dream of using them on humans. Tinkering with the genes inside people has been limited to gene therapy, where the changes don't get passed to the next generation.

11-   1) in      2) through      3) for      4) to

12-   1) to be real      2) as real      3) a reality      4) being a reality

13-   1) called      2) to be called      3) which called      4) is called

14-   1) until recently the methods available to
     2) the until recently methods available to
     3) the methods available to until recently
     4) until available to recently methods

15-   1) as      2) that      3) because      4) such that

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**PART C: Reading Comprehension:**
_Directions: Read the following three passages and answer the questions by choosing the best choice (1), (2), (3), or (4). Then mark the correct choice on your answer sheet._

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_PASSAGE 1:_

Though relatively new in the world of wireless communications, the history of millimeter wave technology goes back to the 1890's when Bose was experimenting with millimeter wave signals at just about the time when his contemporaries like Marconi were inventing radio communications. Following Bose's research, millimeter wave technology remained within the confines of university and government laboratories for almost half a century.

The propagation characteristics of millimeter waves through the atmosphere depend primarily on atmospheric oxygen, humidity, fog and rain. The signal loss due to atmospheric oxygen, although a source of significant limitation in the 60 GHz band, is almost negligible in the 70 and 80 GHz bands. The effect of water vapor, which varies depending on the absolute humidity, is between zero and about 3dB loss per km at very high humidity and temperature.

The performance reliability of a communication system is often benchmarked in terms of availability percentage of the system. It signifies the average percentage of the time the system is expected to operate to its specification. As stated before, there are other factors that dictate the performance of a millimeter wave link. An intense rain event may cause significant attenuation of millimeter wave signals, but it may not cause an outage of a millimeter wave data link if the link has sufficient margin.

One of the key advantages of millimeter wave communication technology is the large amount of spectral bandwidth available. The bandwidth available in the 70 GHz and 80 GHz bands, a total of 10 GHz, is more than the sum total of all other licensed spectrum available for wireless communication. With such wide bandwidth available, millimeter wave wireless links can achieve capacities as high as 10 Gbps full duplex, which is unlikely to be matched by any lower frequency RF wireless technologies.

16- **Based on the text, which statement is true?**
   1) Universities and government laboratories banned the use of millimeter waves.
   2) The millimeter waves were used by Marconi for radio communications.
   3) The millimeter waves were rapidly used right after Bose's experiment.
   4) The results of Bose's experiment were not received the attention it deserved by industry.

17- **According to text, we can conclude that ----------------.**
   1) The environmental factors have a significant role in the propagation characteristics of millimeter waves.
   2) The atmospheric oxygen is more destructive when the frequency of millimeter waves increases.
   3) The total attenuation due to humidity does not depend on the transmitter receiver distance.
   4) Millimeter waves are less attenuated when it is very humid.

18- **What is the main adverse attribute of the transmission using millimeter waves?**
   1) It can be used for high rate transmission.
   2) It is highly sensitive to severe weather conditions.
   3) It is a solution for spectrum scarcity.
   4) The large amount of the available bandwidth.

19- **The word "relatively" in the first paragraph, can be replaced by ---------------.**
   1) absolutely    2) entirely    3) comparatively    4) utterly

20- **The word "benchmarked" in the third paragraph can be replaced by ---------------.**
   1) visualized    2) evaluated    3) completed    4) attained

*PASSAGE 2:*

In the 20th century, the world's power systems were based on alternating current (AC). The key to AC's triumph was that power could be transformed to higher voltages by use of magnetic induction and then sent over long distances at low currents, minimizing the losses due to resistance; at the destination, the system would reduce the voltage for local distribution. At the time, there was no way to do the same with direct current (DC). However, power engineers also knew that a DC system operating at high voltage would be superior to AC for the same task, since the amount of electricity lost during DC transmission would be far less.

Let's say you are transmitting a given amount of power by high-voltage DC (HVDC): When you double the voltage, you need only half the current of a comparable AC system, thus reducing the line losses by a factor of four. You also need a lot less wire, as DC current penetrates the entire conductor of a power line, whereas AC current remains largely near the surface. In other words, for the same conductor size, the effective resistance is greater with AC, and more power is lost as heat. In practice, that means the overall transmission infrastructure for AC far exceeds that for DC.

HVDC also allows for the easy transfer of power between grids that are operating at different frequencies. The converters, cables, breakers, and other components for HVDC are more expensive than those for AC, so it only makes economic sense to use HVDC over distances of 500 km or more. But that break-even distance has continued to come down as the cost of DC components drops. With these advantages in mind, power engineers experimented with DC transmission technology throughout the 20th century.

