

प्रश्न पत्र/QUESTION PAPER

**अनुकम्पा नियुक्ति परीक्षा (स्तर-II- बैचलर ऑफ इंजीनियर मेकेनिकल)
Compassionate Ground Appointment Examination (Level-II – BE- ELECTRONICS)**

परीक्षा तिथि/Examination Date : 25.05.2022

पूर्णांक/ Max Marks – 85

समय /Time : 10:00 to 13:00 बजे/Hrs

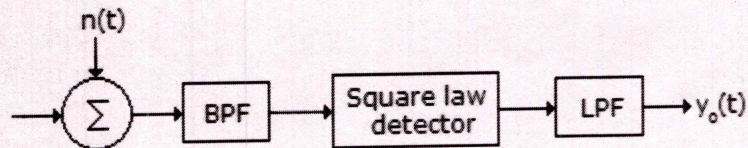
अवधि /Duration – 3:00 घंटे/Hrs

अनुदेश/Instructions

1. कृपया निर्देश तथा प्रश्न को उत्तर देने के पहले ध्यानपूर्वक पढ़ ले।
Please read the instructions and questions carefully before answering.
2. सभी प्रश्न अनिवार्य हैं।
All questions are compulsory.
3. हिन्दी एवं अंग्रेजी रूपांतरों में अंतर पाये जाने पर अंग्रेजी रूपांतर ही सही समझा जाएगा।
In case of discrepancy/mismatch in Hindi and English versions, English version will stand good.
4. यह परीक्षार्थी का उत्तरदायित्व होगा कि वे उत्तर देते समय सही प्रश्न क्रमांक तथा उसका उप प्रश्न क्रमांक एवं भाग क्रमांक यदि हो, उत्तर पुस्तिका में अंकित करें। सही प्रश्न क्रमांक न होने पर उत्तर पर कोई अंक नहीं दिया जाएगा।
It will be responsibility of the candidates to indicate the correct question number including sub question number and part number, if any and no marks will be awarded for answers without the correct question number.
5. उत्तर केवल एक रंग की स्याही में देना है। यह रंग नीला या काला होना चाहिए अन्यथा उत्तर पुस्तिका का मूल्यांकन नहीं किया जाएगा तथा उम्मीदवार को अयोग्य करार किया जा सकता है।
Answer should be given only in single colour ink blue or black otherwise answer sheet will not be evaluated and candidate may be disqualified.
6. वस्तुनिष्ठ प्रश्नों के उत्तर देते समय, उत्तर में करेक्शन मान्य नहीं है। इस तरह के उत्तरों का मूल्यांकन नहीं किया जाएगा।
While answering objective type questions no corrections in the answers is allowed. In such types of corrections the answer will not be evaluated.
7. परीक्षार्थी अपना नाम अथवा किसी प्रकार का पहचान चिन्ह इत्यादि उत्तर पुस्तिका के अन्दर (आवेदन पत्र अन्य उत्तर, स्थान, जहाँ सामान्यतः नाम का उल्लेख किया जाता है वहाँ भी) न लिखें अन्यथा उनकी उम्मीदवारी निरस्त की जा सकती है।
Candidates should not write their names or leave any identification mark etc. in the answer sheet (including applications or other places/answers where generally name is mentioned) otherwise his candidature may be cancelled.

भाग-ए / PART-A		
To be answered in English Only.		[70 Marks]
Q-1.	Fill in the blanks with appropriate propositions.	[1 x 5 Marks]
	i) Are you going to study _____ the afternoon or _____ night? ii) Success in this examination depends _____ hard work alone. iii) Jawaharlal Nehru spent his childhood _____ Anand Bhawan. iv) I hate sitting _____ him as he always smells of garlic.	
Q-2.	Write the noun forms of the following : -	[1 x 5 mark]
	i) Enable ii) add iii) beautify iv) compare v) decide	
Q-3.	Write the past tense form.	[1 x 5 mark]
	i) teach ii) spend iii) shut iv) seek v) tell	
Q-4.	Write a paragraph of about 200 words "Sardar Vallabhai Patel"	[1 x 5 mark]
Q-5	Choose the Correct Answer	[1 x 30 mark]
1. In a communication system, a process in which statistical averages and time averages are equal is called as, A. stationary B. ergodic C. Gaussian D. BIBO stable		
2. The materials not having negative temperature coefficient of resistivity are A. metals B. semiconductors C. insulators D. none of the above		
3. Which of the following counters can be used to divide the clock frequency of a microprocessor by 5? A. 3 bit counter B. 5 bit counter C. mod 3 counter D. mod 5 counter		

