

PART A: Vocabulary

Directions: Choose the word or phrase (1), (2), (3), or (4) that best completes each sentence. Then mark the correct choice on your answer sheet.

- 1- These ideas are not quite new; they ----- ancient philosophers.
 1) descend from 2) depart for 3) put over 4) give rise to
- 2- The story ----- the lives of people in the last century.
 1) contends 2) settles 3) depicts 4) persists
- 3- Strong storms have been ----- our efforts to find flood survivors.
 1) submitting 2) hampering 3) surmising 4) demarcating
- 4- The military in most countries uses radar satellites to ----- targets through clouds and at night.
 1) dominate 2) disallow 3) track 4) overthrow
- 5- The association works to promote the ----- of retired people as active and useful members of the community.
 1) standpoint 2) posture 3) status 4) disclosure
- 6- At the end of the article, the author bridges all the different ----- of the argument together.
 1) dealings 2) strands 3) remnants 4) conversions
- 7- Life in Britain was transformed by the ----- of the steam engine.
 1) expenditure 2) advent 3) disposition 4) undertaking
- 8- There is evidence that a(n) -----to cancer runs in some families.
 1) prospect 2) incident 3) dilemma 4) predisposition
- 9- The journalists insisted on getting to the front line of the battle, ----- of the risks.
 1) heedless 2) inevitable 3) devoid 4) unaccustomed
- 10- Computers operate using ----- numbers (the values 0 and 1).
 1) binary 2) scant 3) dual 4) trivial

PART B: Cloze Test

Directions: 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.

The Sahara is the great desert of northern Africa and the largest in the world. (11) ----- the Atlantic Ocean on the west to the Red Sea on the east, and from the Atlas Mountains and Mediterranean Sea on the north (12) ----- the savannas of the Sudan region on the south. (13) ----- more than 3 million square miles (8 million sq km), the Sahara is divided among many countries. Parts of the desert are known by separate names, such as the Eastern or Arabian Desert between the Nile River and the Red Sea, and the Libyan Desert along the border between Egypt and Libya. The Sahara has (14) ----- of 2 million excluding the densely settled Nile Valley, (15) ----- apart from the surrounding desert. The principal language of the people of the Sahara is Arabic and their religion is Islam.

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- | | |
|-------------------------------|----------------------------|
| 11- 1) There extends from | 2) It extends between |
| 3) It extends from | 4) There extends between |
| 12- 1) at | 3) in |
| 2) on | 4) to |
| 13- 1) To be an area with | 2) With an area of |
| 3) To be an area of | 4) Across an area with |
| 14- 1) estimated a population | 2) a population estimated |
| 3) a population estimating | 4) an estimated population |
| 15- 1) which is considered | 2) that is considered |
| 3) that it considers | 4) which it considers |

PART C: Reading Comprehension

Directions: Read the following four passages and choose the best choice (1), (2), (3), or (4). Then mark it on your answer sheet.

PASSAGE 1:

Millions of people suffer organ and tissue loss every year from accidents, birth defects, and disease such as cancer and diabetes. In the last quarter of the 20th century, innovative drugs, surgical procedures, and medical devices have greatly improved the care of these patients. Yet these treatments are imperfect and often impair the quality of life. The control of diabetes with insulin shots, for instance, is only partly successful. Injection of hormone insulin once or several times a day helps the cells of diabetics to take up the sugar glucose from the blood. However, the appropriate insulin dosage for each patient may vary widely from day to day and even hour to hour. Often amounts can not be determined precisely enough to maintain the blood sugar level in the normal range and prevent complications of diabetes – such as blindness, kidney failure, and heart disease-later in life.

Innovative research in biosensor design and drug delivery will someday make insulin injections obsolete. In many diabetics, the disease is caused by destruction in the pancreas. In others, the pancreas makes insulin, but not enough to meet the body's demands. It is possible to envision a sensor-controlled device that would function like the pancreas, continuously monitoring glucose levels and releasing the appropriate amount of insulin in response. This device could be implanted or worn externally.

16- The text hopes that someday -----.

- 1) the insulin injection will be increased in the patient population
- 2) we can decrease the number of organ loss due to birth defect
- 3) biomedical approaches help diabetics to have a better life
- 4) people learn how to prevent blindness and kidney failure caused by diabetes

17- In the sentence "It will someday make the insulin injection obsolete." The word "Obsolete" can be replaced by:

- 1) out-of-order
- 2) popular
- 3) useless
- 4) up-to-date

18- According to the text, the biosensor has to -----.

- 1) observe the glucose level and act accordingly
- 2) be implanted inside the body by surgery
- 3) remove the pancreas
- 4) monitor all hormones including the glucose level

19- According to the text, what is the major disadvantage of insulin injection?

