THE MAHARAJA SAYAJIRAO UNIVERSITY OF BARODA, VADODARA

Ph. D. ENTRANCE TEST (PET) 2025

Signature of Invigilator

Roll. No.

Paper - II
Mechanical Engineering

Maximum Marks: 50 **No. Of Printed Pages: 8**

Instruction for the Candidate:

1. This paper consists of **FIFTY (50)** multiple choice type questions. Each Question carries **ONE (1)** mark.
2. There is no Negative Marking for Wrong Answer.
3. A separate OMR Answer Sheet has been provided to answer questions. Your answers will be evaluated based on your response in the OMR Sheet only. No credit will be given for any answering made in question booklet.
4. Defective question booklet or OMR if noticed may immediately replace by the concerned invigilator.
5. Write roll number, subject code, booklet type, category and other information correctly in the OMR Sheet else your OMR Sheet will not be evaluated by machine.
6. Select most appropriate answer to the question and darken appropriate oval on the OMR answer sheet, with black / blue ball pen only. DO NOT USE PENCIL for darkening. In case of over writing on any answer, the same will be treated as invalid. Each question has exactly one correct answer and has four alternative responses (A), (B), (C) and (D). You have to darken the circle as indicated below on the correct response against each item.
   Example: Ⓐ ● Ⓒ Ⓓ where (B) is correct response.
7. Rough Work is to be done in the end of this booklet.
8. If you write your Name, Roll Number, Phone Number or put any mark on any part of the OMR Answer Sheet, except for the space allotted for the relevant entries, which may disclose your identity, or use abusive language or employ any other unfair means, such as change of response by scratching or using white fluid, you will render yourself liable to disqualification.
9. Calculators, Log tables any other calculating devices, mobiles, slide rule, text manuals etc are NOT allowed in the examination hall. If any of above is seized from the candidates during examination time; he/ she will be immediately debarred from the examination and corresponding disciplinary action will be initiated by the Center Supervisor as deemed fit.
10. DO NOT FOLD or TEAR OMR Answer sheet as machine will not be able to recognize torn or folded OMR Answer sheet.
11. **You have to return the OMR Answer Sheet to the invigilator at the end of the examination compulsorily** and must not carry it with you outside the Examination Hall. You are however, allowed to carry original question booklet on conclusion of examination.

Paper - II
Mechanical Engineering

Note: This paper contains **FIFTY (50)** multiple-choice questions. Each Question carries **ONE (1)** mark.

01) A sampling method in which the researcher selects the sample based on subjective judgment rather than the random selection is
A) Probability sampling
B) Non-probability sampling
C) Both A and B
D) None of these

02) Predicting the number of welding defects per 100 meters of circular pipe by
A) Gamma Distribution
B) Poisson Distribution
C) Gaussian Distribution
D) Exponential Distribution

03) To find the probability of a certain number of defective or non-defective items in a batch by
A) Gamma Distribution
B) Poisson Distribution
C) binomial Distribution
D) Exponential Distribution

04) which of the following method is a direct method for solving linear algebraic equations?
A) Bisection method
B) Newton-Raphson method
C) Gauss Elimination method
D) Jacobi Iteration

05) Which of the following is not the applications of linear equations
A) predicting radiation heat transfer in a cylindrical object
B) converting between temperature scales
C) calculating interest rates or inflation
D) calculating wage based on number of hours an operator worked

06) Bernoulli's equation is applicable to
A) compressible and viscous flow
B) Incompressible and non-viscous flow
C) supersonic flow
D) Multiphase flow

07) which of the following equations governs viscous incompressible flow?
A) Eulers's equation
B) Navier-Stokes Equation
C) Bernoulli's Equation
D) Pascal's Law

08) Laminar flow through a circular pipe of an incompressible viscous fluid follows which law?
A) Pascal's Law
B) Newton's Law
C) Bernoullis's Law
D) Hagen-Poiseuille Law

09) In Laminar pipe flow of a Newtonian fluid, Shear stress is
A) Maximum at center and zero at wall
B) Constant across pipe radius
C) Zero at centre and maximum at wall
D) Zero everywhere.

10) The region outside the boundary layer is considered
A) Inviscid
B) Viscous
C) Vacuum
D) Stationary

11) Separation of boundary layer occurs when
A) Pressure decreases
B) Velocity increases
C) Density becomes zero
D) Adverse pressure gradient exists

12) In boundary layer theory, the shear stress at the wall is known as
A) Boundary force
B) Kinetic stress
C) Skin friction
D) Wall stress

13) Pick the metal having the least thermal resistance to the flow
A) Copper
B) Silver
C) Steel
D) Aluminum

14) A steam pipe is to be coated with two layers of insulating materials of different thermal conductivities, for applying effective insulation steam pipe, in order to do so;
A) the better insulating material must wrap the pipe first and should be at inside.
B) the better insulating material must wrap the pipe second and should be at outside.
C) the condition of steam, its temperature and surrounding temperature should be considered to decide what is the best sequence.
D) there may be any sequence one can follow only care should take is both the insulation radiuses must have insulation radios higher than its corresponding critical radiuses.