4. Consider an AM system using a square law detector as shown in figure.



$$X_c(t) = A_c[1 + u x(t)] \cos \omega_c t, |ux(t)| \ll 1$$

The signal power at the output is :

- A. $A_c^2 u^2 E[x^2(t)]$
- B. $A_c^2 u^2 E(x)$
- C. $u^2 E \left[x \left(\frac{1}{t} \right) \right]$
- D. None

5. Thermal noise is passed through an ideal low-pass filter having cut-off at $f_c = \omega$ Hz. The auto correlation value of the noise at the output of the filter is given as

- A. Triangular function over the range $-\frac{1}{2\omega} \leq t \leq \frac{1}{2\omega}$
- B. Gaussian over the range $-\infty \leq t \leq \infty$
- C. A Delta function at $t = 0$
- D. Sin c function over the range $-\infty \leq t \leq \infty$

6. All poles and zeros of a driving point immittance function of an L-C network

- A. should lie on the $j\omega$ axis
- B. should lie on the +ve real axis
- C. should lie on the -ve real axis
- D. can lie anywhere in s-plane

7. Determine the correctness or otherwise of the following Assertion [a] and the Reason [r].

Assertion : FETs are more suitable at the input stages compared to BJTs

Reason: A FET has lower output impedance than a BJT.

- A. Both [a] and [r] are true and [r] is the correct reason for [a]
- B. Both [a] and [r] are true but [r] is not the correct reason for [a]
- C. Both [a] and [r] are false
- D. Both [a] and [r] are true

8. What are the ultimate purpose of minimizing logic expressions?

1. To get small size expression.
2. To reduce the number of variables in the given expression.
3. To implement the function of the logic expression with least hardware.
4. To reduce the expression for making it feasible for hardware implementation.

Select the correct answer from the codes given below:

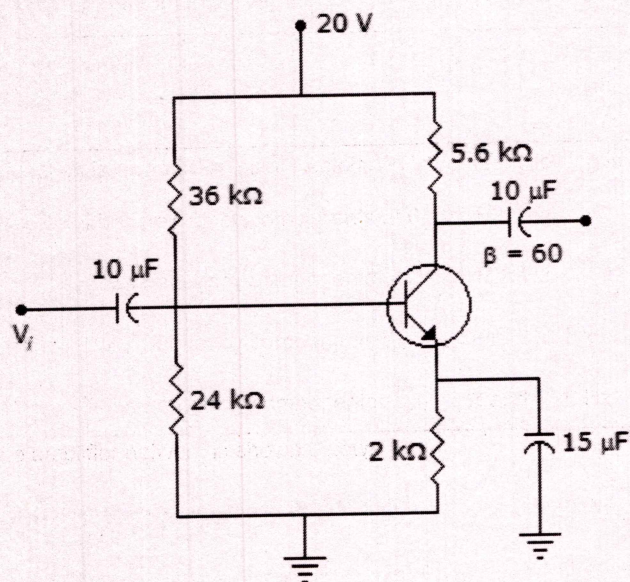
- A. 1 only
- B. 2 and 3

- C. 3 only
D. 3 and 4

9. A function is given $f(t) = \sin^2 t + \cos 2t$. Which of the following is true?

- A. f has frequency components at 0 and $1/2\pi$ Hz
B. f has frequency components at 0 and $1/\pi$ Hz
C. f has frequency components at $1/2\pi$ and $1/\pi$ Hz
D. f has frequency components at 0, $1/2\pi$ and $1/\pi$ Hz

10. The amplifier network is shown below:



r_e and z_0 is:

- A. $6.42 \text{ k}\Omega$, $5.6 \text{ k}\Omega$
B. 6.42Ω , $(5.62) \text{ k}\Omega$
C. $6.4 \text{ k}\Omega$, $(5.62) \text{ k}\Omega$
D. 6.42Ω , $5.6 \text{ k}\Omega$

11. Efficiency of general AM signal with $e_m = E_1 \cos \omega_1 t + E_2 \cos \omega_2 t$ with modulation index m_1 and m_2 is _____.