The key building block for HVDC was and still is the converter, located at either end of an HVDC line. It serves to convert high-voltage AC to high-voltage DC and DC back to AC. Through the 1960s, such converters relied on mercury arc valves, which were basically electronic switches that could only be turned on and not off, thereby limiting their functionality and resulting in substantial losses.

21- **How is passage organized?**
1) The merits and drawbacks of AC and DC in power distribution systems are compared.
2) The history of the power systems in the 21$^{st}$ century is reviewed.
3) It explains the break – even distance.
4) The characteristics of the HVDC are outlined.

22- **Why in the 20$^{th}$ century, power engineers did not use DC systems for power transmission?**
1) Low demand for lossless distribution lines.
2) Short distance transmission lines.
3) Lack of knowledge about its advantages.
4) Inefficiency of DC components.

23- **According to the text, HVDC has the following advantages over HVAC except** ----------.
1) cheaper transmission infrastructure.
2) easier power grids connection.
3) use of magnetic induction.
4) lower transmission loss.

24- **What are the main components in HVDC?**
1) transmission lines.                 2) AC/DC converters.
3) circuit breakers.                   4) transformers.

25- **Which of the following is the most likely topic of the paragraph following the passage?**
1) technology of mercury-arc valves in 1960s.
2) AC's triumph in modern power transmission systems.
3) history of power systems in the 21$^{st}$ century.
4) advancements in AC/DC converters.

*PASSAGE 3:*

Effective network planning is essential to cope with the increasing number of mobile broadband data subscribers and bandwidth-intensive services competing for limited radio resources in cellular systems. Operators have met this challenge by increasing capacity with new radio spectrum, adding multi-antenna techniques and implementing more efficient modulation and coding schemes.

However, these measures alone are insufficient in the most crowded environments and at cell edges where performance can significantly degrade. Operators are also adding small cells and tightly-integrating these with their macro networks to spread traffic loads, widely maintain performance and service quality while reusing spectrum most efficiently.

One way to expand an existing macro-network, while maintaining it as a homogeneous network, is to "densify" it by adding more sectors per base station or deploying more macro base stations. However, reducing the site-to-site distance in the macro-network can only be pursued to a certain extent because finding new macro-sites becomes increasingly difficult and can be expensive, especially in city centers. An

alternative is to introduce small cells through the addition of low-power base stations. The actual cell size depends not only on base station power but also on antenna position, as well as the location environment; e.g. rural or city, indoor or outdoor. Small cells are primarily added to increase capacity in hot spots with high user demand and to fill in areas not covered by the macro network - both outdoors and indoors. They also improve network performance and service quality by offloading from the large macro-cells. The result is a heterogeneous network with large macro-cells in combination with small cells providing increased bitrates per unit area.

26- **According to the text, what is the main challenge in the network planning?**
1) Services which require significant bandwidths.
2) Systems with rising number of subscribers.
3) Spectrum scarcity.
4) All of the above.

27- **Based on the text, which statement is valid?**
1) The problem of network planning has been solved by increasing the number of sectors per base station.
2) Utilizing multi-antenna systems is enough for efficient network planning in the crowded area.
3) Heterogeneous networks expand the capacity of the cellular systems.
4) Improving the modulation and coding is the most productive approach to be used in cell edges.

28- **Which of the following approaches does not result in a homogeneous network?**
1) Deploying small cells with low power base stations in addition to the existing macro base station.
2) Implementing more efficient techniques for modulation and coding.
3) Densifying the network by implementing more macro base stations.
4) Expanding the number of sectors for each base station.

29- **According to the text, we can conclude that ---------------**
1) Densifying the network with more macro base stations in hot spots is an easy and economically efficient task.
2) Small cells in heterogeneous networks cover the areas with low coverage from macro base stations.
3) The actual size of a cell is affected only by the power of its base station.
4) The number of macro base stations can be increased to any arbitrary level.