- 1) Insulin injection can not prevent kidney disease or heart failure.
- 2) The patients, especially children, can not inject themselves.
- 3) Implanting a sensor is easier than injection.
- 4) The adequate insulin for each patient depends on his/her body and changes with time.

20- Which word has the closest meaning to “innovative research”?

- 1) initiating research 2) ingenious research 3) recent research 4) traditional research

PASSAGE 2:

Mobile networks have enabled dramatic advances and changes in telecommunications over the last two decades, and mobile operators have offered their subscribers a service set as rich as their wireline competitors, plus mobility. However, with the broadband market success in cable, xDSL and Wi-Fi, the competitive landscape is changing. Although 3G technologies deliver significantly higher bit rates than 2G technologies, there is still more opportunity for wireless operators to capitalize on the ever-increasing demand for “wireless broadband”, even lower latency and multi-megabit throughput. Consequently, there is an expanding revenue opportunity from a growing pool of underserved consumers that can only be satisfied with next generation networks. The solution is “LTE” (Long Term Evolution), the next-generation network beyond 3G.

In addition to enabling fixed to mobile migrations of Internet applications such as Voice over IP, vide streaming, music downloading, mobile TV and many others, LTE networks will also provide the capacity to support an explosion in demand for connectivity from a new generation of consumer devices tailored to those new mobile applications. Competing technologies are already emerging to address the growing nomadic wireless broadband market space. However, mobile operators, thanks to their incumbent position, have a unique opportunity to evolve their infrastructures to next generation wireless networks and capitalize on this great opportunity to further grow their dominant market share. Their decision on which technology and when to evolve to the higher performing next generation networks will underpin their market success.

21- In the sentence “However, the mobile operators thanks to ...”, what does “thanks to” mean?

- 1) despite to 2) trying to 3) due to 4) appreciation

22- Based on the text, which of the following has the lowest “throughput”?

- 1) 3G systems 2) LTE 3) DSL 4) 2G systems

23- In the last sentence of the text: “Their decision on, will underpin their success”. What does “underpin” mean?

- 1) establish 2) convey 3) destroy 4) accomplish

PASSAGE 3:

Nanotechnology is the manipulation of matter for use in particular applications through certain chemical / physical processes to create materials with specific properties. There are both “bottom-up” processes that create nanoscale materials from atoms and molecules, as well as “top-down” processes that create nanoscale materials from their macro-scale counterparts. Nanoscale materials that have macro-scale counterparts frequently display different or enhanced properties compared to the macro-scale form. Such engineered or manufactured nanomaterials are referred to as “intentionally produced nanomaterials”. The definition of nanotechnology does not include unintentionally produced nanomaterials, such as diesel exhaust particles or other friction or airborne combustion byproducts, or nanosized materials that occur naturally in the environment, such as viruses or volcanic ash.

Nanotechnology has the potential to improve the environment, both through direct applications of nanomaterials to detect, prevent, and remove pollutants, as well as indirectly by using nanotechnology to design cleaner industrial processes and create environmentally responsible products. However, there are unanswered questions regarding the impacts of nanoproducts on human health and the environment. Thus the Environmental Protection Agency has the obligation to ensure that potential risks are adequately understood to protect human health and the environment.

24- “Unintentionally produced nanomaterials” refers to:

- 1) Nanomaterials which have been produced in laboratories.
- 2) Nanomaterials which have been produced prudentially.
- 3) Non-natural nanomaterials.
- 4) Nanomaterials which have not been produced deliberately.

25- Which of the following phrases describes the term “environmentally responsible products” the best?

- 1) Products which will be used in the environment.
- 2) Manufactured products.
- 3) Recyclable products.
- 4) Products whose producer is responsible for them.

26- In the last sentence of the text, “adequately understood” can be replaced by:

- 1) Inherently responsive.
- 2) Thoroughly studied.
- 3) Suitably ignored.
- 4) Insufficiently discussed.

27- According to the text, how nanotechnology can improve the human health?

- 1) By removing viruses and volcanic ash from the atmosphere.
- 2) By using nanomaterial products in medical applications.
- 3) By collecting all the combustion byproducts.
- 4) By exploiting nanotechnological approaches in the industrial world.

PASSAGE 4:

Another source of noise is loose lamination. The magnet body and plunger (armature) are made up of thin sheets of iron laminated and riveted together to reduce eddy currents and hysteresis, iron losses showing up as heat. Eddy currents are shorted currents induced in the metal by the transformer action of an ac coil. Although these currents are small, they heat up the metal, create an iron loss, and contribute to inefficiency. At one time, laminations in magnets were insulated from each other by a thin, nonmagnetic coating; however, it was found that the normal oxidation of the metallic laminations reduces the effects of eddy currents to a satisfactory degree, thus eliminating the need for a coating.

