| Seat No. | |
|---|---|

## M.Phil./Ph.D. Entrance Examination, August - 2018
## MECHANICAL ENGINEERING

**Day and Date : Friday, 10 - 08 - 2018**  **Total Marks : 100**
**Time : 04.00 p.m. to 06.00 p.m.**

**Instructions :**
1) All questions are compulsory.
2) Each question carries 2 marks.
3) Answers should be marked in the given OMR answer sheet by darkening the appropriate option.
4) Use black ball point pen only for marking the circle. Do not make any stray mark on the OMR Answer Sheet.
5) Follow the instructions given on OMR Sheet.
6) Rough work shall be done on the sheet provided at the end of question paper.
7) Only non programmable calculators are allowed.

1. Research is classified on the basis of ____ and methods.

   A) Purpose
   B) Intent
   C) Methodology
   D) None of the above

2. Research conducted to find solution for an immediate problem is ____.

   A) Fundamental Research
   B) Analytical Research
   C) Survey
   D) Action Research

3. Two types of errors associated with hypothesis testing are Type I and Type II. Type II error is committed when

   A) We reject the null hypothesis whilst the alternative hypothesis is true

   B) We reject a null hypothesis when it is true

   C) We accept a null hypothesis when it is not true

   D) None of the above

*P.T.O.*

**4.** Research conducted in class room atmosphere is called

A) Field study

B) Survey

C) Laboratory Research

D) Empirical Research

**5.** One or two tail test will determine

A) If the two extreme values (min or max) of the sample need to be rejected

B) If the hypothesis has one or possible two conclusions

C) If the region of rejection is located in one or two tails of the distribution

D) None of the above

**6.** What are the two types of variance which can occur in your data?

A) Between or within groups

B) Repeated and extraneous

C) Experimenter and participant

D) Independent and confounding

**7.** ICSSR stands for

A) Indian Council for Survey and Research

B) Indian Council for strategic Research

C) Indian Council for Social Science Research

D) Inter National Council for Social Science Research

**8.** Which ONE of these techniques is most likely to be used in quantitative analysis?

A) Multivariate analysis

B) Sound-tape recordings

C) Transcripts

D) Videos

**9.** To ensure adequate informed consent, a researcher should include all of the following components in an introduction except _____ .

A) Promise of anonymity and confidentiality

B) Sponsoring organization

C) Purpose of the research

D) Estimate of when the research study will be published

10. An interval scale contains _____.

    A) Mutually exclusive and collectively exhaustive categories as well as the property of order, but not distance or unique origin

    B) The properties of order, classification and equal distance between points but no unique origin

    C) Mutually exclusive and collectively exhaustive categories, but without the properties of order, distance and origin

    D) The properties of classification, order, equal distance and unique origin

11. Which of the following is true of resistant statistics?

    A) Inappropriate for statistical analysis

    B) Corrupted with measurement bias

    C) Based on nominal scales

    D) Able to resist influence of extreme values

12. A _____ is an abstraction formed by generalization from particulars

    A) Hypothesis            B) Variable

    C) Concept               D) Facts

13. Conclusions from qualitative research are

    A) less certain than from quantitative research

    B) of little practical use.

    C) of descriptive value only.

    D) seldom defensible.

14. A Hypothesis which develops while planning the research is

    A) Null Hypothesis          B) Working Hypothesis

    C) Relational Hypothesis     D) Descriptive Hypothesis

**15.** When a hypothesis is stated negatively it is called

A) Relational Hypothesis
B) Situational Hypothesis

C) Null Hypothesis
D) Casual Hypothesis

**16.** _____which deals with the techniques by which the procedures specified in the sampling, statistical and observational designs can be carried out

A) Statistical design
B) Observational design

C) Operational design
D) Sampling design

**17.** A Hypothesis must be _____.

A) Diffuse
B) Specific

C) Slow
D) Speedy

**18.** The first purpose of a survey is to _____.

A) Description
B) Evaluation

C) Propagation
D) Provide Information

**19.** In Testing the statistical hypothesis, which of the following statement is false

A) The critical region is the values of the test statistic for which we reject null hypothesis.