30- **The word "expand" in the third paragraph, can not be replaced by which of the following words?**
1) Develop          2) Extend          3) Enlarge          4) Restrict

ریاضیات (معادلات دیفرانسیل، ریاضیات مهندسی، آمار و احتمالات):

۳۱- اگر $y(t) = u_1 \cos 3t + u_2 \sin 3t$ جواب معادلهٔ دیفرانسیل $y'' + 9y = \sec^2(3t)$ به روش تغییر پارامتر باشد، $u_1(t)$ کدام است؟

۱) $c_1 - \dfrac{1}{\cos 3t}$

۲) $c_1 + \dfrac{1}{\cos 3t}$

۳) $c_1 + \dfrac{3}{\cos 3t}$

۴) $c_1 - \dfrac{3}{\cos 3t}$

۳۲- جواب مسئلهٔ مقدار اولیهٔ زیر، کدام است؟

$$\begin{cases} x\dfrac{dy}{dx} = y + x\sec\left(\dfrac{y}{x}\right) \\ y(1) = \dfrac{\pi}{4} \end{cases}$$

۱) $\cos\left(\dfrac{y}{x}\right) = \text{Ln}|x| - \dfrac{\sqrt{2}}{2}$

۲) $\cos\left(\dfrac{y}{x}\right) = \text{Ln}|x| + \dfrac{\sqrt{2}}{2}$

۳) $\sin\left(\dfrac{y}{x}\right) = \text{Ln}|x| - \dfrac{\sqrt{2}}{2}$

۴) $\sin\left(\dfrac{y}{x}\right) = \text{Ln}|x| + \dfrac{\sqrt{2}}{2}$

۳۳- مجموعه نقاط تکین معادلهٔ $\tan(2x-1)y'' + xy' = \dfrac{1}{x}$، چیست؟

۱) $\left\{ ..., \dfrac{-3\pi-2}{2}, \dfrac{-\pi-2}{2}, 0, \dfrac{\pi-2}{2}, \dfrac{3\pi-2}{2}, ... \right\}$

۲) $\left\{ ..., \dfrac{-3\pi-2}{2}, \dfrac{-\pi-2}{2}, \dfrac{\pi-2}{2}, \dfrac{3\pi-2}{2}, ... \right\}$

۳) $\left\{ ..., \dfrac{-3\pi-2}{4}, \dfrac{-\pi-2}{4}, 0, \dfrac{\pi-2}{4}, \dfrac{3\pi-2}{4}, ... \right\}$

۴) $\left\{ ..., \dfrac{-3\pi-2}{4}, \dfrac{-\pi-2}{4}, \dfrac{\pi-2}{4}, \dfrac{3\pi-2}{4}, ... \right\}$

۳۴- اگر جواب معادلهٔ $x^\Upsilon y'' + xy' + (x^\Upsilon - 1)y = 0$ را به روش فروبنیوس به ازای ریشهٔ بزرگتر معادلهٔ مشخصه در نظر بگیریم، روابط بازگشتی بین ضرایب سری به چه صورت است؟

$$a_n = \frac{a_{n-\Upsilon}}{1 - n^\Upsilon} \quad (1$$

$$a_n = \frac{a_{n-\Upsilon}}{n^\Upsilon - 1} \quad (\Upsilon$$

$$a_{n+\Upsilon} = \frac{a_n}{(n+\Upsilon)(n+\Upsilon)} \quad (\Upsilon$$

$$a_{n+\Upsilon} = \frac{-a_n}{(n+\Upsilon)(n+\Upsilon)} \quad (\Upsilon$$

۳۵- به ازای $-\pi < x < \pi$، $x = -\Upsilon \sum_{n=1}^{\infty} \frac{(-1)^n}{n} \sin(nx)$ و $x^\Upsilon = -\Upsilon \sum_{n=1}^{\infty} (\frac{\pi^\Upsilon}{n} - \frac{\varphi}{n^\Upsilon})(-1)^n \sin(nx)$ است. از ضرب داخلی این دو تابع، کدام نتیجه، حاصل میشود؟

$$\sum_{n=1}^{\infty} \frac{1}{n^\Upsilon}(\pi^\Upsilon - \frac{\varphi}{n^\Upsilon}) = \frac{\pi^\Upsilon}{10} \quad (1$$

$$\sum_{n=1}^{\infty} \frac{1}{n^\Upsilon}(\pi^\Upsilon - \frac{\varphi}{n^\Upsilon}) = \frac{\pi^\Upsilon}{\Delta} \quad (\Upsilon$$

$$\sum_{n=1}^{\infty} \frac{1}{n^\Upsilon}(\pi^\Upsilon - \frac{\varphi}{n^\Upsilon}) = \frac{\pi^\Upsilon}{\Delta} \quad (\Upsilon$$

$$\sum \frac{1}{n^\Upsilon}(\pi^\Upsilon - \frac{\varphi}{n^\Upsilon}) = \frac{\pi^\Upsilon}{10} \quad (\Upsilon$$

