महाराष्ट्र राजपत्रित तांत्रिक सेवा (मुख्य) स्पर्धा परीक्षा- 2021

यांत्रिकी अभियांत्रिकी मुख्य परीक्षा 2021

प्रश्नपुस्तिका क्रमांक

BOOKLET No. पत्रिका दि. 1 ऑक्टोबर, 2022

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प्रश्नपुस्तिका – I **B16** संच क्र. **A**

यांत्रिकी अभियांत्रिकी पेपर – 1

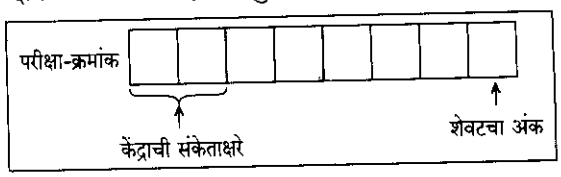
एकूण प्रश्न : 100
एकूण गुण : 200

वेळ : 2 (दोन) तास

सूचना

(1) सदर प्रश्नपुस्तिकेत **100** अनिवार्य प्रश्न आहेत. उमेदवारांनी प्रश्नांची उत्तरे लिहिण्यास सुरुवात करण्यापूर्वी या प्रश्नपुस्तिकेत सर्व प्रश्न आहेत किंवा नाहीत याची खात्री करून घ्यावी. तसेच अन्य काही दोष आढळल्यास ही प्रश्नपुस्तिका समवेक्षकांकडून लगेच बदलून घ्यावी.

(2) आपला परीक्षा-क्रमांक ह्या चौकोनांत **न विसरता बॉलपेनने** लिहावा.



(3) वर छापलेला प्रश्नपुस्तिका क्रमांक तुमच्या उत्तरपत्रिकेवर विशिष्ट जागी उत्तरपत्रिकेवरील सूचनेप्रमाणे **न विसरता नमूद करावा.**

(4) या प्रश्नपुस्तिकेतील प्रत्येक प्रश्नाला 4 पर्यायी उत्तरे सुचविली असून त्यांना 1, 2, 3 आणि 4 असे क्रमांक दिलेले आहेत. त्या चार उत्तरांपैकी सर्वात योग्य उत्तराचा क्रमांक उत्तरपत्रिकेवरील सूचनेप्रमाणे तुमच्या उत्तरपत्रिकेवर नमूद करावा. अशा प्रकारे उत्तरपत्रिकेवर उत्तरक्रमांक नमूद करताना तो संबंधित प्रश्नक्रमांकासमोर छायांकित करून दर्शविला जाईल याची काळजी घ्यावी. **ह्याकरिता फक्त काळ्या शाईचे बॉलपेन वापरावे, पेन्सिल वा शाईचे पेन वापरू नये.**

(5) सर्व प्रश्नांना समान गुण आहेत. यास्तव सर्व प्रश्नांची उत्तरे द्यावीत. घाईमुळे चुका होणार नाहीत याची दक्षता घेऊनच शक्य तितक्या वेगाने प्रश्न सोडवावेत. क्रमाने प्रश्न सोडविणे श्रेयस्कर आहे पण **एखादा प्रश्न कठीण वाटल्यास त्यावर वेळ न घालविता पुढील प्रश्नाकडे वळावे.** अशा प्रकारे शेवटच्या प्रश्नापर्यंत पोहोचल्यानंतर वेळ शिल्लक राहिल्यास कठीण म्हणून वगळलेल्या प्रश्नांकडे परतणे सोईस्कर ठरेल.

(6) उत्तरपत्रिकेत एकदा नमूद केलेले उत्तर खोडता येणार नाही. नमूद केलेले उत्तर खोडून नव्याने उत्तर दिल्यास ते तपासले जाणार नाही. एकापेक्षा जास्त उत्तरे नमूद केल्यास ते उत्तर चुकीचे धरले जाईल व त्या चुकीच्या उत्तराचे गुण वजा केले जातील.