28- All the following can be the cause of inefficiency in the magnets except:

1) oxidation

2) iron loss

3) heating

4) eddy currents

29- It is stated that the disturbances to the magnet core such as eddy currents, and hysteresis -----.

1) reduce efficiency

2) are demonstrated as heat

3) may be small

4) all of the above

30- The word "rivet" is closet in meaning to -----.

1) inject

2) fasten

3) combine

4) weld

۳۱- جواب عمومی معادله $y' - x \sin^2 y = x e^{-x^2} \cos^2 y$ کدام گزینه است؟

$$(۱) \quad 4 \operatorname{tg} x + e^{-x^2} - 4 c e^{x^2} = 0 \quad (۲) \quad 4 \operatorname{tg} x + \frac{x^2}{2} - 4 c e^{x^2} = 0$$

$$(۳) \quad 4 \operatorname{tg} y + e^{-x^2} - 4 c e^{-x^2} = 0 \quad (۴) \quad 4 \sin y + e^{-x^2} + c \cos y = 0$$

۳۲- از معادله دیفرانسیل $ty'' + (1-t)y' + ny = 0$ تبدیل لاپلاس گرفته و $Y(s) = L\{y(t)\}$ را حساب می‌کنیم، کدام یک از گزاره‌های زیر درست است؟

(۱) معادله دیفرانسیل داده شده برای $y(t)$ دو جواب مستقل ندارد زیرا $Y(s)$ چنین نشان می‌دهد.

(۲) معادله دیفرانسیل داده شده برای $y(t)$ فقط دارای یک جواب مستقل است زیرا معادله دیفرانسیل تبدیل لاپلاس $Y(s)$ حاصل فقط مرتبه اول است و یک جواب مستقل دارد.

(۳) معادله دیفرانسیل داده شده دارای معادله دیفرانسیل مرتبه اول برای تبدیل لاپلاس $Y(s)$ است، لذا تبدیل لاپلاس کلیه جواب‌های $y(t)$ به دست نیامده است.

(۴) معادله دیفرانسیل داده شده برای $y(t)$ جواب نمی‌دهد زیرا تبدیل لاپلاس‌گیری برای $Y(s)$ دو جواب مستقل نمی‌دهد.

۳۳- اگر $L_n(s) = \frac{(s-1)^n}{s^{n+1}} = L[I_n(t)]$ ، آنگاه $I_n(t) = L^{-1}[L_n(s)]$ کدام است؟

$$(۱) \quad e^t \frac{d^n}{dt^n} (t^n e^t) \quad (۲) \quad \frac{e^{-t}}{n!} \frac{d^n}{dt^n} (t^n e^{-t}) \quad (۳) \quad \frac{e^t}{n!} \frac{d^n}{dt^n} (t^n e^{-t}) \quad (۴) \quad e^t \frac{d^n}{dt^n} (t^n e^{-t})$$

۳۴- مسئله مقدار اولیه دستگاه زیر داده شده است:

$$\begin{cases} y_1'(t) = -3y_1 + y_2 + u(t-1)e^t, & y_1(0) = 0 \\ y_2'(t) = -4y_1 + 2y_2 + u(t-1)e^t, & y_2(0) = 3 \end{cases}$$

که در آن $u(\tau) = \begin{cases} 1, & \tau \geq 0 \\ 0, & \tau < 0 \end{cases}$ تابع پله واحد است. $y(t)$ کدام است؟

$$(۱) \quad e^t - e^{-2t} \quad (۲) \quad e^t - e^{-2t} + \frac{1}{3}(e^t - e^{3-2t})u(t-1) \quad (۳) \quad e^t - e^{-2t} + (e^t - e^{3-2t})u(t-1) \quad (۴) \quad \frac{1}{3}(e^t - e^{3-2t})u(t-1)$$

۳۵- اگر تابع $f(x,y)$ را در ناحیه $0 < x < a$ و $0 < y < b$ به صورت سری

$$f(x,y) = \sum_{m=1}^{\infty} \sum_{n=1}^{\infty} A_{mn} \sin\left(\frac{m\pi x}{a}\right) \sin\left(\frac{n\pi y}{b}\right)$$