15) In case of designing a fin over a high temperature base surface it is important to note that
   A) longer the fin the fin is more efficient.
   B) shorter the fin it is more effective.
   C) fin is more efficient if it is thicker and tip is insulated.
   D) fin is more efficient if it is large in numbers with thin cross sections.

16) Pick the correct option. Emissivity of a surface, participating in thermal radiation, can be reduced by;
   A) making surface rough
   B) making surface to corrode
   C) making surface black in color
   D) making surface reflect high radiation

17) A radiation shilled can be explained as an additional resistance in the radiation heat transfer circuit;
   A) having material with negligible internal energy
   B) having material with high transmissivity
   C) having material with high absorptivity
   D) having material with high conductivity

18) Which force will play its role in natural as well as forced convection both:
   A) buoyancy force
   B) gravitational force
   C) diffusive force
   D) viscous force

19) Drop wise condensation usually occurs in
   A) glazed surface
   B) metal coated surface
   C) oily surface
   D) inclined surface

20) Question: The modulus of the complex number $3 + 4i$ is
   A) 3
   B) 4
   C) 5
   D) 7

21) A balloon filled with gas, when receives heat, its volume increases in proportion to the temperature rise. This is as per which law?
   A) Charles' law
   B) Boyle's law
   C) Gay-Lusac's law
   D) Avogadro's law

22) Which statement is ***not correct*** for compressibility factor Z?
   A) Its minimum value is 0
   B) Its maximum value is 1
   C) Its value is close to 1 at very low pressures
   D) Non-unity value means deviation from ideal gas behaviour

23) The mist appearing over the surface of ice is due to
   A) Air getting condensed near its surface
   B) Water vapour getting condensed near its surface
   C) Sublimation of ice into water vapour
   D) Combination of the above three phenomenon

24) Efficiency in Rankine cycle can be increased by following ways (choose the ***incorrect statement***)
   A) Condenser pressure is increased
   B) Boiler pressure is increased
   C) Steam is superheated
   D) Condensation temperature is decreased

25) Which is the cycle followed in a gas turbine power plant?
   A) Ericsson cycle
   B) Carnot cycle
   C) Otto cycle
   D) Brayton cycle

26) Which of the following statements about a four-stoke I.C. engine is ***not correct***?
   A) The compression stroke is a polytropic process
   B) Combustion process is a polytropic process
   C) Exhaust process occurs at constant pressure
   D) Intake of air occurs at constant pressure

27) Two tapering bars of the material are subjected to tensile load P. The length of the both the bars are the same. The larger diameter of each of the bars is D. The diameter of the bar A at its smaller end is D/2 and that of the bar B is D/3. What is the ratio of the elongation of the bar A to that of the bar B?
   A) 3: 2
   B) 2:3
   C) 1:3
   D) 3:1

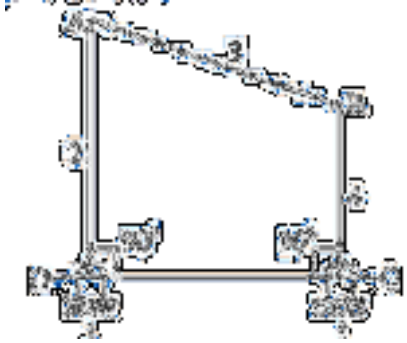
28) The poisson's ratio of an elastic material is 0.3, then the ratio of its young's modulus and bulk modulus is -------.
A) 1.3
B) 1.4
C) 1.5
D) None of the above

29) A block is dimensions of upper surface 100 mm x 100 mm. The height of the block is 10 mm. A tangential force of 10 KN is applied at the centre of the upper surface. The block is displaced by 1 mm with respect to lower face. Direct shear stress in the element is :
A) 10 Mpa
B) 1 Mpa
C) 0.1Mpa
D) 100 Mpa

30) The steel bar AB varies linearly in diameter from 25 mm to 50 mm in a length 500 mm. It is held between two unyielding support at room temperature. What is the stress induced in the bar, If temperature rises by 25 ^{0}C ? Take E= 2 x 10^5 N/mm^2 and α= 1.667 x 10^{-6}/ ^{0}C.
A) No stress developed
B) 110 N/mm^2
C) 120 N/mm^2
D) 130 N/mm^2

31) The number of independent elastic constants in Triclinic material is
A) 2
B) 9
C) 21
D) None of the above

32) Consider the following statements with reference to the four bar mechanism as shown the figure below :



At the instant considered,
1. $\omega_2 = \omega_1$.
2. Link 3 undergoes pure translation
3. Velocity diagram is straight line
4. $V_{A/B} = (\omega_4 = \omega_2)$ X AB

Which of the above statements are correct?