B) The level of significance is the probability of type I error

C) The p-value measures the probability that the null hypothesis is true

D) None of the above

**20.** Chi-square test for independence assesses which of the following?

A) It assesses whether there is a relationship between two categorical variables

B) It assesses whether there is a relationship between the population and the sample

C) It assesses whether there is a significant difference between two categorical variables

D) It assesses whether there is significant difference between scores taken at time 1 and those taken at time 2

**21.** For collection of Data _____ time is devoted.

A) 50%    B) 25%

C) 75%    D) 33%

**22.** Final stage in the Research Process is

A) Problem formulation    B) Data collection

C) Data Analysis    D) Report Writing

**23.** _____ is a statistical technique that identifies homogenous subgroups.

A) Factor analysis    B) Multivariate analysis of variance

C) Cluster analysis    D) Discriminant analysis

**24.** A short summary of Technical Report is called

A) Article    B) Research Abstract

C) Publication    D) Guide

**25.** Which of the following measures become larger as the data is more dispersed - the mean, median, range, variance or standard deviation?

A) The mean and the median.

B) The median and range.

C) The mean, variance and standard deviation.

D) The range, variance and standard deviation.

**26.** A cantilever beam having square cross-section of side $a$ is subjected to an end load. If $a$ is increased by 19%, the tip deflection decreases approximately by

A) 19%    B) 29%

C) 41%    D) 50%

**27.** A car is moving on a curved horizontal road of radius 100 m with a speed of 20 m/s. The rotating masses of the engine have an angular speed of 100 rad/s in clockwise direction when viewed from the front of the car. The combined moment of inertia of the rotating masses is 10 kg-m$^2$. The magnitude of the gyroscopic moment (in N-m) is _____.

A) 180    B) 200

C) 250    D) 225

**28.** The spring constant of a helical compression spring DOES NOT depend on

A) Coil diameter        B) Material strength

C) Number of active turns        D) Wire diameter

**29.** For a floating body, buoyant force acts at the

A) Centroid of the floating body

B) Center of gravity of the body

C) Centroid of the fluid vertically below the body

D) Centroid of the displaced fluid

**30.** Which of the following statements are TRUE with respect to heat and work?

i) They are boundary phenomena

ii) They are exact differentials

iii) They are path functions

A) Both (i) and (ii)        B) Both (i) and (iii)

C) Both (ii) and (iii)        D) Only (iii)

**31.** The INCORRECT statement about regeneration in vapor power cycle is that

A) It increases the irreversibility by adding the liquid with higher energy content to the steam generator.

B) Heat is exchanged between the expanding fluid in the turbine and the compressed fluid before heat addition.

C) The principle is similar to the principle of Stirling gas cycle.

D) It is practically implemented by providing feed water heaters.

**32.** The "Jominy test" is used to find

A) Young's modulus        B) Hardenability

C) Yield strength        D) Thermal conductivity

**33.** The part of a gating system which regulates the rate of pouring of molten metal is

A) Pouring basin        B) Runner

C) Choke        D) Ingate

**34.** The non-traditional machining process that essentially requires vacuum is

A) Electron beam machining

B) Electro chemical machining

C) Electro chemical discharge machining

D) Electro discharge machining

**35.** Consider a Poisson distribution for the tossing of a biased coin. The mean for this distribution is $\mu$. The standard deviation for this distribution is given by

A) $\sqrt{\mu}$

B) $\mu^2$

C) $\mu$

D) $\dfrac{1}{\mu}$

**36.** A shaft with a circular cross-section is subjected to pure twisting moment. The ratio of the maximum shear stress to the largest principal stress is

A) 2.0

B) 1.0

C) 0.5

D) 0

**37.** A single degree of freedom mass-spring-viscous damper system with mass $m$, spring constant $k$ and viscous damping coefficient q is critically damped. The correct relation among $m$, $k$ and $q$ is