چگونه خواهد بود؟

$$\frac{1}{ab} \int_0^a \int_0^b f(x,y) \sin\left(\frac{m\pi x}{a}\right) \sin\left(\frac{n\pi y}{b}\right) dy dx \quad (۲)$$

$$\frac{1}{ab} \int_0^a \int_0^b f(x,y) \sin\left(\frac{m\pi x}{a}\right) \sin\left(\frac{n\pi y}{b}\right) dy dx \quad (۳)$$

$$\frac{4}{ab} \int_0^a \int_0^b f(x,y) \sin\left(\frac{m\pi x}{a}\right) \sin\left(\frac{n\pi y}{b}\right) dy dx \quad (۴)$$

۳۶- در مسئله مقدار اولیه

$$\begin{cases} u_{tt} - a^2 u_{xx} = 0, & \forall t > 0, -\infty < x < \infty \\ u(x, 0) = 0, & u_t(x, 0) = g(x) = \begin{cases} g_0, & x_1 < x < x_2 \\ 0, & \text{های دیگر } x \end{cases} \end{cases}$$

اگر جواب به صورت

$$u(x,t) = \frac{1}{2a} \int_{x-at}^{x+at} g(s) ds = G(x+at) - G(x-at)$$

باشد، آنگاه تابع $G(x)$ کدام است؟

$$\begin{cases} 0, & x \leq x_1 \\ \frac{1}{a}(x-x_1)g_0, & x_1 \leq x < x_2 \\ \frac{1}{a}(x_2-x_1)g_0, & x > x_2 \end{cases} \quad (۲)$$

(۴) تابع $G(x)$ پیوسته موجود نیست.

$$\begin{cases} 0, & x \leq x_1 \\ \frac{1}{2a}(x-x_1)g_0, & x_1 \leq x \leq x_2 \\ \frac{1}{2a}(x_2-x_1)g_0, & x > x_2 \end{cases} \quad (۱)$$

$$\begin{cases} 0, & x \leq x_1 \\ \frac{1}{2a}(x-x_1)g_0, & x_1 < x < x_2 \\ 0, & x > x_2 \end{cases} \quad (۳)$$

۳۷- برای میله‌ای به طول L که سطح جانبی و دو سر آن کاملاً عایق است، و $u(x,0) = f(x)$ و $u_t = c^2 u_{xx}$ کدام گزینه

برای $u(x,t)$ صحیح است؟

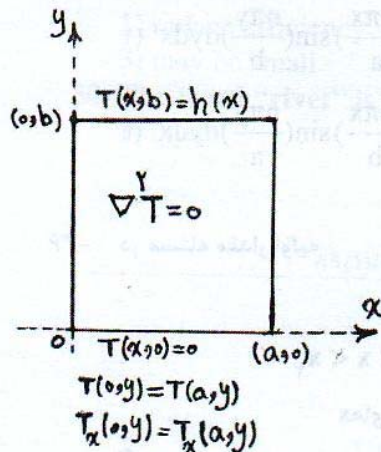
$$A_0 + \sum_{n=1}^{\infty} A_n e^{\left(\frac{n\pi c}{L}\right)^2 t} \cos\left(\frac{n\pi x}{L}\right) \quad (۲)$$

$$A_0 + \sum_{n=1}^{\infty} A_n e^{-\left(\frac{n\pi c}{L}\right)^2 t} \cos\left(\frac{n\pi x}{L}\right) \quad (۴)$$

$$A_0 + \sum_{n=1}^{\infty} A_n e^{-\left(\frac{n\pi c}{L}\right)^2 t} \cos\left(\frac{n\pi x}{L}\right) \quad (۱)$$

$$A_0 + \sum_{n=1}^{\infty} A_n e^{-\left(\frac{n\pi c}{L}\right)^2 t} \cos\left(\frac{n\pi x}{2L}\right) \quad (۳)$$

۳۸- برای حل مسئله مقدار مرزی معادله دیفرانسیل لاپلاس در داخل مستطیل با شرایط مرزی داده شده طبق شکل، تابع تگه‌ای هموار معلوم (مفروض) h بر حسب کدام پایه متعامد باید بسط داده شود؟



$$\frac{1}{2}, \sin \frac{2\pi x}{a}, \cos \frac{2\pi x}{a}, \sin \frac{4\pi x}{a}, \cos \frac{4\pi x}{a}, \dots, \sin \frac{2n\pi x}{a}, \cos \frac{2n\pi x}{a}, \dots \quad (1)$$

$$\frac{1}{2}, \cos \frac{\pi x}{a}, \cos \frac{2\pi x}{a}, \dots, \cos \frac{n\pi x}{a}, \dots \quad (2)$$

$$\frac{1}{2}, \cos \frac{2\pi x}{a}, \cos \frac{4\pi x}{a}, \dots, \cos \frac{2n\pi x}{a}, \dots \quad (3)$$

$$\frac{1}{2}, \sin \frac{\pi x}{a}, \cos \frac{\pi x}{a}, \sin \frac{2\pi x}{a}, \cos \frac{2\pi x}{a}, \dots, \sin \frac{n\pi x}{a}, \cos \frac{n\pi x}{a}, \dots \quad (4)$$