- A. $\frac{m_1^2 + m_2^2}{2 + m_1^2 + m_2^2} \times 100$
B. $\frac{2 + m_1^2 + m_2^2}{m_1^2 + m_2^2} \times 100$
C. $\frac{\sqrt{m_1^2 + m_2^2}}{2 + \sqrt{m_1^2 + m_2^2}} \times 100$
D. $\frac{2 + \sqrt{m_1^2 + m_2^2}}{\sqrt{m_1^2 + m_2^2}} \times 100$

12. Poynting vector is associated with

- A. flux in magnetic field
- B. power flow in electrostatic field
- C. current in electrostatic field
- D. charge in electrostatic field

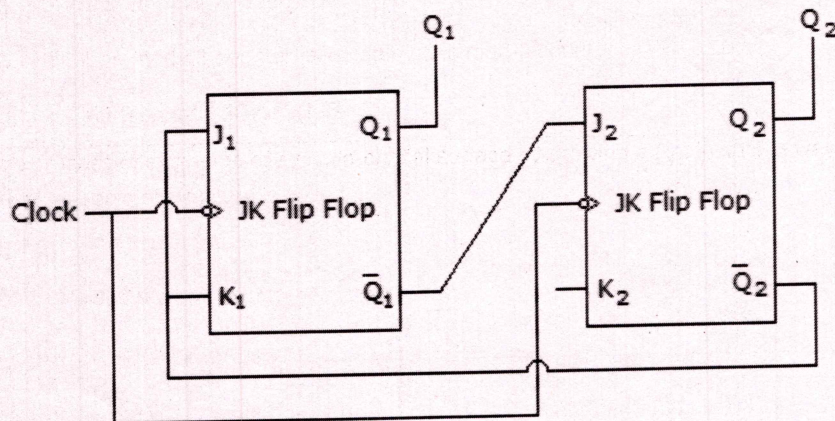
13. A divide by 78 counters can be realized by using

- A. six mod-13 counters
- B. thirteen mod-6 counters
- C. one mod 13 counter followed by one mod-6 counter
- D. thirteen mod-13 counters

14. The process of extension of a single-crystal surface by growing a film in such a way that the added atoms form a continuation of the single-crystal structure is called

- A. Ion implantation
- B. Chemical vapour deposition
- C. Electroplating
- D. Epitaxy

15. What are the counting stages (Q_1, Q_2) for the counter shown in the figure below?



- A. 11, 10, 00, 11, 10, ...
- B. 01, 10, 11, 00, 10, ...
- C. 00, 11, 01, 10, 00, ...
- D. 01, 10, 00, 01, 10, ...

16. Consider the transmission line of length 37.5 cm, which is terminated into zero resistance. This line is being excited by a source of 1 GHz which has an internal impedance of 50Ω . What is the input impedance of the line as seen by the source?

- A. 50Ω
- B. Zero Ω
- C. 100Ω
- D. Infinite Ω

17. The junction capacitance of a linearly graded pn junction (with applied voltage = V_B) is proportional to

- A. $\frac{1}{V_B^2}$
- B. $-\frac{1}{V_B^2}$
- C. $\frac{1}{V_B^3}$
- D. $-\frac{1}{V_B^3}$