۳۶- تابع $f(x,t)$ در هر لحظه $t$ای نسبت به متغیر $x$، تکهای هموار بوده و قابل نمایش به صورت یک سری فوریه با ضرایب پیوستهٔ $f_n(t)$، نسبت به پایهٔ متعامد مورد نیاز مسئلهٔ مقدار اولیه ــ مرزی زیر است.

$$\begin{cases} u_{tt} - a^2 u_{xx} = f(x,t), 0 < x < L, t > 0 \\ u(x,0) = 0, u_t(x,0) = 0, 0 \leq x \leq L \\ u(0,t) = 0 = u(L,t), t > 0 \end{cases}$$

اگر $u(x,t) = \int_0^t \int_0^L G(x,z,t-\tau)f(z,\tau)dzd\tau$، جواب مسئلهٔ مقدار اولیه ــ مرزی باشد، تابع $G$ کدام است؟

$$1)\quad \frac{2}{\pi a}\sum_{n=1}^{\infty}\frac{1}{n}\sin\frac{n\pi}{L}a(t-\tau)(\sin\frac{n\pi x}{L})(\sin\frac{n\pi z}{L})$$

$$2)\quad \frac{2}{\pi}\sum_{n=1}^{\infty}\frac{1}{n}\sin\frac{n\pi}{L}a(t-\tau)(\sin\frac{n\pi x}{L})(\sin\frac{n\pi z}{L})$$

$$3)\quad \frac{2}{\pi a}\sum_{n=1}^{\infty}\frac{1}{n}\sin\frac{2n\pi}{L}a(t-\tau)(\sin\frac{2n\pi x}{L})(\sin\frac{2n\pi z}{L})$$

$$4)\quad \frac{2}{\pi}\sum_{n=1}^{\infty}\frac{1}{n}\sin\frac{2n\pi}{L}a(t-\tau)(\sin\frac{2n\pi x}{L})(\sin\frac{2n\pi z}{L})$$

۳۷- برای حل معادلهٔ ناهمگن حرارت $u_t = u_{xx} + h(x,t)$، $0 < x < \pi$، $t > 0$، با شرایط مرزی $u(0,t) = u(\pi,t) = 0$ که در آن تابع $h$ تکهای هموار است، اگر $u(x,t) = \sum_{n=1}^{\infty}u_n(t)\sin(nx)$ اختیار شود، که در آن $u_n(t)$ از معادلهٔ دیفرانسیل $u'_n(t) + n^2\pi^2 u_n = A_n(t)$ به دست میآید، عبارت $A_n(t)$ کدام است؟

$$1)\quad \int_0^\pi h(x,t)\sin nx\, dx$$

$$2)\quad \pi\int_0^\pi h(x,t)\sin nx\, dx$$

$$3)\quad \frac{\pi}{2}\int_0^\pi h(x,t)\sin nx\, dx$$

$$4)\quad \frac{2}{\pi}\int_0^\pi h(x,t)\sin nx\, dx$$

۳۸- تعداد نقاط غیر تحلیلی تابع $f(z) = \dfrac{Log(iz+\Upsilon)}{(z-\Lambda)\cosh(\pi z)\sin z}$ در درون مرز $|z| = \Upsilon$ کدام است؟ (Log شاخهٔ اصلی

تابع لگاریتم است)

۱) ۵

۲) ۳

۳) ۶

۴) بی‌شمار

۳۹- حاصل $\displaystyle\int (x - y + ix^{\Upsilon})dz$ ، در طول خط راست واصل از $z = \circ$ به $z = \Lambda + i$، کدام است؟

۱) $\Lambda + \dfrac{i}{\Upsilon}$

۲) $\dfrac{\Lambda}{\Upsilon}(i+\Lambda)$

۳) $\dfrac{\Lambda}{\Upsilon}(i-\Lambda)$

۴) $\Lambda - \dfrac{i}{\Upsilon}$

۴۰- اگر $B(p,q) = \displaystyle\int_{\circ}^{\Lambda} t^{P-\Lambda}(\Lambda - t)^{q-\Lambda}dt$ به ازای $q > \circ, p > \circ$ (ثابت) تابع بتا باشد، با استفاده از تغییر متغیر

$t = \dfrac{\Lambda}{x+\Lambda}$، مقدار $B(a, \Lambda - a)$ (به ازای $\circ < a < \Lambda$)، کدام است؟