۳۹- تابع $\phi(x,y) = x^3 - 3xy^2$ در همه نقاط هارمونیک (همساز) می‌باشد. تابع مختلط تحلیلی G از متغیر z را به گونه‌ای تعیین نمایید که $\text{Re } G = \phi$.

$$(x^3 - 3xy^2) + i(4xy - y^3 + c) \quad (2)$$

$$(x^3 - 3xy^2) + i(3xy^2 - y^3 + c) \quad (1)$$

$$(x^3 - 3xy^2) + i(3x^2y - y^3 + c) \quad (4)$$

$$(x^3 - 3xy^2) + i(4xy^2 + y^3 + c) \quad (3)$$

۴۰- تبدیل $w = \sin z$ را در نظر می‌گیریم. در مورد یک به یک و پوششی بودن نگاشت، کدام یک از گزینه‌های زیر نادرست است؟

$$(1) \text{ نوار } -\frac{\pi}{2} \leq x \leq \frac{\pi}{2} \text{ به تمام صفحه مختلط } w$$

$$(2) \text{ نیمه نوار } 0 \leq x \leq \frac{\pi}{2} \text{ و } y \geq 0 \text{ به ربع اول صفحه } w$$

$$(3) \text{ نیمه نوار } -\frac{\pi}{2} \leq x \leq \frac{\pi}{2} \text{ و } y \geq 0 \text{ به نیمه بالایی صفحه } w$$

$$(4) \text{ نیمه نوار } -\frac{\pi}{2} \leq x \leq 0 \text{ و } y \geq 0 \text{ به ربع دوم صفحه } w$$

۴۱- تعداد نقاط غیر تحلیلی تابع $f(z) = \frac{\log(3+z)}{(z^2+2)\sin z}$ درون مرز $|z|=2$ کدام است؟

$$3 \quad (4)$$

$$4 \quad (3)$$

$$7 \quad (2)$$

$$2 \quad (1)$$

۴۲- فرض می‌کنیم x^{-a} که در آن $0 < a < 1$ ، معرف مقدار اصلی توان مورد نظر x باشد، یعنی

$$x^{-a} = e^{-a \ln x} \text{ در این صورت مقدار } \int_0^{\infty} \frac{x^{-a}}{1+x} dx \text{ کدام است؟}$$

$$\frac{a}{\pi \sin a} \quad (4)$$

$$\frac{a}{\sin(\pi a)} \quad (3)$$

$$\frac{\pi}{\sin(\pi a)} \quad (2)$$

$$\frac{\pi a}{\sin a} \quad (1)$$

۴۳- جعبه‌ای شامل ۱۰ مهره‌ی سفید، ۱۰ مهره‌ی سیاه و ۱۰ مهره‌ی آبی که هر کدام از ۱ تا ۱۰ شماره‌گذاری شده‌اند. دو مهره به تصادف و بدون جایگذاری از این جعبه انتخاب می‌شود. احتمال اینکه دو مهره‌ی انتخابی هم رنگ یا هم شماره باشند، چقدر است؟

- (۱) $\frac{10}{29}$ (۲) $\frac{2}{3}$ (۳) $\frac{1}{3}$ (۴) $\frac{11}{29}$

۴۴- تابع احتمال متغیر تصادفی X به صورت

$$f_X(x) = \begin{cases} \frac{4}{\pi(1+x^2)} & 0 < x < a \\ 0 & \text{در سایر جاها} \end{cases}$$

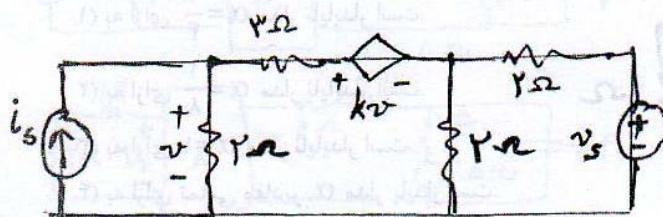
است. در صورتی که $E(X) = \frac{\ln 4}{\pi}$ باشد، مقدار a کدام است؟

- (۱) $\ln 4$ (۲) ۲ (۳) ۱ (۴) $\frac{\pi}{2}$

۴۵- اگر تابع چگالی احتمال توأم X و Y برابر $f_{X,Y}(x,y) = e^{-\frac{x}{2}} y e^{-y^2}$ باشد، احتمال $p(\sqrt{x} > y)$ برابر کدام است؟

