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نام:
نام خانوادگی:
محل امضا:

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

صبح پنج‌شنبه
۹۵/۰۲/۱۶

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

آزمون ورودی دوره‌های کارشناسی‌ارشد ناپیوستهٔ داخل ــ سال ۱۳۹۵

مجموعهٔ مهندسی مکانیک ــ کد ۱۲۶۷

تعداد سؤال: ۱۷۰ — مدت پاسخگویی: ۱۸۰ دقیقه

عنوان مواد امتحانی، تعداد و شمارهٔ سؤالات

ردیف	مواد امتحانی	تعداد سؤال	از شماره	تا شماره
۱	زبان عمومی و تخصصی (انگلیسی)	۳۰	۱	۳۰
۲	ریاضی (ریاضی عمومی ۱ ، ۲، معادلات دیفرانسیل، ریاضی مهندسی)	۲۰	۳۱	۵۰
۳	حرارت و سیالات (ترمودینامیک، مکانیک سیالات، انتقال حرارت)	۲۰	۵۱	۷۰
۴	جامدات (استاتیک، مقاومت مصالح، طراحی اجزا)	۲۰	۷۱	۹۰
۵	دینامیک و ارتعاشات (دینامیک، ارتعاشات، دینامیک ماشین، کنترل)	۲۰	۹۱	۱۱۰
۶	ساخت و تولید(ماشین‌ابزار، قالب پرس، علم مواد، ماشین‌های کنترل عددی، اندازه‌گیری، تولید مخصوص، هیدرولیک و نیوماتیک، مدیریت تولید)	۲۰	۱۱۱	۱۳۰
۷	مبانی بیومکانیک ۱ و ۲	۲۰	۱۳۱	۱۵۰
۸	دروس پایهٔ پزشکی (فیزیولوژی، آناتومی، فیزیک پزشکی)	۲۰	۱۵۱	۱۷۰

این آزمون نمرهٔ منفی دارد.

استفاده از ماشین حساب مجاز نیست.

حق چاپ، تکثیر و انتشار سؤالات به هر روش (الکترونیکی و ...) پس از برگزاری آزمون، برای تمامی اشخاص حقیقی و حقوقی تنها با مجوز این سازمان مجاز می‌باشد و با متخلفین برابر مقررات رفتار می‌شود.

زبان عمومی و تخصصی (انگلیسی):

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

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

PART B: Cloze Passage
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.

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

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.

PASSAGE 1:

Forces

Forces acting on objects are vectors that are characterized by not only a magnitude (e.g. pounds force or Newtons) but also a direction. A force vector F (vectors are usually noted by a boldface letter) can be broken down into its components in the x, y and z directions in whatever coordinate system you've drawn:

$F = Fxi + Fyj + Fzk$ Equation 13

Where Fx, Fy and Fz are the magnitudes of the forces in the x, y and z directions and i, j and k are the unit vectors in the x, y and z directions (i.e. vectors whose directions are aligned with the x, y and z coordinates and whose magnitudes are exactly 1 (no units)).

Forces can also be expressed in terms of the magnitude = (Fx2 + Fy2 + Fz2)1/2 and direction relative to the positive x-axis (= tan-1(Fy/Fx) in a 2-dimensional system). Note that the tan-1(Fy/Fx) function gives you an angle between +90° and -90° whereas sometimes the resulting force is between +90° and +180° or between -90° and -180°; in these cases you'll have to examine the resulting force and add or subtract 180° from the force to get the right direction.

Some types of structures can only exert forces along the line connecting the two ends of the structure, but cannot exert any force perpendicular to that line. These types of structures include ropes, ends with pins, and bearings. Other structural elements can also exert a force perpendicular to the line. This is called the moment of force (often shortened to just "moment", but to avoid confusion with "moment" meaning a short period of time, we will use the full term "moment of force") which is the same thing as torque. Usually the term torque is reserved for the forces on rotating, not stationary, shafts, but there is no real difference between a moment of force and a torque.

16- The difference between a vector force and an ordinary one is that the vector force has ----------.

1) coordinate 2) component 3) direction 4) magnitude

17- The underlined word "aligned", as used in the first paragraph, is closest in meaning to ----------.

1) flattened 2) secured 3) straightened 4) lined up

18- The second part of the first paragraph mainly discusses how to ----------.

1) determine the direction 2) determine the functions
3) express coordinates 4) measure the magnitude

19- The underlined "This" in the second paragraph refers to the type of structure that exerts a force ----------.

1) along the line 2) in both directions
3) longitudinally 4) perpendicularly

20- The word "moment" in the passage is a measure of ----------.

1) direction 2) force 3) torque1 4) time

PASSAGE 2:

Stresses and strains

As a follow-on to the discussion of statics we need to consider whether a material subject to a given set of forces will break and if not, how much will it bend? To determine this, the first step is to compute the stress in the material. There are two flavors of stress, the normal stress which is the stress in the direction perpendicular to an imaginary plane in the material, and the shear stress which is the stress in the direction parallel to that same imaginary plane. Of course, this imaginary plane could be in any direction, so the magnitude of the normal and shear stresses depends strongly on the choice of said imaginary plane. How should one choose said plane and what is the relationship between normal and shear stresses?

The normal stress (σ) in a material is defined as $\sigma \equiv F/A$

where F is the force (either tension or compression) acting perpendicular to an imaginary plane surface passing through a piece of material and A is the cross section area. It is called "normal" not in the sense of being "typical" or "standard" but in the sense of being perpendicular or orthogonal to the cross-section of the material. Stress is defined as positive if the material is in tension (i.e. the material is being pulled apart) and negative if the material is in compression (i.e. being squeezed together). From the definition it is clear that stress has units of force/area, i.e. the same as pressure. The units are typically N/m2 or lbf/in2. Often the unit of "kips" (kilopounds per square inch = 1000 lbf/in2) is used to report stress.