(7) **प्रस्तुत परीक्षेच्या उत्तरपत्रिकांचे मूल्यांकन करताना उमेदवाराच्या उत्तरपत्रिकेतील योग्य उत्तरांनाच गुण दिले जातील. तसेच ''उमेदवाराने वस्तुनिष्ठ बहुपर्यायी स्वरूपाच्या प्रश्नांची दिलेल्या चार उत्तरांपैकी सर्वात योग्य उत्तरेच उत्तरपत्रिकेत नमूद करावीत. अन्यथा त्यांच्या उत्तरपत्रिकेत सोडविलेल्या प्रत्येक चुकीच्या उत्तरांसाठी 25% किंवा 1/4 गुण वजा करण्यात येतील''.**

ताकीद

ह्या प्रश्नपत्रिकेसाठी आयोगाने विहित केलेली वेळ संपेपर्यंत ही प्रश्नपुस्तिका आयोगाची मालमत्ता असून ती परीक्षाकक्षात उमेदवाराला परीक्षेसाठी वापरण्यास देण्यात येत आहे. ही वेळ संपेपर्यंत सदर प्रश्नपुस्तिकेची प्रत/प्रती, किंवा सदर प्रश्नपुस्तिकेतील काही आशय कोणत्याही स्वरूपात प्रत्यक्ष वा अप्रत्यक्षपणे कोणत्याही व्यक्तीस पुरविणे, तसेच प्रसिद्ध करणे हा गुन्हा असून अशी कृती करणाऱ्या व्यक्तीवर शासनाने जारी केलेल्या ''परीक्षांमध्ये होणाऱ्या गैरप्रकारांना प्रतिबंध करण्याबाबतचा अधिनियम-82'' यातील तरतुदीनुसार तसेच प्रचलित कायद्याच्या तरतुदीनुसार कारवाई करण्यात येईल व दोषी व्यक्ती कमाल एक वर्षाच्या कारावासाच्या आणि/किंवा रुपये एक हजार रकमेच्या दंडाच्या शिक्षेस पात्र होईल.

तसेच ह्या प्रश्नपत्रिकेसाठी विहित केलेली वेळ संपण्याआधी ही प्रश्नपुस्तिका अनधिकृतपणे बाळगणे हा सुद्धा गुन्हा असून तसे करणारी व्यक्ती आयोगाच्या कर्मचारीवृंदापैकी, तसेच परीक्षेच्या पर्यवेक्षकीयवृंदापैकी असली तरीही अशा व्यक्तीविरूद्ध उक्त अधिनियमानुसार कारवाई करण्यात येईल व दोषी व्यक्ती शिक्षेस पात्र होईल.

पर्यवेक्षकांच्या सूचनेविना हे सील उघडू नये

पुढील सूचना प्रश्नपुस्तिकेच्या अंतिम पृष्ठावर पहा

कच्च्या कामासाठी जागा / SPACE FOR ROUGH WORK

1. SI unit of absolute viscosity is $N.s/m^2$. Which of the following is true about this unit ?
   (1) $1\ N.s/m^2 = 10$ poise
   (2) $10\ N.s/m^2 = 1$ poise
   (3) $1\ N.s/m^2 = 10$ stokes
   (4) $10\ N.s/m^2 = 1$ stoke

2. The vertical distance between HGL (Hydraulic Grade Level) and TEL (Total Energy Level) is
   (1) $\frac{v^2}{g}$
   (2) $\frac{v^2}{2g}$
   (3) $\frac{p}{\rho.g}$
   (4) $\frac{p}{\rho}$

3. Which among the following is true for continuum concept in fluid mechanics ?
   (1) The properties of matter are considered as continuous function of space variables.
   (2) The properties of matter are discrete functions of time.
   (3) Both (1) and (2) above
   (4) None of the above

4. Normal acceleration in fluid flow situation exists only when
   (1) the flow is unsteady.
   (2) the flow is two-dimensional.
   (3) the streamlines are straight and parallel.
   (4) the streamlines are curved.

5. Which of the following equations hold true for Pascal's law ?
   (1) $P_x = P_z = 2P_s$
   (2) $P_s = P_x = P_z$
   (3) $P_x = P_y = 2P_s$
   (4) None of the above

6. On account of which of the following does the boundary layer exist ?
   (1) Surface tension
   (2) Gravitational effect
   (3) Viscosity of fluid
   (4) None of the above

7. Printer's ink is an example of _____.
   (1) Newtonian fluid
   (2) Non-Newtonian fluid
   (3) Thixotropic substance
   (4) Elastic solid