A) 1, 2, 3 only
B) 2 and 3 only
C) 2 and 4 only
D) 1, 2, 3 and 4

33) A gear set consists of a 20-tooth pinion driving a 40-tooth gear having the diametral pitch 2. Compute the center distance between the gears in mm.
A) 10 mm
B) 15 mm
C) 20 mm
D) None of the above

34) The type of gear used for speed reduction of 50:1 will be :
A) Spur
B) Herringbone
C) Bevel
D) worm wheel

35) In an open belt drive, the tight and slack sides of the belt loads are 2000 N and 1000 N respectively. The belt speed is 120 m/min. The power in Watts transmitted by the system is.
A) 1000
B) 2000
C) 3000
D) 4000

36) If an element has undergone failure below its yield point on application of constant load at constant elevated temperature, then which of the following has it undergone?
A) Creep
B) Fatigue
C) Tensile Fatigue
D) Crushing failure

37) Line imperfection in a crystal is called :
A) Edge dislocation
B) Frenkel defect
C) Miller defect
D) Schottky defect

38) During Brinell Hardness Test on a specimen, the Brinell Hardness number can be calculated by using the formula where, P = applied load, D = ball diameter, d = diameter of the impression

A) BHN = $\frac{2P}{\pi D(D-\sqrt{D^2+d^2})}$

B) BHN = $\frac{2P}{\pi D(D-\sqrt{D^2-d^2})}$

C) BHN = $\frac{P}{\pi D(D-\sqrt{D^2-d^2})}$

D) BHN = $\frac{2P}{\pi D(D+\sqrt{D^2-d^2})}$

39) Which one of the following sequence of increasing order of cutting speed of material is correct?

A) HSS < Carbon Steel < Cemented carbide < Ceramics

B) Carbon Steel < HSS < Cemented carbide < Ceramics

C) Carbon Steel < HSS < Ceramics < Cemented carbide

D) HSS < Carbon Steel < Ceramics < Cemented carbide

40) Find the heat dissipated by resistance welding of a 1mm thick workpiece if heat required to melt the weld nugget is 380 J for a current of ohm and contactμ5000 A and resistance 200 period of 0.1 S

A) 400 J

B) 120 J

C) 198 J

D) 500 J

41) If a shaper has a stroke length of 240 mm and number of double strokes per minute is 40 and ratio of return to cutting time is 2 : 3, then its cutting speed is-

A) 16 m/min

B) 6.4 m/min

C) 32 m/min

D) 3.2 m/min

42) A straight teeth slab milling cutter of 100 mm diameter and 10 teeth rotating at 200 r.p.m. is used to remove a layer of 3 mm thickness from a steel bar. If the table feed is 400 mm/minute, the feed per tooth in this operation will be:

A) 0.2 mm

B) 0.4 mm

C) 0.5 mm

D) 1 mm

43) The land of a twist drill is

A) the edge formed by the inter section of flute surface and the body clearness

B) the edge formed by the inter section of the flank and face

C) the central portion of the drill situated between the roots of the flutes and extending from the point towards the shank

D) the cylindrical ground surface on the leading cases of the drill flutes

44) What will be the percentage reduction in the cross-sectional area of the billet after the extrusion considering extrusion ratio as 20?

A) 90%

B) 95%

C) 99%

D) 98%

45) A hole of 20 mm diameter is punched in a plate of 10 mm thick. The shear stress induced in the plate is 0.4 kN/mm2 . Then, the force exerted by the punch is

A) 80 π

B) 100π

C) 120π

D) 150π

46) In ultrasonic machining, glass is being machined at a metal rate of 6 mm^3 /minute by Al_2O_3 abrasive grits of dia 0.15 mm. If 0.1 mm grits were used, what would be the metal removal rate (mm^3/min) ?

A) 4

B) 6

C) 8

D) 1

47) In correct sequences of the given processes in manufacturing by powder metallurgy is :

A) Blending, compacting, sizing and sintering

B) Compacting, sizing, blending and sintering

C) Compacting, blending, sizing and sintering

D) Blending, compacting, sintering and sizing

48) Consider the following hole and shaft sizes of mating parts according to hole basis system. What is the value of allowance?

Hole	Shaft
37.50mm	37.47mm
37.52mm	37.45mm

A) 0.03 mm
B) 0.07 mm
C) 0.02 mm
D) 0.05 mm

49) In a hole basis system, what is correct?
A) shaft upper deviation is zero
B) hole upper deviation is zero
C) shaft lower deviation in zero
D) hole lower deviation is zero

50) Use of plug gauge is
A) to measure screw threads
B) to measure angles
C) to measure cylindrical bores
D) to measure spherical holes

****

Rough Work: