# MAHARAJA RANJIT SINGH PUNJAB TECHNICAL UNIVERSITY, BATHINDA

## Ph.D. Entrance Examination of Mechanical Engineering

**Q. 1:** The lowest eigen of 2×2 matrix $\begin{bmatrix} 4 & 2 \\ 1 & 3 \end{bmatrix}$ is

(a) 1 (b) 2 (c) 3 (d) 4

**Q. 2:** The following simultaneous equations

$x + y + z = 3$

$x + 2y + 3z = 4$

$x + 4y + kz = 6$

will not have unique solution for $k$ equal to

(a) 7 (b) 6 (c) 0 (d) 5

**Q. 3:** Find the minimum value of the expression

(a) -3 (b) 2 (c) 3/2 (d) 3

**Q. 4:** The value of

$\oint dl$ along a circle of radius 2 units is

(a) Zero (b) $2\pi$ (c) $4\pi$ (d) $8\pi$

**Q. 5:** The solution of the differential equation $dy = (1+y^2)\,dx$ is

(a) $y = \tan x + c$ (b) $y = \tan (x + c)$ (c) $x = \tan^{-1} (y + c)$ (d) $2x = \tan^{-1} (y + c)$

**Q. 6:** In a 3D axisymmetric solid, because of symmetry about the longitudinal z-axis, the stresses do not vary along the coordinate

(a) x (b) y (c) z (d) θ

**Q. 7:** The argument of the complex number

$\sqrt{-1}$ is

(a) 0 (b) π (c) π/2 (d) $-\pi$

**Q. 8:** The median, mode and mean of 9, 5, 8, 9, 9, 7, 8, 9, 8 are respectively

(a) 9, 9, 9 (b) 9, 8, 9 (c) 8, 9, 8 (d) 8, 9, 9

**Q. 9:** Consider a Poisson distribution for the tossing of a biased coin, the mean of distribution is μ. The deviation of this distribution is given by

(a) $\mu^{1/2}$ (b) $\mu^2$ (c) μ (d) $1/\mu$

**Q. 10:** For the data $x = 0, 1, 2$ and respectively $f(x) = 8, 5, 6$. By Trapezoidal rule, the value of $\int_0^2 [f(x)]^2 dx$ will be

(a) 92 (b) 75 (c) 123 (d) 42

**Q. 11:** The moment of inertia of a rectangular section 3 cm wide and 4 cm deep about X-X axis is

(a) 9 $cm^4$ (b) 12 $cm^4$ (c) 16 $cm^4$ (d) 20 $cm^4$

**Q. 12:** A 1 kg ball drops vertically onto the floor with a speed of 25 m/s. It rebounds with an initial speed of 10 m/s. The impulse action on the ball during contact will be

(a) 15 N-s (b) 25 N-s (c) 35 N-s (d) 45 N-s

**Q. 13:** During tensile test on a specimen of 1 $cm^2$ cross section, maximum load observed was 8 tonnes and area of cross section at the neck was 0.5 $cm^2$. Ultimate tensile strength of the specimen is

(a) 4 tonnes/$cm^2$ (b) 8 tonnes/$cm^2$ (c) 16 tonnes/$cm^2$ (d) 22 tonnes/$cm^2$

**Q. 14:** In case of beam is simply supported at both ends, if the same load instead of being concentrated at the center is distributed uniformly throughout the length, then deflection at center will be reduced by

(a) 1/2 times (b) 1/4 times (c) 5/8 times (d) 3/8 times

**Q. 15:** A power transmission solid shaft of diameter d, length l and rigidity modulus G is subjected to a pure torque. The maximum allowable shear stress is $\tau_{max}$. The maximum strain energy per unit volume in the shaft is given by

(a) $\tau^2_{max}/4G$ (b) $\tau^2_{max}/2G$ (c) $2\tau^2_{max}/3G$ (d) $3\tau^2_{max}/2G$

**Q. 16:** Klein's construction is mainly used for

(a) determine linear velocity of piston (b) determine linear acceleration of piston
(c) determine linear displacement of piston (d) None of the above

**Q. 17:** The number of degrees of freedom of an epicyclic gear train is

(a) Zero (b) One (c) Two (d) Three

**Q. 18:** The vibration isolation for a forced vibration system is possible when

(a) $\omega/\omega_n > 2^{0.5}$ (b) $\omega/\omega_n = 1$ (c) $\omega/\omega_n < 2^{0.5}$ (d) $\omega/\omega_n < 1$

**Q. 19:** If two nodes are observed at a frequency of 1800 rpm during whirling of a simply supported long slender rotating shaft, the first critical speed of the shaft in rpm is

(a) 100 (b) 200 (c) 600 (d) 900

**Q. 20:** The shear strength, tensile strength and compressive strength of a rivet joint are 100 N, 120 N and 150 N respectively. If the strength of un-riveted plate is 200 N, the efficiency of riveted joint is

(a) 60% (b) 75% (c) 80% (d) 50%

**Q. 21:** What decreases fatigue strength?

(a) Shot peening (b) Case hardening (c) Inclusions (d) Grain refinement

**Q. 22:** In a manometer using mercury as manometric fluid and measuring the pressure of water in a conduit, the manometric rise is 0.2 m. The specific gravity of mercury is 13.55. The water pressure in m of water is\

(a) 14.55×0.2 (b) 13.55×0.2 (c) 12.55×0.2 (d) none of the given

**Q. 23:** In laminar pipe flow for a given flow rate Q, the power required to overcome friction will be proportional to

(a) Q (b) $Q^2$ (c) $Q^{1/2}$ (d) $Q^{3/2}$

**Q. 24:** Two walls of same thickness and cross sectional area have thermal conductivities in the ratio 1 : 2. If same temperature difference is maintained across the two faces of both the walls, what is the ratio of heat flow $Q_1/Q_2$?

(a) 1/2 (b) 1 (c) 2 (d) 4

**Q. 25:** Which one of the following numbers represents the ratio of kinematic viscosity to the thermal diffusivity?

(a) Grashoff number (b) Prandtl number (c) Mach number (d) Nusselt number

**Q. 26:** For a thermodynamic system, pick up the correct statement regarding path functions and point functions

(a) The point functions are inexact differentials

(b) The point functions and point functions are inexact differentials

(c) The path functions are inexact differentials

(d) The path functions are exact differentials

**Q. 27:** For the same maximum pressure and temperature, what is the relation among the efficiencies (η) of the Otto cycle, the Diesel cycle and the Dual cycle?

(a) $\eta_{Dual} > \eta_{Diesel} > \eta_{Otto}$ (b) $\eta_{Diesel} > \eta_{Dual} > \eta_{Otto}$
(c) $\eta_{Diesel} > \eta_{Otto} > \eta_{Dual}$ (d) $\eta_{Otto} > \eta_{Diesel} > \eta_{Dual}$

**Q. 28:** When the pressure at which heat is added in Rankine cycle increases, the moisture content at the turbine exhaust

(a) increases (b) decreases (c) remains same (d) cannot say

**Q. 29:** If air at dry bulb temperature of 35°C and dew point of 20°C passes through an air washer in which water is sprayed at 25°C, then the process would be

(a) sensible cooling (b) cooling and dehumidification

(c) cooling and humidification (d) heating and humidification

**Q. 30:** Efficiency of the Carnot engine is given as 80%. If the cycle direction is reversed, what will be the value of coefficient of performance of reversed Carnot cycle refrigerator?

(a) 1.25 (b) 0.8 (c) 0.5 (d) 0.25

**Q. 31:** The specific speed is lowest in the case of which turbine

(a) Pelton wheel (b) Francis turbine (c) Kaplan turbine (d) None of the above

**Q. 32:** The crystal structure of Austenite is

(a) body centered cubic (b) face centered cubic

(c) hexagonal closed paced (d) body centered tetragonal

**Q. 33:** Chaplets are made of

(a) graphite (b) plastic

(c) same metal as the cast metal (d) none of the above

**Q. 34:** Cold working of metal forming processes is carried out

(a) below the recrystallising temperature (b) At melting point

(c) above the recrystallising temperature (d) above melting point

**Q. 35:** Soft solder consists of

(a) copper and tin (b) lead and zinc

(c) lead and tin (d) lead and aluminium

**Q. 36:** Tool life criterion is normally used is

(a) flank wear (b) crater wear

(c) crater and flank wear (d) flank wear and nose radius

**Q. 37:** Which type of tolerance does a slip gauge have

(a) unilateral tolerance (b) bilateral tolerance

(c) three dimensional tolerance (d) none of the above

**Q. 38:** When setting up a mechanical drawing in Auto CAD the drafter should set the units to

(a) metric (b) decimal

(c) fractional (d) architectural

**Q. 39:** ABC inventory control focuses on those

(a) items which are not readily available (b) items which consume less money

(c) items which have more demand (d) items which consume more money

**Q. 40:** A PERT network has 9 activities on its critical path. The standard deviation of each activity on the critical path is 3. The standard deviation of critical path is

(a) 3 (b) 9 (c) 81 (d) 27

# Answer Key of MCQ Question Paper for Ph.D. Entrance Examination of Mechanical Engineering

**Q. 1:** (b) 2

**Q. 2:** (a) 7

**Q. 3:** (d) 3

**Q. 4:** (a) Zero

**Q. 5:** (b) $y = \tan(x + c)$

**Q. 6:** (d) $\theta$

**Q. 7:** (c) $\pi/2$

**Q. 8:** (c) 8, 9, 8

**Q. 9:** (a) $\mu^{1/2}$

**Q. 10:** (b) 75

**Q. 11:** (c) 16 $cm^4$

**Q. 12:** (c) 35 N-s

**Q. 13:** (b) 8 tonnes/$cm^2$

**Q. 14:** (d) 3/8 times

**Q. 15:** (a) $\tau^2_{max}/4G$

**Q. 16:** (b) determine linear acceleration of piston

**Q. 17:** (c) Two

**Q. 18:** (a) $\omega/\omega_n > 2^{0.5}$

**Q. 19:** (b) 200

**Q. 20:** (d) 50%

**Q. 21:** (c) Inclusions

**Q. 22:** (c) $12.55 \times 0.2$

**Q. 23:** (b) $Q^2$