18. Consider the following statements:

For a square waveguide of cross-section 3m x 3m it has been found

At 6 GHz dominant mode will propagate

At 4 GHz only dominant modes and evanescent

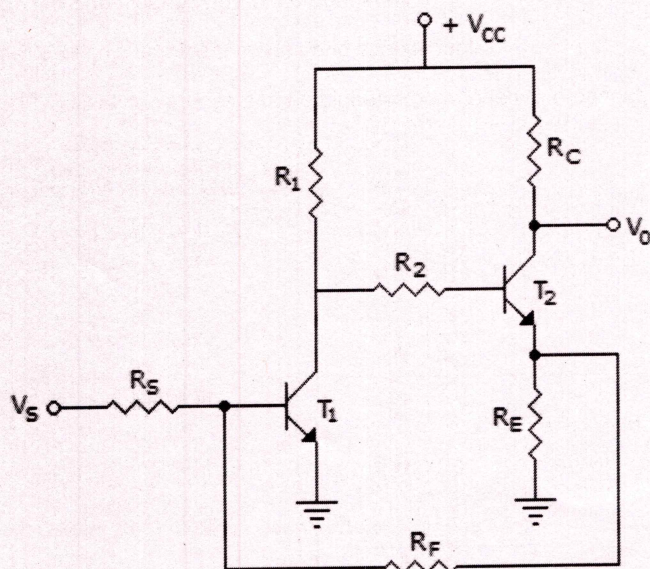
At 11 GHz all the modes and no higher order mode will propagate

At 7 GHz degenerate modes will propagate

Which of the above statements are correct?

- A. 1 and 2 only
- B. 1, 2 and 4
- C. 2 and 3 only
- D. 2, 3 and 4

19. The circuit shown depicts :



- A. voltage series negative feedback
- B. voltage shunt negative feedback
- C. current series negative feedback
- D. current shunt negative feedback

20. Which of the transistor models is most preferred for the analysis of a transistor circuit both at mid-band and at high frequencies?

- A. h-parameter model
- B. y-parameter model
- C. s-parameter model
- D. hybrid-p model

21. It is very likely in _____ gate family that when one gate is driving number of gates in _____, a gate having least voltage for saturation may consume large _____ leaving other gates inoperative and this phenomenon is called _____

- A. DTL, parallel, current, current - sinking
- B. DCTL, parallel, current, current-lagging
- C. ECL, series, voltage, voltage-deterioration
- D. DCTL, series, current, current-lagging

22. The unit step response of an under damped second system has steady state value of - 2. Which one of the following transfer functions has these properties?

- A. $\frac{-2.24}{s^2 + 2.59s + 1.12}$
- B. $\frac{-3.82}{s^2 + 1.91s + 1.91}$
- C. $\frac{-2.24}{s^2 - 2.59s + 1.12}$
- D. $\frac{-3.82}{s^2 - 1.91s + 1.91}$

23. For a system with transfer function

$$T(s) = \frac{16}{s^2 + 4s + 16}$$

The bandwidth of the system is (rad/sec)

- A. 2.828
- B. 5.2915
- C. 5.088
- D. cannot be determined

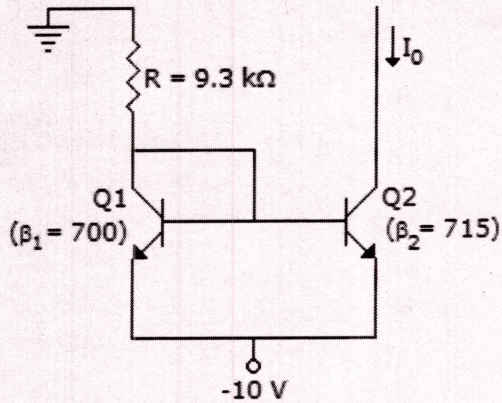
24. Consider the following:

1. Distortion
2. Gain
3. Bias stabilization
4. Sensitivity
5. Frequency response

Which of these properties of the power amplifier one should concentrate upon while designing a good power amplifier circuit?