- (۱) $\frac{1}{6}$ (۲) $\frac{2}{3}$ (۳) $\frac{1}{2}$ (۴) $\frac{1}{3}$

۴۶- در مدار زیر به ازای چه مقدار k ، ولتاژ v ناشی از i_s ، برابر نصف آن می‌شود؟



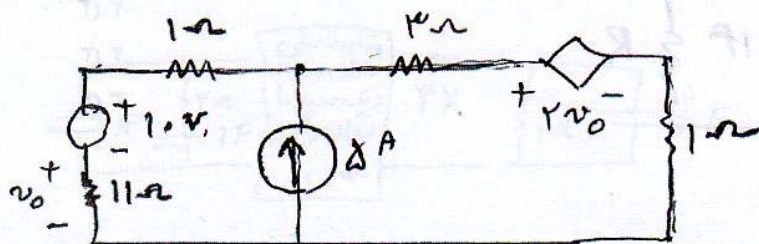
(۱) ۱

(۲) $\frac{1}{2}$

(۳) -۵

(۴) هیچ مقدار k ، چون این مدار جواب یگانه ندارد.

۴۷- در مدار شکل زیر منبع جریان ۵ آمپری را با چه عنصری می‌توان جایگزین نمود به گونه‌ای که جریان و ولتاژ شاخه‌ها هیچ تغییری نکنند؟



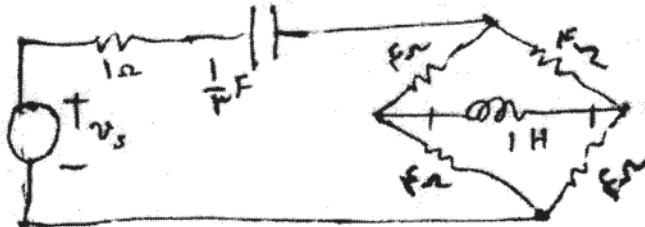
(۱) منبع ولتاژ ۵ ولتی

(۲) مقاومت ۲ اهمی

(۳) مقاومت ۶ اهمی

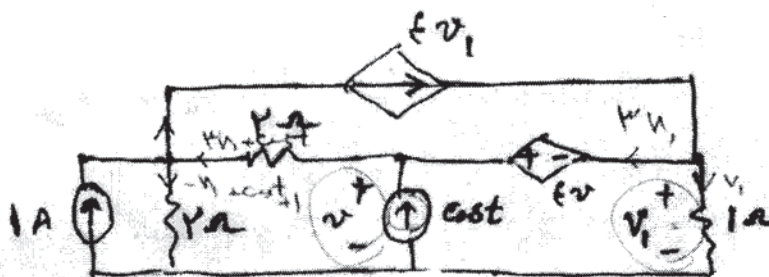
(۴) منبع ولتاژ ۱۵ ولتی

۴۸- در مدار زیر با تبدیل مقاومت 4Ω به 2Ω بیشترین ثابت زمانی مدار چند ثانیه کم می شود؟



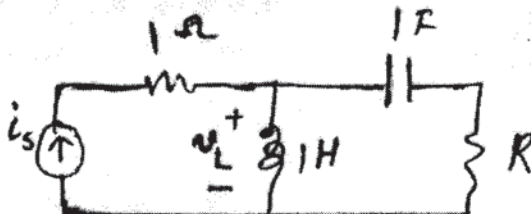
- (۱) $\frac{2}{3}$
- (۲) $\frac{1}{2}$
- (۳) ۱
- (۴) ۲

۴۹- در چه لحظاتی $V(t) = 0$ است؟ (در گزینه ها ۱ عددی صحیح است.)



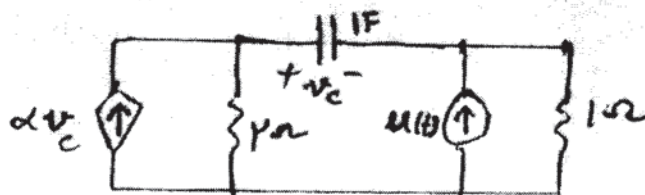
- (۱) $2\pi + \frac{\pi}{3}$
- (۲) $2\pi + \frac{\pi}{4}$
- (۳) $2\pi + \frac{\pi}{2}$
- (۴) $2\pi + \frac{2}{3}\pi$

۵۰- در مدار شکل زیر با تغییر آنی i_s به اندازه $\frac{3}{4}$ آمپر، ولتاژ v_L به اندازه ۲ ولت تغییر آنی می کند. مقاومت R چند اهم است؟



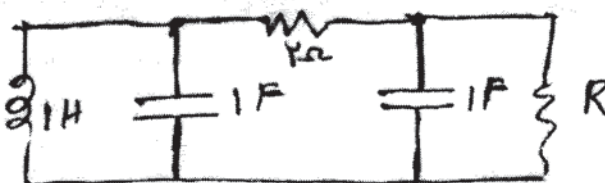
- (۱) $\frac{3}{2}$
- (۲) $\frac{1}{2}$
- (۳) $\frac{4}{3}$
- (۴) ۳

۵۱- در مدار شکل زیر ولتاژ اولیه خازن V_0 می باشد کدامیک از پاسخ های زیر صحیح است؟



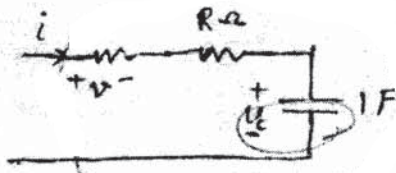
- (۱) به ازای $\alpha = \frac{1}{4}$ مدار ناپایدار است.
- (۲) به ازای $\alpha = \frac{1}{8}$ مدار ناپایدار است.
- (۳) به ازای $\alpha = 1$ مدار ناپایدار است.
- (۴) به ازای تمامی مقادیر α مدار پایدار است.

۵۲- اگر در پاسخ ورودی صفر مدار زیر جمله Ae^{-t} وجود داشته باشد (A ثابت)، مقدار R برابر چند اهم است؟



- (۱) ۱
- (۲) ۳
- (۳) ۲
- (۴) ۳

۵۳- در مدار زیر با مقاومت غیر خطی $v=i^2$ و ولتاژ خازن $v_c = \cos t$ ، به ازای چه مقدار R بر حسب اهم، توان متوسط N برابر یک وات می‌شود؟



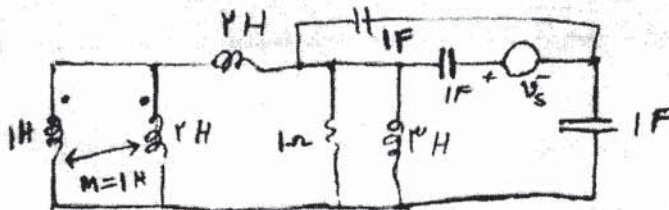
(۱) ۱

(۲) $\frac{1}{2}$

(۳) ۲

(۴) ۴

۵۴- معادله مشخصه مدار زیر کدام است؟ (معادله مشخصه مدار معادله‌ای است که تمام فرکانس‌های طبیعی مدار را می‌دهد)



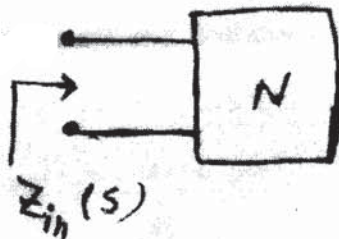
$$(1) s^2(2s^2 + 3s + 2) = 0$$

$$(2) s^2(s^2 + s + 1) = 0$$

$$(3) s^2(s^2 + s + 1) = 0$$

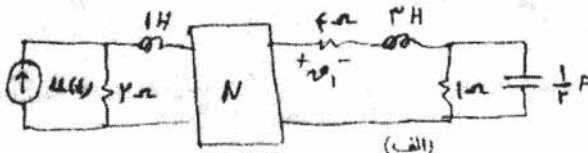
$$(4) s^2(2s^2 + 3s + 2) = 0$$

۵۵- امپدانس ورودی یک دهانه (یک قطبی) خطی و تغییرناپذیر با زمان به صورت $z_{in}(s) = \frac{s+\alpha}{s^2+fs+8}$ است. به ازای کدام مقادیر α این یک دهانه دارای فرکانس تشدید حقیقی است؟

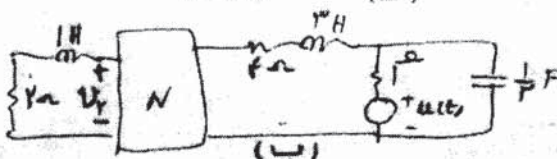
(۱) $\alpha < 2$ (۲) $\alpha > 4$ (۳) $2 < \alpha < 4$

(۴) بازه هیچ مقدار α مدار دارای فرکانس تشدید حقیقی نمی‌باشد.