8. The maximum velocity in a circular pipe when the flow is laminar, occurs at _____.
   (1) the top of the pipe
   (2) the bottom of the pipe
   (3) the centre of the pipe
   (4) None of the above

कच्च्या कामासाठी जागा / SPACE FOR ROUGH WORK

9. In which of the following measuring devices is Bernoulli's equation used ?
   (1) Venturimeter
   (2) Orificemeter
   (3) Pitot tube
   (4) All of the above

10. Streamlines, pathlines and streaklines are identical when _____.
   (1) the flow is uniform
   (2) the flow is steady
   (3) the flow velocities do not change steadily with time
   (4) the flow is neither steady nor uniform

11. Which of the following expressions represents the energy boundary layer thickness ?
   (1) $\int_0^{\delta} \frac{u}{U}\left(1-\frac{u^2}{U^2}\right)dy$
   (2) $\int_0^{\delta} \left(1-\frac{u}{U}\right)dy$
   (3) $\int_0^{\delta} \frac{u}{U}\left(1-\frac{u}{U}\right)dy$
   (4) All of the above

12. Under which of the following conditions is the closure of the valve considered rapid ?
   (Given L : Length of pipe, C : Velocity of pressure wave produced due to water hammer)
   (1) The duration of valve closure is greater than $\frac{2L}{C}$
   (2) The duration of valve closure is less than $\frac{L}{C}$
   (3) The duration of valve closure is less than $\frac{2L}{C}$
   (4) None of the above

13. When a body is immersed in a fluid, partially or completely, the force of buoyancy is equal to
   (1) the weight of the body.
   (2) the weight of the fluid displaced by the body.
   (3) the weight of the volume of the fluid equal to the volume of body.
   (4) None of the above

14. Consider the statement :
A simple pitot tube can be used to measure the following quantities :
a. Static head
b. Datum head
c. Dynamic head
d. Friction head
e. Total head
Answer options :
(1) a, b, d are correct
(2) a, c, e are correct
(3) b, c, d are correct
(4) b, c, e are correct

15. The specific speed of an impulse turbine with one nozzle is 4. If the same turbine is operated with two nozzles, what is the specific speed ?
(1) $4\sqrt{3}$ (2) $4\sqrt{2}$ (3) 5 (4) 5·5

16. Which of the following is an example of free vortex flow ?
(1) A whirlpool in a river
(2) Flow of liquid in centrifugal pump casing
(3) Flow of liquid through a hole provided at the bottom of a container
(4) All of the above

17. Arrange the Pelton turbine, Francis turbine and Kaplan turbine in the ascending order of their specific speeds.
(1) Pelton turbine, Francis turbine, Kaplan turbine
(2) Kaplan turbine, Francis turbine, Pelton turbine
(3) Francis turbine, Kaplan turbine, Pelton turbine
(4) Pelton turbine, Kaplan turbine, Francis turbine

18. Which of the following is an example of phenomenon of surface tension ?
(1) Raindrops
(2) Rise of sap in a tree
(3) Break up of liquid jets
(4) All of the above

19. Which of the following is true for Kaplan turbine ?
(1) It is a low head and low discharge turbine
(2) It is a low head and high discharge turbine
(3) It is a high head and high discharge turbine
(4) All of the above

20. Which of the following factors determine the friction factor for turbulent flow in a rough pipe ?
(1) Mach number and relative roughness
(2) Froude number and mach number
(3) Reynold number and relative roughness
(4) Froude number and relative roughness

21. Due to larger intermolecular spacing and random molecular motion, the thermal conductivity of gases is generally _____ that of the solids.
(1) smaller than
(2) larger than
(3) equal to
(4) None of the above

22. Critical radius of insulation for a cylindrical body is given by _____.
(1) k/2h
(2) k/h
(3) 2k/h
(4) None of the above

23. _____ law states that the amount of heat transfer due to conduction is proportional to the cross-sectional area and temperature gradient.
(1) Stefan-Boltzmann's
(2) Newton's
(3) Fourier's
(4) Kirchhoff's

24. Which of the following dimensionless number has a significant role in forced convection ?
(1) Prandtl number
(2) Péclet number
(3) Mach number
(4) Reynolds number

25. Stored thermal and mechanical energy is given by relation _____ where PE = Potential Energy, KE = Kinetic Energy and IE = Internal Energy.
(1) PE + KE – IE
(2) PE + KE + IE
(3) PE – KE + IE
(4) None of the above