- A. 1, 2 and 3
- B. 1, 3 and 5
- C. 2, 3 and 4
- D. 4 and 5

25. In the silicon BJT circuit shown below, assume that the emitter area of transistor Q1 is half that of transistor Q2.



The value of current I_0 is approximately

- A. 0.5 mA
- B. 2 mA
- C. 9.3 mA
- D. 15 mA

26. A silicon wafer has 100 nm of oxide it and is inserted in a furnace at a temperature above 1000°C for further oxidation in dry oxygen. The oxidation rate

- A. is independent of current oxide thickness and temperature
- B. is independent of current oxide thickness but depends on temperature
- C. slows down as the oxide grows
- D. is zero as the existing oxide prevents further oxidation

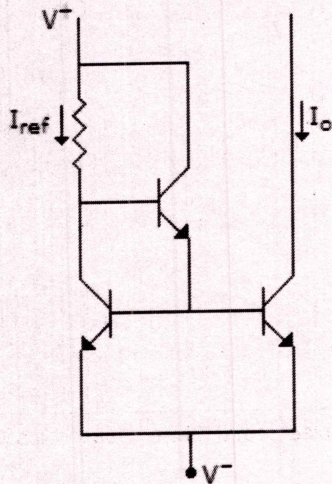
27. When a vector has positive divergence, it indicates that the vector quantity has at that point and if the divergence is negative, it indicates _____.

- A. source, sink
- B. sink, source
- C. positive value, negative value
- D. negative value, positive value

28. A function of one or more variables which conveys information on the nature of physical phenomenon is called

- A. Noise
- B. Interference
- C. System
- D. Signal

29. A current source with three basic transistors is shown. All transistors are similar. All are having finite current gain β



Then I_o is

- A. $\frac{(I_{ref} \beta (1 + \beta))}{(\beta^2 + \beta + 2)}$
- B. $\frac{(I_{ref} \beta (1 + \beta))}{(\beta^2 + \beta + 1)}$
- C. $\frac{(I_{ref} (2 + \beta))}{(\beta + 3)}$
- D. $\frac{(I_{ref} (\beta + 1))}{(\beta + 2)}$

30. Which of the following represent a wave equation for a tightly stretched elastic string of length l and ' m ', mass per unit?

- A. $\frac{dy}{dt} = K \frac{\partial[xy]}{\partial x \partial y}$
- B. $\frac{\partial^2 y}{\partial t^2} = K \frac{\partial^2 y}{\partial x^2}$
- C. $\frac{\partial^2 x}{\partial t^2} = K \frac{\partial^2 y}{\partial^2 y}$
- D. $\frac{\partial^2 x}{\partial y^2} = K \frac{\partial^2 y}{\partial t \partial x}$

भाग-बी / PART-B

उत्तर हिंदी में या अंग्रेजी में दें / Answer can be given either in Hindi or English.

[35 marks]

- Q-6.** एक निश्चित दुकान में, लागत का 320% लाभ होता है। यदि लागत में 25% की वृद्धि होती है लेकिन विक्रय मूल्य स्थिर रहता है, तो विक्रय मूल्य का लगभग कितना प्रतिशत लाभ होता है /
In a certain store, the profit is 320% of the cost. If the cost increases by 25% but the selling price remains constant, approximately what percentage of the selling price is the profit?

[5 Marks]