۵۶- مدار زیر یک مدار هم پاسخ است. اگر در شکل (الف) پاسخ حالت صفر v_1 به صورت $v_1 = u(t)(3 - e^{-t} - 2e^{-2t})$ باشد در مدار شکل (ب)، $v_2(t)$ برابر با کدام گزینه است؟



(الف)



(ب)

$$(1) u(t)(-3e^{-t} + e^{-2t} + 3)$$

$$(2) u(t)(3 - e^{-t} - 2e^{-2t})$$

$$(3) \frac{1}{2}u(t)(3 + e^{-2t} - 4e^{-t})$$

$$(4) \frac{1}{2}u(t)(3 - e^{-t} - 2e^{-2t})$$

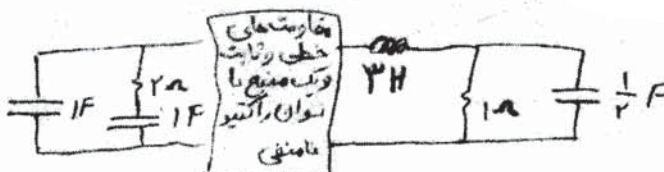
۵۷- فرض کنید مدار زیر در فرکانس $\omega = 2 \frac{\text{rad}}{\text{s}}$ در وضعیت دائمی سینوسی است. اگر توان متوسط مقاومت ۱ اهمی برابر دو وات باشد، مجموع توان‌های راکتیو خازن‌ها حداکثر چند وار (VAR یا ولت آمپر راکتیو) است؟

(۱) ۴۸

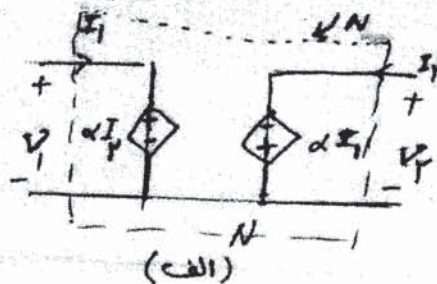
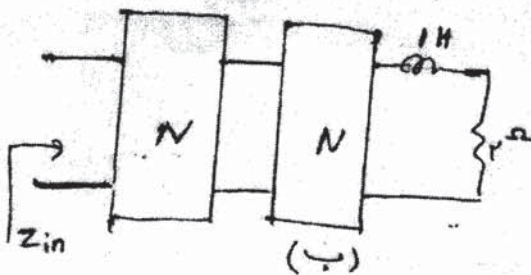
(۲) ۲۴

(۳) ۱۲

(۴) ۶

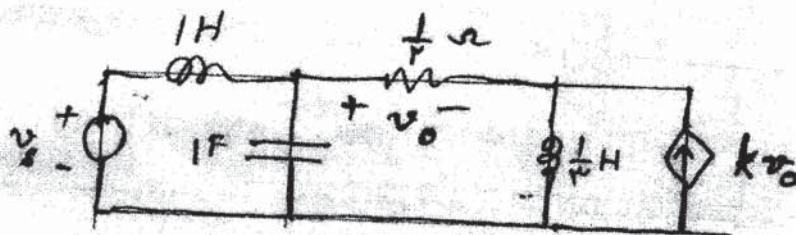


۵۸- با فرض دودهنه N به صورت شکل (الف) امیدانس ورودی مدار شکل (ب) کدام است؟



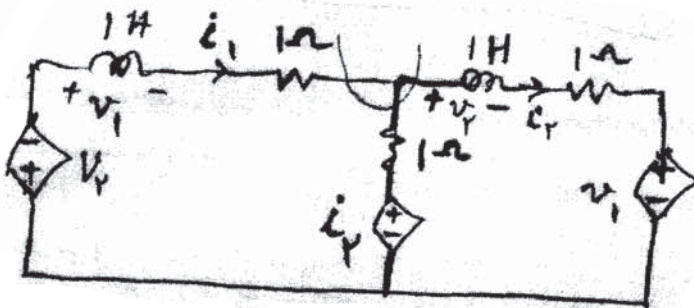
- (۱) $S+1$
- (۲) $2S+1$
- (۳) S
- (۴) $S+2$

۵۹- در مدار شکل زیر محدوده مقادیر k چگونه باشد تا مدار همواره پایدار نمایی باقی بماند؟



- (۱) $-8 < k < -2$
- (۲) $k < -8$
- (۳) $k > -2$
- (۴) مدار همواره ناپایدار است

۶۰- در مدار شکل مقابل، با انتخاب جریان سلف و یا سلفها (i_1 و یا i_2) به عنوان متغیرهای حالت، \underline{A} در معادلات حالت



- (۱) $\underline{A} = (-2)$
- (۲) $\underline{A} = (-\frac{1}{2})$
- (۳) $\underline{A} = \begin{bmatrix} -\frac{1}{2} & 0 \\ 0 & -\frac{1}{2} \end{bmatrix}$
- (۴) $\underline{A} = \begin{bmatrix} -2 & 0 \\ 0 & -2 \end{bmatrix}$