26. Which of the following statements is ***incorrect*** ?
(1) Emissivity of metallic surfaces is generally small.
(2) Emissivity of conductors decreases with increasing temperature.
(3) The presence of oxide layers may significantly increase the emissivity of metallic surfaces.
(4) All of the above

27. _____ is the conversion from mechanical to thermal energy associated with viscous forces acting in a fluid.
(1) Viscosity
(2) Viscometer
(3) Viscous dissipation
(4) Densometer

28. Which of the following is true for opaque surfaces ?

(1) $\alpha + \rho + \tau = 1$ (2) $\rho + \tau = 1$

(3) $\alpha + \tau = 1$ (4) $\alpha + \rho = 1$

29. _____ statement states that it is impossible for any system to operate in a thermodynamic cycle and deliver a net amount of work to its surroundings while receiving energy by heat transfer from a single reservoir.

(1) Kelvin-Planck (2) Clausius

(3) Dittus Boelter (4) Clapeyron

30. Fick's first law of diffusion is related with

(1) diffusion flux and diffusivity

(2) diffusion flux, diffusivity and concentration

(3) diffusion flux, diffusivity and concentration with respect to position

(4) None of the above

31. In Newton's law of cooling, heat transfer is given by

$$Q = \hbar A (T_s - T_f).$$

Here $\hbar$ is _____ heat transfer coefficient.

(1) average (2) local (3) global (4) None of the above

32. The unit of mass diffusivity is _____.

(1) cm^2/sec (2) kg/m·sec (3) $N\text{-}m/sec^2$ (4) All of the above

33. The ratio of buoyancy forces to the viscous forces in the velocity boundary layer is called _____.

(1) Grashof number (2) Reynolds number

(3) Bond number (4) Eckert number

34. For a specified inlet temperature and given heat load and same HE surface area, which of the following is true ?

(1) $(LMTD)_{counter\ flow} > (LMTD)_{parallel\ flow}$

(2) $(LMTD)_{counter\ flow} < (LMTD)_{parallel\ flow}$

(3) $(LMTD)_{counter\ flow} = (LMTD)_{parallel\ flow}$

(4) None of the above

35. The ratio of the heat conduction rate to the thermal energy storage in a solid is called _____.

(1) Biot number
(2) Bond number
(3) Fourier number
(4) Eckert number

36. The compact heat exchangers are characterized by area density (β) as prescribed below

(1) $\beta \geq 400\ m^2/m^3$ for liquids and $\beta \geq 700\ m^2/m^3$ for gases
(2) $\beta \geq 400\ m^2/m^3$ for gases and $\beta \geq 700\ m^2/m^3$ for liquids
(3) $\beta \leq 400\ m^2/m^3$ for liquids
(4) $\beta \leq 700\ m^2/m^3$ for gases

37. _____ is a property that determines the fraction of the incident radiation reflected by a surface.

(1) Absorptivity
(2) Reflectivity
(3) Refractivity
(4) Emissivity

38. Which of the following represents the continuity equation for steady flow of an incompressible fluid ?

(1) $\frac{\partial}{\partial x}(\rho v)\, \partial a \,.\, \partial b \,.\, \partial c$
(2) $\frac{\partial u}{\partial x} + \frac{\partial v}{\partial y} + \frac{\partial w}{\partial z} = 0$
(3) Both (1) and (2)
(4) None of the above

39. The rate at which radiation is incident upon a surface per unit area is called _____.

(1) Radiosity
(2) Irradiation
(3) Emissive power
(4) Refraction

40. Convective mass transfer occurs due to

(1) Random motion of molecules
(2) Transport of a substance by bulk flow
(3) Both (1) and (2)
(4) None of the above

41. The coefficient of performance of refrigeration is defined as

(1) $B_R = \frac{W_{in}}{Q_L}$ (2) $B_R = \frac{Q_L}{W_{in}}$

(3) $B_R = \frac{Q_L}{Q_L - W_{in}}$ (4) $B_R = \frac{W_{in}}{Q_L + W_{in}}$

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42. Coefficient of Performance of Reversed Carnot cycle operating between T_H and T_L is given by the formula

(1) $\frac{T_H - T_L}{T_H}$ (2) $\frac{T_H}{T_H - T_L}$

(3) $\frac{T_L}{T_H - T_L}$ (4) None of the above

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43. Consider the following statements :

Statement I : In an air refrigerator the heat carried by air is in the form of sensible heat only.