۱) $\dfrac{\pi}{\sinh(\pi a)}$

۲) $\dfrac{\Upsilon\pi}{\sin(\pi a)}$

۳) $\dfrac{\pi}{\sin(\pi a)}$

۴) $\dfrac{\pi}{\Upsilon\sin(\pi a)}$

۴۱- اگر برای دو پیشامد $A$ و $B$ داشته باشیم $P(A|B) + P(B|A) = \dfrac{\Upsilon}{\Upsilon}$، $P(B) = \dfrac{\Upsilon}{\Upsilon}$ و $P(A) = \dfrac{\Lambda}{\Upsilon}$. مقدار

$P(A \cup B)$ کدام است؟

۱) $\dfrac{\Lambda}{\mathcal{F}}$

۲) $\dfrac{\Delta}{\mathcal{F}}$

۳) $\dfrac{\Lambda}{\Upsilon}$

۴) $\Lambda$

مجموعة مهندسی برق      112A      صفحه ۱۱

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۴۲- تابع توزیع احتمال مشترک متغیرهای تصادفی X و Y به شکل زیر است. میانهٔ متغیر تصادفی Y کدام است؟ (k عدد ثابت است)

$$f_{XY}(x,y) = \begin{cases} kx & \circ < x < y < 1 \\ \circ & \text{otherwise} \end{cases}$$

1) $2^{-\frac{1}{3}}$

2) $3^{-1}$

3) $2^{-\frac{1}{2}}$

4) $\frac{3}{4}$

مدارهای الکتریکی ۱ و ۲:

۴۳- در مدار زیر، به‌ازای چه مقدار α، مقاومت معادل دیده‌شده از دو سر a و b به‌صورت $R_{th} = R$ است؟
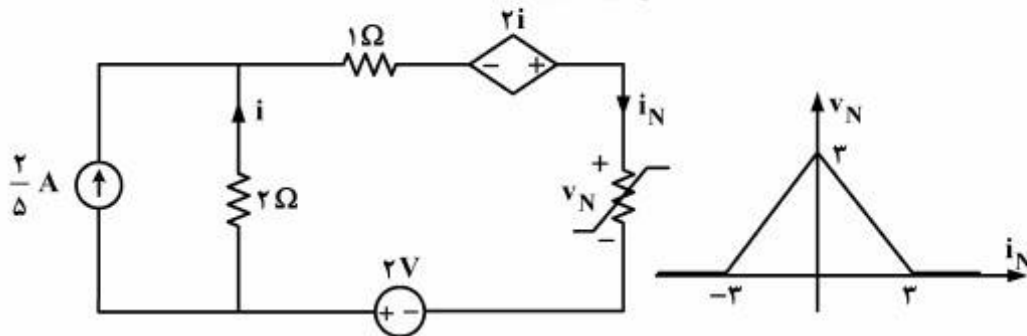
1) $\alpha = \circ$

2) $\alpha = \frac{1}{2}$

3) $\alpha = 1$

4) تمامی مقادیر $\alpha \neq \circ$
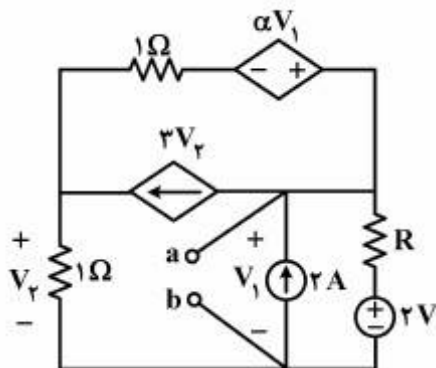
۴۴- در مدار زیر، باتوجه به مشخصهٔ مقاومت غیرخطی $i_N - v_N$، جریان $i$ چند آمپر است؟