Q-7.	सही उत्तर का चयन करें / Choose the Correct Answer.	[1x 10 Marks]
	<p>i) दो अंकों वाली एक संख्या के अंकों का योग है 15 तथा उसके अंकों के मान का अंतर है 3 तो यह दो अंकों वाली संख्या क्या है? / The sum of the digits of a two-digit number is 15 and the difference between the digits is 3. What is the two-digit number?</p> <p>a) a) 87 b) b) 96 c) c) 78 d) d) None of these</p> <p>ii) दो संख्याओं का गुणनफल 120 है तथा उनके वर्गों का योग 289 है इन दो संख्याओं का योग है / The product of two numbers is 120 and the sum of their squares is 289. The sum of the numbers is</p> <p>a) 20 b) 23 c) 169 d) None of these</p> <p>iii) एक सेकंड एक घंटे का क्या दशमलव भिन्न है? / What decimal of an hour is a second?</p> <p>a) 0.0025 b) 0.0256 c) 0.00027 d) 0.000126</p> <p>iv) यदि 0.232323 _____ को अनुपात में बदला जाये तो परिणाम होगा / When 0.232323 _____ is converted into a fraction, then the result is</p> <p>a) 1/5 b) 2/9 c) 23/100 d) 23/99</p> <p>v) दो संख्याएं किसी तीसरी संख्या से क्रमशः 20% और 50% अधिक हैं तो इन दो संख्याओं का अनुपात है / Two numbers are respectively 20% and 50% more than a third number. The ratio of the two numbers is</p> <p>a) 2:5 b) 3:5 c) 4:5 d) 6:7</p> <p>vi) $\cot 45^\circ$ equal to</p> <p>a) a) $\sqrt{3}/2$ b) b) $1/\sqrt{2}$ c) c) 0 d) d) 1</p> <p>vii) 1 से 70 तक ऐसी संख्याओं का प्रतिशत कितना होगा जिनके इकाई स्थान पर अंक 1 या 9 आता है / What percentage of numbers from 1 to 70 has 1 or 9 in the unit's place.</p> <p>a) a) 1% b) b) 14% c) c) 20% d) d) 10%</p> <p>viii) रुपये 450 को 4.5% सालाना के सामान्य ब्याज दर से रुपये 81 ब्याज अर्जित करने में कितना समय लगेगा / How much time will it take for an amount of Rs. 450 to yield Rs. 81 as interest at 4.5% per annum of simple interest?</p> <p>a) a) $3\frac{1}{2}$ Years b) b) 4 Years c) c) $4\frac{1}{2}$ Years d) d) 5 Years</p> <p>ix) एक विक्रेता ने एक रुपये में 6 पर टॉफियां खरीदीं। उसे एक रुपए में कितनी टॉफियां बेचनी चाहिए जिससे की 20 प्रतिशत का लाभ हो / A vendor bought toffees at 6 for a rupee. How many for a rupee must he sell to gain 20%?</p> <p>a) a) 5 b) b) 4 c) c) 3 d) d) 6</p> <p>x) निम्नलिखित में से कौन एक अभाज्य संख्या है / Which of the following is a prime number?</p> <p>a) a) 33 b) b) 81 c) c) 93 d) d) 97</p>	
Q-8.	<p>एक तौलिये को ब्लीच करने पर पाया गया की उसकी लंबाई का 20% और उसकी चौड़ाई का 10% कम हो गई। उसके क्षेत्रफल में हुई कमी का प्रतिशत ज्ञात कीजिए / A towel, when bleached, was found to have lost 20% of its length and 10% of its breadth. What is the percentage of decrease in area.</p>	[5 Marks]
Q-9.	<p>एक बेटी और उसकी माँ की आयु का योग 56 वर्ष है 4 वर्ष बाद माँ की आयु पुत्री की आयु की 3 गुना होगी तो पुत्री और माँ की क्रमशः आयु क्या होगी / The sum of the ages of a daughter & mother is 56 years after 4 years the age of the mother will be 3 times that of the daughter. What is the age of the daughter & the mother respectively?</p>	[5 Marks]
Q-10.	<p>एक व्यक्ति एक बिंदु से शुरू होकर 1 किमी पूर्व की ओर चलता है, फिर वह दक्षिण की ओर मुड़ता है और 5 किमी चलता है। इसके बाद वह पूर्व की ओर मुड़ता है और 2 किमी चलता है। इसके बाद वह उत्तर की ओर मुड़कर 11 किमी चलता है तो वह अपने शुरुआती बिंदु से कितनी दूर होगा / Starting from a point a person walk 1 km to east then he turns to the south & walks for 5 km. Next he turns east & walks 2 km. After this he turns to the north & walks for 11 km. How far is he from his starting point?</p>	[5 Marks]
Q-11.	<p>ए, बी और सी एक व्यवसाय के लिए 50,000 रुपये की सदस्यता लेते हैं। A, B से 4000 रुपये अधिक और B, C से 5000 रुपये अधिक लेता है तो 35000 रुपये के कुल लाभ किसे कितनी राशि प्राप्त होगी / A, B, C subscribe Rs. 50,000 for a business. A subscribes Rs. 4000 more than B and B Rs. 5000 more than C. Out of a total profit of Rs. 35000 what amount will A receive.</p>	[5 Marks]