Statement II : Therefore, mass of air circulation required is more than other refrigerant used systems.

Statement III : Therefore, mass of air circulation required is less than other refrigerant used systems.

Select the correct answer from the following :

(1) Statement I and Statement II are correct

(2) Statement II and Statement III are correct

(3) Statement I and Statement III are correct

(4) Only Statement I is correct

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44. The viscosity of refrigerant used in refrigeration is required to be

(1) Medium (2) Low

(3) High (4) None of the above

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45. The purpose of condenser is to condense the gas coming out from exit of

(1) Evaporator (2) Turbine

(3) Compressor (4) Throttle

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46. Liquid entry to refrigerant compressor is avoided due to
(1) Chances of scoring of piston and cylinder assembly only
(2) Washing away of lubricant only
(3) Both (1) and (2) together
(4) Leakage problem

47. For comfort in winter season, air conditioning requires
(1) Cooling and humidification (2) Cooling and dehumidification
(3) Heating and humidification (4) Heating and dehumidification

48. The arrangement of 3 temperature values of wet bulb, dry bulb and dew point temperature in decreasing order will be
(1) Dew point temperature, dry bulb temperature, wet bulb temperature.
(2) Dry bulb temperature, wet bulb temperature, dew point temperature.
(3) Dry bulb temperature, dew point temperature, wet bulb temperature.
(4) None of the above

49. The performance of cooling and heating coil will be better with
(1) Higher bypass factor of both coils
(2) Lower bypass factor of both coils
(3) Cooling coil with high bypass factor and heating coil with low bypass factor
(4) None of the above

50. What are the methods used for air conditioning duct design ?
(1) Equal friction /pressure drop method
(2) Velocity reduction method
(3) Static regain method
(4) All of the above

51. During adiabatic saturation process on unsaturated air _____ remains constant.
(1) Dry bulb temperature (2) Relative humidity
(3) Wet bulb temperature (4) None of the above

52. If t_1 and t_2 be dry bulb temperature of air entering and leaving the cooling coil and t_3 is average surface temperature of cooling coil, then the bypass factor of coil is

(1) $\frac{t_2 - t_3}{t_1 - t_3}$ (2) $\frac{t_1 - t_3}{t_2 - t_3}$ (3) $\frac{t_3 - t_1}{t_2 - t_3}$ (4) $\frac{t_3 - t_2}{t_1 - t_3}$

कच्च्या कामासाठी जागा / SPACE FOR ROUGH WORK

53. The cross-sectional area of one cylinder of an engine multiplied by stroke length is called _____.

(1) Engine capacity
(2) All cylinder volume
(3) Swept volume
(4) Clearance volume

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54. For the same size, the actual power produced by a two-stroke engine as compared to a four-stroke engine is _____.

(1) 2 times
(2) 1·3 times
(3) the same
(4) None of the above

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55. If Otto cycle and Diesel cycle are working under same maximum pressure and temperature, which of the following statements is correct ?

(1) Heat rejected by both cycles is same.
(2) Heat supplied to Diesel cycle is more than that of the Otto cycle.
(3) Diesel cycle is more efficient than Otto cycle.
(4) All of the above

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56. In which engine is dissociation effect more pronounced ?

(1) SI engine
(2) CI engine
(3) Both SI and CI engine
(4) None of the above

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57. Find the matching pairs for reducing the detonation of SI engine.

a.	Spark timing	I.	Weak
b.	Humidity	II.	Retard
c.	Distance of flame travel	III.	Increase
d.	Air-fuel ratio	IV.	Reduce

Answer options :

	a	**b**	**c**	**d**
(1)	II	III	IV	I
(2)	II	IV	III	I
(3)	II	I	IV	III
(4)	IV	I	III	II

58. The relationship between octane number and cetane number is

(1) $CN = \frac{104 - ON}{3{\cdot}75}$ (2) $ON = \frac{104 - CN}{3{\cdot}75}$

(3) $CN = \frac{104 - ON}{2{\cdot}75}$ (4) $ON = \frac{104 - CN}{2{\cdot}75}$

59. Thermostat valve in water cooling system starts to open at about _____ temperature.

(1) 90°C (2) 80°C (3) 100°C (4) 70°C

60. In a typical diesel engine, generally how much amount of heat is going to the cooling water ?

(1) 10% (2) 50% (3) 70% (4) 30%

61. Which of the following factors are used for deciding degree of supercharging in compression ignition engine ?

(1) Thermal load (2) Size of piston

(3) Type of fuel supply system (4) None of the above

62. The cubic capacity of four-stroke SI engine is 250 cc. The oversquare ratio of engine is 1·2 and the clearance volume is 30 cc. What is the compression ratio of the engine ?