۱) $-\dfrac{2}{5}$

۲) $-\dfrac{9}{10}$

۳) $-\dfrac{3}{7}$

۴) $-\dfrac{6}{7}$

۴۵- در مدار زیر که شامل مقاومت غیرخطی با مشخصهٔ نشان‌داده شده است، اگر $8\,V = v(\bar{0})$ باشد، بعد از چه مدتی $v$ به مقدار ۲- ولت می‌رسد؟
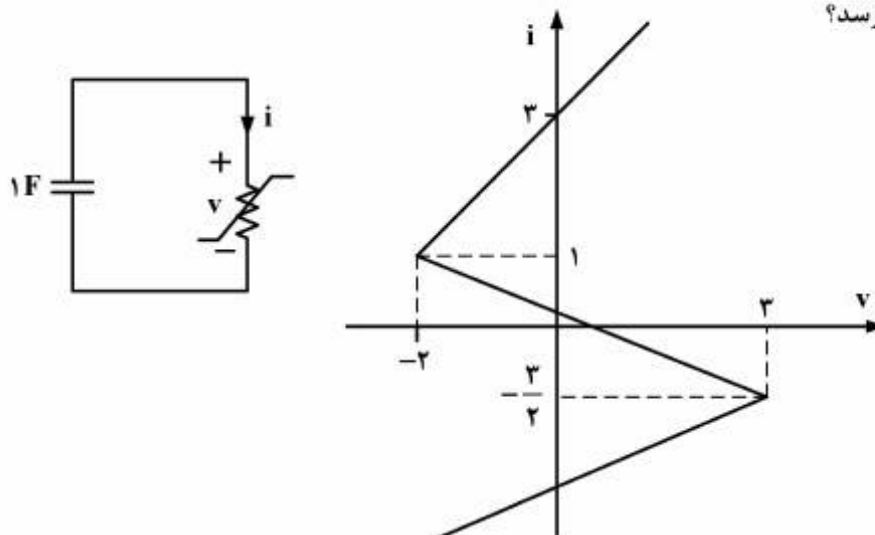


۱) $\ln 5$

۲) $\ln 11$

۳) ۱

۴) ۲

۴۶- در مدار زیر با $v_C(o) = 2V$ و $i_L(o) = 3A$، مقدار $i_L''(o^+)$، چند آمپر است؟



1) $-\dfrac{16}{3}$

2) $-\dfrac{7}{5}$

3) $-2$
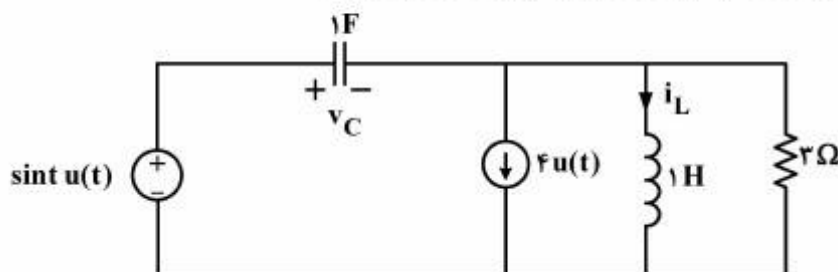
4) $-\dfrac{19}{3}$

۴۷- در مدار زیر، مقدار بیشینهٔ توان منبع در حالت دائمی سینوسی، چند وات است؟



1) ۵

2) ۱۰

3) ۱۵
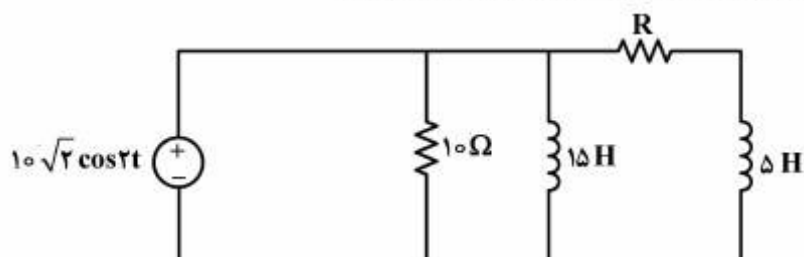
4) ۳۰

۴۸- به‌ازای چه مقداری برای خازن C، امپدانس دیده‌شده از سرهای a و b در فرکانس $\omega = 2\dfrac{rad}{s}$ به‌صورت سلفی خالص می‌شود؟



1) $\dfrac{1}{10}F$

2) $\dfrac{1}{6}F$

3) $\dfrac{1}{5}F$
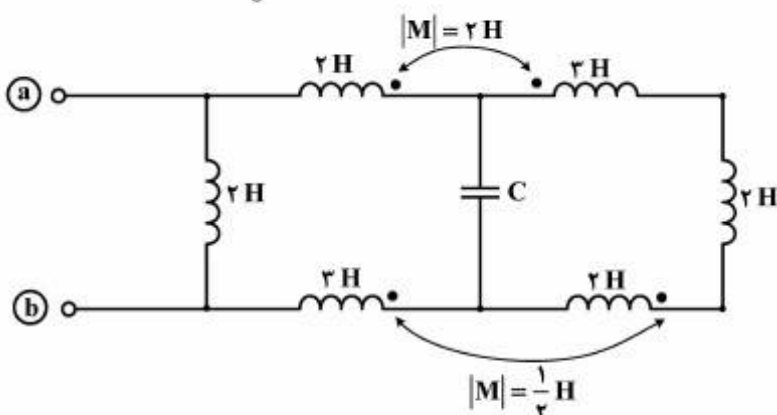
4) $\dfrac{1}{3}F$

۴۹- در گراف ۶ شاخه‌ای و ۴ گرهی، ماتریس کات ست‌های اساسی به‌صورت زیر است. ماتریس حلقه‌های اساسی کدام است؟

