

प्रश्न पत्र/QUESTION PAPER

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

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]
<p>1. Two balls of equal mass and of perfectly elastic material are lying on the floor. One of the ball with velocity v is made to struck the second ball. Both the balls after impact will move with a velocity</p> <p>A. v</p> <p>B. $v/2$</p> <p>C. $v/4$</p> <p>D. $v/8$</p>		
<p>2 The velocity ratio in case of an inclined plane inclined at angle θ to the horizontal and weight being pulled up the inclined plane by vertical effort is</p> <p>A. $\sin \theta$</p> <p>B. $\cos \theta$</p> <p>C. $\tan \theta$</p> <p>D. $\operatorname{cosec} \theta$</p>		
<p>3. When a rigid body is suspended vertically, and it oscillates with a small amplitude under the action of the force of gravity, the body is known as</p> <p>A. simple pendulum</p> <p>B. compound pendulum</p> <p>C. torsional pendulum</p> <p>D. second's pendulum</p>		

4. The total energy line lies over the hydraulic gradient line by an amount equal to the

- A. pressure head
- B. velocity head
- C. pressure head + velocity head
- D. pressure head - velocity head

5. A tank of uniform cross-sectional area (A) containing liquid upto height (H₁) has an orifice of cross-sectional area (a) at its bottom. The time required to empty the tank completely will be

- A. $\frac{2 A \sqrt{H_1}}{C_d \times a \sqrt{2g}}$
- B. $\frac{2 A H_1}{C_d \times a \sqrt{2g}}$
- C. $\frac{2 A H_1^{3/2}}{C_d \times a \sqrt{2g}}$
- D. $\frac{2 A H_1^2}{C_d \times a \sqrt{2g}}$

6. The metacentric heights of two floating bodies A and B are 1 m and 1.5 m respectively. Select the correct statement.

- A. The bodies A and B have equal stability
- B. The body A is more stable than body B
- C. The body B is more stable than body A
- D. The bodies A and B are unstable

7. Which of the following is correct?

- A. Absolute pressure = Gauge pressure + Atmospheric pressure
- B. Gauge pressure = Absolute pressure + Atmospheric pressure
- C. Atmospheric pressure = Absolute pressure + Gauge pressure
- D. Absolute pressure = Gauge pressure - Atmospheric pressure

8. The value of gas constant (R) in S. I. units is

- A. 0.287 J/kgK
- B. 2.87 J/kgK
- C. 28.7 J/kgK
- D. 287 J/kgK

9. The value of 1 mm of Hg is equal to

- A. 1.333 N/m²
- B. 13.33 N/m²
- C. 133.3 N/m²
- D. 1333 N/m

10. The isentropic enthalpy drop in moving blade is two-third of the isentropic enthalpy drop in fixed blades of a turbine. The degree of reaction will be
- A. 0.4
 - B. 0.56
 - C. 0.67
 - D. 1.67
11. The efficiency of reaction turbine is maximum when (where α = Angle made by the absolute velocity (V) at inlet)
- A. $V_b = 0.5 V \cos \alpha$
 - B. $V_b = V \cos \alpha$
 - C. $V_b = 0.5 V^2 \cos \alpha$
 - D. $V_b = V^2 \cos \alpha$
12. The Parsons' reaction turbine has
- A. only moving blades
 - B. only fixed blades
 - C. identical fixed and moving blades
 - D. fixed and moving blades of different shape
13. The thermal efficiency of a standard Otto cycle for a compression ratio of 5.5 will be
- A. 25%
 - B. 50%
 - C. 70%
 - D. 100%
14. In a four stroke cycle petrol engine, the charge is ignited at
- A. 30° before top dead centre
 - B. 30° after top dead centre
 - C. 30° before bottom dead centre
 - D. 30° after bottom dead centre
15. The basic requirement of a good combustion chamber is
- A. minimum turbulence
 - B. low compression ratio
 - C. high thermal efficiency and power output
 - D. low volumetric efficiency
16. Which of the following statement is wrong?
- A. In a two stage reciprocating air compressor with complete intercooling, maximum work is saved.
 - B. The minimum work required for a two stage reciprocating air compressor is double the work required for each stage.
 - C. The ratio of the volume of free air delivery per stroke to the swept volume of the piston is called volumetric efficiency.
 - D. none of the above

17. The efficiency of a jet engine is higher at

- A. low speeds
- B. high speeds
- C. low altitudes
- D. high altitudes

18. Intercooling in gas turbines

- A. decreases net output but increases thermal efficiency
- B. increases net output but decreases thermal efficiency
- C. decreases net output and thermal efficiency both
- D. increases net output and thermal efficiency both

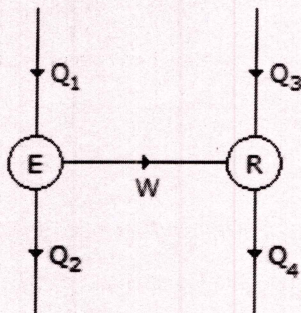
19. The leakage in a refrigeration system using ammonia is detected by