A) $q = \sqrt{2km}$

B) $q = 2\sqrt{km}$

C) $q = \sqrt{\dfrac{2k}{m}}$

D) $q = \sqrt{\dfrac{k}{m}}$

**38.** A thin cylindrical pressure vessel with closed-ends is subjected to internal pressure. The ratio of circumferential (hoop) stress to the longitudinal stress is

A) 0.25

B) 0.50

C) 1.0

D) 2.0

**39.** The internal energy of an ideal gas is a function of

A) Temperature and pressure  B) Volume and pressure

C) Entropy and pressure  D) Temperature only

**40.** The heat removal rate from a refrigerated space and the power input to the compressor are 7.2 kW and 1.8 kW, respectively. The coefficient of performance (COP) of the refrigerator is _____.

A) 2  B) 1

C) 4  D) 0.25

**41.** The welding process which uses a blanket of fusible granular flux is

A) Tungsten inert gas welding  B) Submerged arc welding

C) Electro-slag welding  D) Thermit welding

**42.** Grashoff number signifies the ratio of

A) Inertia force to viscous force

B) Buoyancy force to viscous force

C) Buoyancy force to inertia force

D) Inertia force to surface tension force

**43.** Internal gears are manufactured by

A) hobbing  B) shaping with pinion cutter

C) shaping with rack cutter  D) milling

**44.** A single degree of freedom spring mass system with viscous damping has a spring constant of 10 kN/m. The system is excited by a sinusoidal force of amplitude 100 N. If the damping factor (ratio) is 0.25, the amplitude of steady state oscillation at resonance is mm.

A) 18  B) 25

C) 30  D) 20

**45.** Match the following:

| P. | Feeler gauge | I. | Radius of an object |
|---|---|---|---|
| Q. | Fillet gauge | II. | Diameter within limits by comparison |
| R. | Snap gauge | III. | Clearance or gap between components |
| S. | Cylindrical plug gauge | IV. | Inside diameter of straight hole |

A) P – III, Q – I, R – II, S – IV   B) P – III, Q – II, R – I, S – IV

C) P – IV, Q – II, R – I, S – Ill   D) P – IV, Q – I, R – II, S – III

**46.** Maximize $Z = 15X_1 + 20X_2$

subject to

$12X_1 + 4X_2 \geq 36$

$12X_1 - 6X_2 \leq 24$

$X_1, X_2 \geq 0$

The above linear programming problem has

A)  Infeasible solution        B)  Unbounded solution

C)  Alternative optimum solutions     D)  Degenerate solution

**47.** A hollow cylinder has length L, inner radius $r_1$, outer radius $r_2$, and thermal conductivity k. The thermal resistance of the cylinder for radial conduction is

A) $\dfrac{\ln\left(\dfrac{r_2}{r_1}\right)}{2\pi kL}$

B) $\dfrac{\ln\left(\dfrac{r_1}{r_2}\right)}{2\pi kL}$

C) $\dfrac{2\pi kL}{\ln\left(\dfrac{r_2}{r_1}\right)}$

D) $\dfrac{2\pi kL}{\ln\left(\dfrac{r_1}{r_2}\right)}$

**48.** A solid shaft is to transmit 20kW at 200 rpm. The ultimate shear stress for the steel may be taken as 360 MPa and a factor of safety as 8, then the diameter of the shaft will be

A)  45mm

B)  46mm

C)  48mm

D)  50mm

**49.** For an orthogonal cutting operation, tool material is HSS, rake angle is 22°, chip thickness is 0.8 mm, speed is 48 m/min and feed is 0.4 mm/rev. The shear plane angle (in degrees) is

A)  19.24

B)  29.70

C)  56.00

D)  68.75

**50.** A Carnot engine operating between temperatures T1 and T2 has efficiency 1/6. When T2 is lowered by 62 K, its efficiency increases to 1/3. Then T1 and T2 are, respectively

A)  310 K and 248 K

B)  372 K and 310 K

C)  372 K and 330 K

D)  330 K and 268 K

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**Rough Work**

**Rough Work**