(1) 8·5 (2) 9 (3) 10·3 (4) 9·33

63. Which of the following fuel-air mixture results in less hydrocarbon emission ?

(1) Lean fuel mixture

(2) Rich fuel mixture

(3) Stoichiometric fuel air mixture

(4) Fuel air mixture does not have any effect on hydrocarbons

64. For comparison of two types of engine, the correction factor is given by

(1) Correction factor = $\frac{20}{\%CO_2 + \%CO + \%C}$

(2) Correction factor = $\frac{15}{\%CO_2 + \%CO + \%C}$

(3) Correction factor = $\frac{20}{\%CO_2 + \%NO_x + \%C}$

(4) Correction factor = $\frac{20}{\%HC + \%NO_x + \%CO_2}$

कच्च्या कामासाठी जागा / SPACE FOR ROUGH WORK

65. Which of the following statements is correct with respect to Regenerative cycle ?

(1) The heat rejected in the condenser is at a higher rate and thus efficiency is lower.

(2) The heat rejected in the condenser is at a reduced rate and thus efficiency is higher.

(3) The heat added in the condenser is at a reduced rate and thus efficiency is higher.

(4) The heat added in the condenser is at a higher rate and thus efficiency is lower.

66. The thermal efficiency of Gas Turbine Power Plant can be increased by _____.

(1) Intercooling

(2) Reheating

(3) Regeneration

(4) All of the above

67. A fluidised bed may be defined as the bed of _____.

(1) solid particles behaving as a gas

(2) solid particles behaving as a fluid

(3) liquid particles behaving as a gas

(4) gas particles behaving as a liquid

68. The proximate analysis of coal gives

(1) various chemicals like carbon, hydrogen, oxygen and ash.

(2) fuel constituents as percentage by volume of moisture, fixed carbon and ash.

(3) percentage by weight of moisture, volatile matter, fixed carbon and ash.

(4) None of the above

69. In run off river plant, the power generated depends on

(1) the length of the river.

(2) the depth of the river.

(3) the quantity of water in the river.

(4) the quantity of flow.

70. In two-stage gas turbine plant, with intercooling and reheating

(1) both work ratio and thermal efficiency improves.

(2) work ratio improves but thermal efficiency decreases.

(3) thermal efficiency improves but work ratio decreases.

(4) both work ratio and thermal efficiency decreases.

---

71. Due to high negative temperature coefficient, a PWR is _____ in operation and regulation.

(1) safe and unstable

(2) unsafe but stable

(3) safe and stable

(4) unsafe and unstable

---

72. A Diesel Power Plant is used as

a. Peak load plant

b. Mobile plant

c. Standby unit

d. Nursery station

Which one of the above options is/are correct ?

(1) a and b

(2) b and c

(3) a, b and c

(4) All of the above

---

73. The part load efficiency for which cycle of Gas Turbine Power Plant is observed to be the best ?

(1) Open cycle with regenerator

(2) Closed cycle

(3) Semi-closed cycle

(4) Simple open cycle

---

74. The operation of _____ boiler is similar to an electric transformer in which two pressures are used to effect an interchange of heat energy.

(1) LaMont

(2) Benson

(3) Loeffler

(4) Schmidt – Hartmann

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75. In case of solar concentrators, if the length 1m and width 1m reflector is in the form of trough with parabolic cross-section, the solar radiation will be focused along a _____.