شمارهٔ شاخه‌ها

$$Q = \begin{bmatrix} -1 & 1 & -1 & 0 & 0 & 0 \\ 1 & 0 & 1 & 1 & -1 & 0 \\ -1 & 0 & 0 & 0 & 1 & 1 \end{bmatrix} \begin{matrix} 1 & 2 & 3 & 4 & 5 & 6 \end{matrix}$$

$$(1)\quad B = \begin{bmatrix} 1 & 1 & 0 & -1 & 0 & 1 \\ 0 & 1 & 1 & -1 & 0 & 0 \\ 0 & 0 & 0 & 1 & 1 & -1 \end{bmatrix}$$

$$(2)\quad B = \begin{bmatrix} 1 & -1 & 0 & 1 & 0 & -1 \\ 0 & -1 & 1 & 1 & 0 & 0 \\ 0 & 0 & 0 & -1 & 1 & 1 \end{bmatrix}$$

$$(3)\quad B = \begin{bmatrix} 1 & 0 & 0 & 1 & -1 & 1 \\ 0 & 1 & 0 & 1 & -1 & 0 \\ 0 & 0 & 1 & 0 & 1 & -1 \end{bmatrix}$$

$$(4)\quad B = \begin{bmatrix} 1 & 0 & 0 & -1 & 1 & -1 \\ 0 & 1 & 0 & -1 & 1 & 0 \\ 0 & 0 & 1 & 0 & -1 & 1 \end{bmatrix}$$

۵۰- در مدار زیر با فرض اینکه بردار حالت به‌صورت $x = \begin{bmatrix} i(t) \\ v_1(t) \end{bmatrix}$ می‌باشد، ماتریس $A$ در معادلات حالت مدار $\dot{x} = Ax + Bv$، کدام است؟
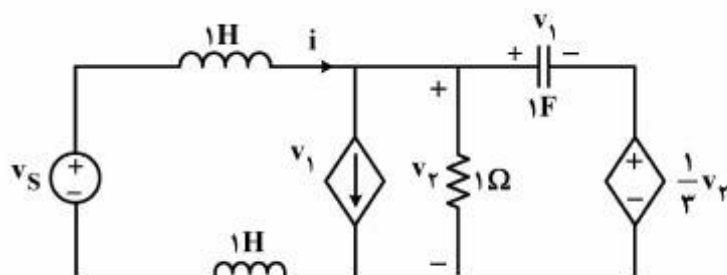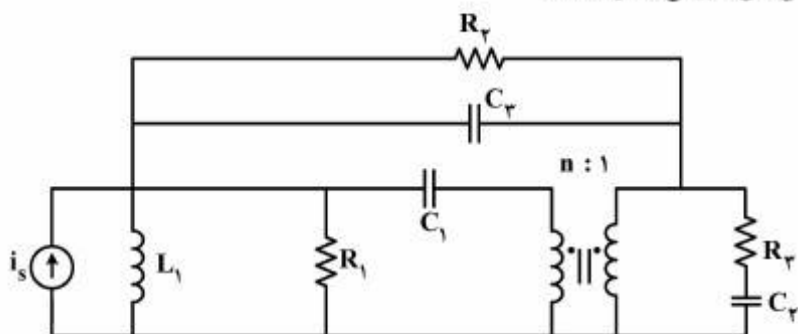


$$(1)\quad \begin{bmatrix} 0 & -\dfrac{1}{2} \\ 1 & -\dfrac{5}{2} \end{bmatrix}$$

$$(2)\quad \begin{bmatrix} 0 & -\dfrac{1}{2} \\ -1 & \dfrac{3}{2} \end{bmatrix}$$

$$(3)\quad \begin{bmatrix} 0 & -\dfrac{3}{4} \\ 1 & -\dfrac{3}{2} \end{bmatrix}$$

$$(4)\quad \begin{bmatrix} 0 & -\dfrac{3}{4} \\ 1 & -\dfrac{5}{2} \end{bmatrix}$$