- A. halide torch
- B. sulphur sticks
- C. soap and water
- D. all of these

20. The power per tonne of refrigeration is

- A. 3.5/C.O.P.
- B. C.O.P/3.5
- C. 3.5 x C.O.P.
- D. none of these

21. In figure shown, E is a heat engine with efficiency of 0.4 and R is a refrigerator. It is given that $Q_2 + Q_4 = 3Q_1$. The C.O.P. of the refrigerator is



- A. 2.5
- B. 3.0
- C. 4.0
- D. 5.0

22. A feasible solution to the linear programming problem should

- A. satisfy the problem constraints
- B. optimise the objective function
- C. satisfy the problem constraints and non-negativity restrictions
- D. satisfy the non-negativity restrictions

23. The process capability of a machine is defined as the capability of the machine to

- A. produce a definite volume of work per minute
- B. perform definite number of operations
- C. produce job at a definite spectrum of speed
- D. hold a definite spectrum of tolerance and surface finish

24. Both Rowan plan and 50-50 Halsey plan will provide the same earning when the actual time is _____ the standard time.

- A. one-fourth
- B. one-half
- C. equal to
- D. twice

25. A body is subjected to a direct tensile stress (σ) in one plane. The shear stress is maximum at a section inclined at _____ to the normal of the section.

- A. 45° and 90°
- B. 45° and 135°
- C. 60° and 150°
- D. 30° and 135°

26. According to Euler's column theory, the crippling load for a column of length (l) with one end fixed and the other end hinged, is

- A. $\frac{\pi^2 EI}{l^2}$
- B. $\frac{\pi^2 EI}{4 l^2}$
- C. $\frac{2\pi^2 EI}{l^2}$
- D. $\frac{4\pi^2 EI}{l^2}$

27. The relation between modulus of elasticity (E) and modulus of rigidity (C) is given by

- A. $C = \frac{m E}{2(m + 1)}$
- B. $C = \frac{2(m + 1)}{m E}$
- C. $C = \frac{2m E}{m + 1}$
- D. $C = \frac{m + 1}{2m E}$

28. The cam and follower is an example of

- A. sliding pair
- B. rolling pair
- C. lower pair
- D. higher pair

29. The velocity of the reciprocating roller follower when it has contact with the straight flanks of the tangent cam, is given by (where ω = Angular velocity of the cam shaft)

- A. $\omega (r_1 - r_2) \sin \theta$
- B. $\omega (r_1 + r_2) \sin \theta \sec^2 \theta$
- C. $\omega (r_1 - r_2) \cos \theta$
- D. $\omega (r_1 + r_2) \cos \theta \operatorname{cosec}^2 \theta$

30. In vibration isolation system, if $\omega/\omega_n < 2$, then for all values of damping factor, the transmissibility will be (where ω = Angular speed of the system, ω_n = Natural frequency of vibration of the system)

- A. less than unity
- B. equal to unity
- C. greater than unity
- D. zero

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]

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?

- | | | | |
|----------|----------|----------|---------------------|
| a) a) 87 | b) b) 96 | c) c) 78 | d) d) None of these |
|----------|----------|----------|---------------------|

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

- | | | | |
|-------|-------|--------|------------------|
| a) 20 | b) 23 | c) 169 | d) None of these |
|-------|-------|--------|------------------|

iii) एक सेकंड एक घंटे का क्या दशमलव भिन्न है? /
What decimal of an hour is a second?

- | | | | |
|-----------|-----------|------------|-------------|
| a) 0.0025 | b) 0.0256 | c) 0.00027 | d) 0.000126 |
|-----------|-----------|------------|-------------|

iv) यदि 0.232323 _____ को अनुपात में बदला जाये तो परिणाम होगा /
When 0.232323 _____ is converted into a fraction, then the result is

- | | | | |
|--------|--------|-----------|----------|
| a) 1/5 | b) 2/9 | c) 23/100 | d) 23/99 |
|--------|--------|-----------|----------|

v) दो संख्याएँ 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

- | | | | |
|--------|--------|--------|--------|
| a) 2:5 | b) 3:5 | c) 4:5 | d) 6:7 |
|--------|--------|--------|--------|

	vi) Cot 45° equal to			
	a) $\sqrt{3}/2$	b) $1/\sqrt{2}$	c) 0	d) 1
	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.			
	a) 1%	b) 14%	c) 20%	d) 10%
	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?			
	a) $3\frac{1}{2}$ Years	b) 4 Years	c) $4\frac{1}{2}$ Years	d) 5 Years
	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%?			
	a) 5	b) 4	c) 3	d) 6
	x) निम्नलिखित में से कौन एक अभाज्य संख्या है / Which of the following is a prime number?			
	a) 33	b) 81	c) 93	d) 97
Q-8.	<p>एक तौलिये को ब्लिच 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 /</p> <p>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 /</p> <p>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/</p> <p>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 /</p> <p>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]