(1) Point
(2) Vertex point
(3) Line
(4) None of the above

---

76. In paraboloid dish collector, to achieve high _____, it is required to build a point focusing collector.

(1) Concentration Ratio (CR)
(2) Temperature
(3) Concentration Ratios and temperature
(4) Radiation

---

77. In upper convective zone, non-convective zone and storage zone of solar pond the salinity _____.

(1) is same throughout
(2) decreases from upper zone to storage zone
(3) increases from upper zone to storage zone
(4) is more in upper convective zone only

---

78. The rate at which solar energy arrives at the top of the atmosphere is called _____.

(1) Diffuse radiation
(2) Solar constant
(3) Scattering
(4) Beam radiation

---

79. In homojunction cells with silicon as base material and manufactured as amorphous silicon, means it is

(1) non-crystalline silicon.
(2) polycrystalline silicon.
(3) single crystal silicon.
(4) heterojunction cell.

---

80. The maximum rated power capacity of wind turbine is given for a specified rated wind speed commonly about _____.

(1) 21 m/s (2) 31 m/s

(3) 12 m/s (4) 50 m/s

---

81. Wind power produced is proportional to _____.

(1) square of wind velocity

(2) cube root of wind velocity

(3) cube of wind velocity

(4) square root of wind velocity

---

82. Theoretically, what is the maximum power extracted by a turbine rotor out of the total wind energy in the area swept by the rotor ?

(1) 5·93% (2) 70·3%

(3) 59·3% (4) 35·1%

---

83. For effective installation of a windmill the minimum average wind speed should be _____.

(1) above 7 m/sec

(2) in between 1 m/sec to 3 m/sec

(3) less than 5 m/sec

(4) more than 100 m/sec

---

84. A wind farm _____ generated energy to the grid but during the no-wind periods the local requirement of the energy is met from the grid.

(1) imports

(2) exports

(3) shares half

(4) does not supply

---

85. Which of the following is the correct statement for all possible processes that a system in the given surrounding undergoes ?

(1) $ds]_{system} \leqslant 0$

(2) $ds]_{surround} \geqslant 0$

(3) $(ds]_{system} + ds]_{surround}) \geqslant 0$

(4) $(ds]_{system} + ds]_{surround}) < 0$

---

86. When water is heated at a constant pressure above critical point, then

(1) it forms liquid + vapour two-phase mixture

(2) it forms dry saturated steam

(3) it flashes suddenly into vapour

(4) any of the above is possible

---

87. All natural processes are carried out

(1) with finite gradient

(2) infinitely slowly

(3) so that all states passed are in equilibrium

(4) All of the above

---

88. Which of the following statements is correct for Heat and Work ?

(1) Heat and work are properties of the system.

(2) Both heat and work can be stored in the system.

(3) Heat and work are independent of path of process.

(4) None of the above

---

89. For a reversible process with law PV^n = constant, match the following depending on value of index 'n'.

a.	$n = 0$	I.	Isothermal
b.	$n = \infty$	II.	Isobaric
c.	$n = 1$	III.	Isochoric
d.	$n = \gamma$	IV.	Adiabatic

Answer options :

	a	**b**	**c**	**d**
(1)	II	I	IV	III
(2)	II	III	I	IV
(3)	III	I	IV	II
(4)	III	II	I	IV

---

90. In an internal combustion engine, during compression stroke the heat rejected to cooling water is 50 kJ/kg and work input is 100 kJ/kg. Calculate the change in internal energy of the working fluid.

(1) 150 kJ/kg (2) 100 kJ/kg

(3) 50 kJ/kg (4) 75 kJ/kg

---

91. Work done during isochoric process from state P_1, V_1 to final state P_2, V_2 is given as

(1) $V(P_2 - P_1)$ (2) Zero

(3) $P(V_2 - V_1)$ (4) $P_1V_1 \, ln \, (P_2/P_1)$

---

92. The enthalpy of dry saturated steam _____ with the increase in pressure.

(1) increases (2) remains constant

(3) decreases (4) None of the above

---

93. If 1 kg of water is heated from 0°C to 100°C the sensible heat added to it will be

(1) 450 kJ (2) 418 kJ

(3) 335 kJ (4) All of the above

---

94. Which of the following ***cannot*** be the ideal reversible process ?

(1) Condensation and boiling of liquids

(2) Frictionless adiabatic expansion

(3) Frictionless isothermal expansion

(4) Mixing of two fluids

---

95. The Carnot cycle consists of four reversible processes. Which of the following represents the correct Carnot cycle ?

(1) Reversible isothermal expansion, reversible adiabatic expansion, reversible isothermal compression, reversible adiabatic compression

(2) Isentropic expansion, isentropic compression, isentropic heat addition, adiabatic expansion

(3) Constant volume heat addition, adiabatic compression, adiabatic expansion, heat rejection

(4) All of the above

---

96. A centrifugal pump receives water at atmospheric pressure of 103 kPa and delivers it at 600 kPa. Neglecting kinetic and potential energy changes, find the work done on water per unit mass if there is no change in specific volume of water. The specific volume of water is 0·001 m^3/kg.