۵۱- در مدار زیر، بهازای کدام مقدار n، ضریب جملهٔ بیشترین درجهٔ معادلهٔ مشخصهٔ مدار، صفر میشود؟ (معادلهٔ مشخصهٔ مدار، معادلهٔ تمام فرکانسهای طبیعی مدار است.)
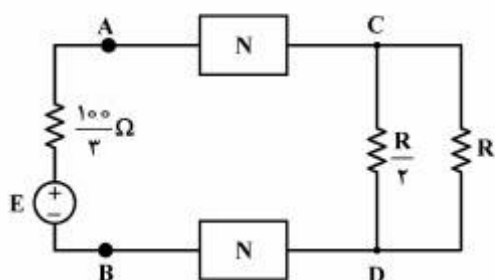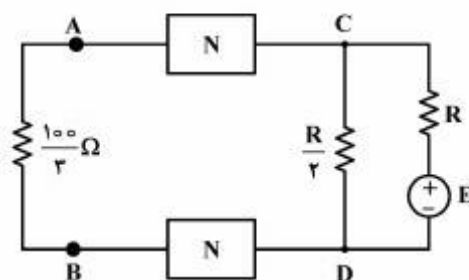
۱) $n = ۱$

۲) $n > ۲$

۳) n هر مقداری میتواند باشد.

۴) جوابی وجود ندارد.



۵۲- در مدار زیر N یک شبکهٔ متقابل و E ثابت است. اگر در شکل (۱) $v_{AC} = \frac{۱}{۴} E$ و در شکل (۲) $v_{AB} = \frac{۱}{۶۰} E$ باشد، مقدار R چند اهم است؟
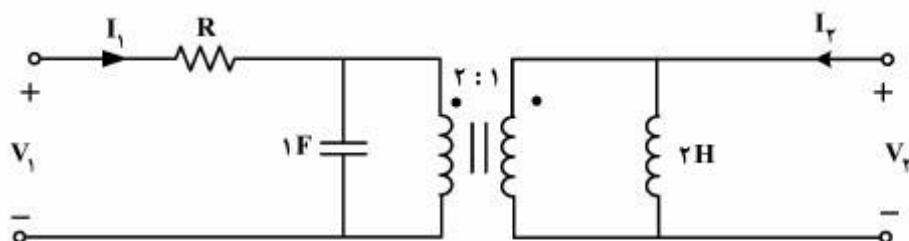


(۱)

(۲)

۱) ۸۰۰

۲) ۹۰۰

۳) ۱۱۰۰

۴) ۱۹۰۰

۵۳- در شکل زیر، اگر دترمینان ماتریس ادمیتانس دوقطبی نشانداده شده در $s = \frac{۱}{۲}$، برابر با ۱۲ باشد، مقاومت R چند اهم است؟
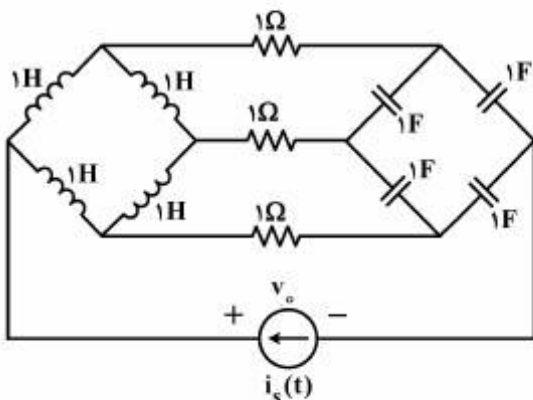
۱) ۰

۲) ۱

۳) ۲

۴) ۴

۵۴- در مدار زیر با $i_s = u(t)$، پاسخ حالت صفر $v_o$ کدام است؟ ($s_1$ و $s_2$ فرکانس‌های طبیعی مدار می‌باشند)



1) $v_o(t) = \dfrac{1}{2}u(t) + tu(t) + k_1 e^{s_1 t} + k_2 e^{s_2 t}$

2) $v_o(t) = \dfrac{1}{2}\delta(t) + \dfrac{1}{2}tu(t) + k_1 e^{s_1 t} + k_2 e^{s_2 t}$

3) $v_o(t) = \dfrac{1}{2}u(t) + \dfrac{1}{2}tu(t) + k_1 e^{s_1 t} + k_2 e^{s_2 t}$

4) $v_o(t) = \dfrac{1}{2}\delta(t) + \dfrac{1}{2}u(t) + \dfrac{1}{2}tu(t) + k_1 e^{s_1 t} + k_2 e^{s_2 t}$