In order to characterize the deformation of a material in response to stress we define another property called strain (ε) which is the fractional amount of elongation (increase in length) or contraction (decrease in length) in a material caused by a stress. For example, if under a given amount of tensile stress, a steel bar stretches from a length (L) of 1.00 inch to 1.01 inch (a change in length, ΔL, of 0.01 inch) the strain = (1.01 – 1.00)/1.00 = 0.01.

21- The underlined "this" in the first paragraph refers to ----------.
1) the magnitude of bending 2) the magnitude of breaking
3) the type of force applied 4) the type of material

22- According to the passage, ---------- determines the magnitude of the shear.
1) the magnitude of the shear 2) the direction of the plane
3) the type of material 4) the cross section area

23- The underlined word "flavors", as used in the passage, is closest in meaning to ----------.
1) compositions 2) smells 3) categories 4) tastes

24- According to the text, "elongation" and "contraction" are the products of ----------.
1) tensile 2) stretch 3) strain 4) stress

25- If stress is not perpendicular or orthogonal to the cross section, it is considered ----------.
1) abnormal 2) standard 3) natural 4) regular

PASSAGE 3:

Second Law of thermodynamics

The First Law of Thermodynamics told us that energy is conserved, i.e., the energy contained in an isolated system (one that does not exchange energy with its surroundings) cannot change. But this is not the whole story, because it does not place any restrictions on the direction of a process. For example, one can readily fill a (constant-volume) combustion chamber with a mixture of methane and air at 300K, ignite the mixture with a spark, and observe a flame burn the mixture to form carbon dioxide, water and nitrogen at 2000K. Clearly this does not violate the First Law. But when was the last time you saw carbon dioxide, water and nitrogen at 2000K in a chamber spontaneously cool off to form methane and air at 300K? Clearly this does not violate the First Law either, since energy is conserved in either the forward or reverse direction, but you have never seen the reverse process and you never will.

So clearly we need a Second Law of Thermodynamics that places restrictions on the direction of processes. The Second Law invokes a property of substances called entropy, which is the measure of the "disorganization" or "randomness" of a substance. The hotter or less dense a substance is, the less information we have about where the individual molecules are, and thus the higher its entropy will be. The Second Law can be stated simply as "The entropy of an isolated system always increases or remains the same", meaning that the entropy never decreases. The methane – air mixture at 300K has a lower entropy than the carbon dioxide, water and nitrogen mixture at 2000K, so only the usual combustion process is physically possible, never the reverse. (Of course I could take that carbon dioxide, water and nitrogen at 2000K, cool it off to 300K, break the molecules apart, rearrange them to form methane and air, but to do this I would need to increase the entropy of the surroundings by more than the entropy change of combustion, so there would be a net increase in the entropy of the universe.)

It is impossible to create a device that has no effect other than the transfer of heat from a lower temperature to a higher temperature. If this were not true, then it would be possible for an object initially at uniform temperature to spontaneously become hotter on one side and colder on the other – which is obviously a more organized (lower entropy) state than the original, uniform-temperature object. This statement is sometimes stated as "heat is always transferred from hot to cold, never the reverse" – which is only a requirement if there is no

other effect. Obviously a refrigerator transfers heat from a lower temperature (your food and drink) to a higher temperature (the air in your kitchen) but it has other effects too – namely there is a work input to the process.

26- The second paragraph mainly discusses ----------.
1) disorganization 2) direction of process
3) entropy 4) randomness

27- We understand from the passage that the shortcoming of the First Law of Thermodynamics is that ----------.
1) there is no energy exchange with the surrounding
2) The energy is contained in an isolated system
3) it does not concern the direction of process
4) energy is conserved in reverse direction

28- According to the second paragraph, a major factor deciding entropy is ----------.
1) direction 2) density 3) medium 4) input

29- We understand from the third paragraph that uniform-temperature objects have a/the ---------- entropy.
1) same 2) constant 3) lower 4) higher

30- The example of the refrigerator is given in the last paragraph to show ----------.
1) direction of heat transfer 2) lower entropy
3) a work input 4) other effects

ریاضی (ریاضی عمومی ۱ ، ۲، معادلات دیفرانسیل، ریاضی مهندسی):

۳۱- در مورد همگرایی و واگرایی سری‌های $\sum_{n=1}^{\infty} \frac{۴^n (n!)^۲}{(۲n)!}$ و $\sum_{n=1}^{\infty} \ln \frac{\cosh(\frac{۱}{n})}{\cos(\frac{۱}{n})}$، به ترتیب از راست به چپ، گزینهٔ صحیح، کدام است؟

۱) همگرا - همگرا ۲) واگرا - همگرا
۳) همگرا - واگرا ۴) واگرا- واگرا

۳۲- اگر $f(x) = \frac{۴x^۳}{x^۲ + ۱}$ باشد، مقدار $(f^{-۱})'(۲)$، کدام است؟

۱) $\frac{۱۱۲}{۲۵}$ ۲) $\frac{۲۵}{۱۱۲}$
۳) $\frac{۱}{۴}$ ۴) ۴

۳۳- در چند نقطه از منحنی پارامتری $\begin{cases} x = \cos ۳\theta \\ y = ۲\sin\theta \end{cases}$، خط مماس در آن نقطه از منحنی، موازی محور yهاست؟

۱) ۲ ۲) ۴
۳) ۶ ۴) ۸