(1) 0·497 kJ (2) – 0·497 kJ

(3) – 0·523 kJ (4) 0·523 kJ

97. According to Avogadro's hypothesis

(1) the volume of 1 mole of any gas is same as the volume of any other gas when the gases are at same temperature and pressure.

(2) the weight of one mole of any gas is same as the weight of any other gas.

(3) the volume of 1 kg of gas is same as volume of any other 1 kg of gas.

(4) None of the above

98. In a closed rigid container containing air at atmospheric pressure and 300 k, 100 kJ of energy is added in the form of heat. What would be the increase in the internal energy ?

(1) 105 kJ

(2) 95 kJ

(3) 100 kJ

(4) 90 kJ

99. Which of the following is correct for an isolated system ?

(1) $dQ = 0$

(2) $dW = 0$

(3) $dE = 0$

(4) All of the above

100. An isentropic process is always

(1) irreversible and adiabatic

(2) reversible and isothermal

(3) frictionless and irreversible

(4) reversible and adiabatic

सूचना – (पृष्ठ 1 वरून पुढे.....)

(8) प्रश्नपुस्तिकेमध्ये विहित केलेल्या विशिष्ट जागीच कच्चे काम (रफ वर्क) करावे. प्रश्नपुस्तिकेव्यतिरिक्त उत्तरपत्रिकेवर वा इतर कागदावर कच्चे काम केल्यास ते कॉपी करण्याच्या उद्देशाने केले आहे, असे मानले जाईल व त्यानुसार उमेदवारावर शासनाने जारी केलेल्या ''परीक्षांमध्ये होणाऱ्या गैरप्रकारांना प्रतिबंध करण्याबाबतचे अधिनियम-82'' यातील तरतुदीनुसार कारवाई करण्यात येईल व दोषी व्यक्ती कमाल एक वर्षाच्या कारावासाच्या आणि/किंवा रुपये एक हजार रकमेच्या दंडाच्या शिक्षेस पात्र होईल.

(9) सदर प्रश्नपत्रिकेसाठी आयोगाने विहित केलेली वेळ संपल्यानंतर उमेदवाराला ही प्रश्नपुस्तिका स्वत:बरोबर परीक्षाकक्षाबाहेर घेऊन जाण्यास परवानगी आहे. **मात्र परीक्षाकक्षाबाहेर जाण्यापूर्वी उमेदवाराने आपल्या उत्तरपत्रिकेचा भाग-1 समवेक्षकाकडे न विसरता परत करणे आवश्यक आहे.**

नमुना प्रश्न

Pick out the correct word to fill in the blank :

Q. No. 201. I congratulate you _____ your grand success.

(1) for (2) at

(3) on (4) about

ह्या प्रश्नाचे योग्य उत्तर ''(3) on'' असे आहे. त्यामुळे या प्रश्नाचे उत्तर ''(3)'' होईल. यास्तव खालीलप्रमाणे प्रश्न क्र. **201** समोरील उत्तर-क्रमांक ''③'' हे वर्तुळ पूर्णपणे छायांकित करून दाखविणे आवश्यक आहे.

प्र. क्र. 201. ① ② ● ④

अशा पद्धतीने प्रस्तुत प्रश्नपुस्तिकेतील प्रत्येक प्रश्नाचा तुमचा उत्तरक्रमांक हा तुम्हाला स्वतंत्ररीत्या पुरविलेल्या उत्तरपत्रिकेवरील त्या त्या प्रश्नक्रमांकासमोरील संबंधित वर्तुळ पूर्णपणे छायांकित करून दाखवावा. **ह्याकरिता फक्त काळ्या शाईचे बॉलपेन वापरावे, पेन्सिल वा शाईचे पेन वापरू नये.**

कच्च्या कामासाठी जागा/SPACE FOR ROUGH WORK