Ph. D. Entrance Test – 2015
Subject: Mechanical Engineering
Paper – I

Important: *Please consult your Admit Card/Roll No. slip before filling your Roll Number on the Test Booklet and Answer Sheet.*

Roll No.   *In Figure*   *In Words*

O.M.R. Answer Sheet Serial No.

Signature of Candidate: _____   *Signature of Invigilator:* _____

Time: 60 Minutes   Number of Questions: 50   Maximum Marks: 50
DO NOT OPEN THE SEAL ON THE BOOKLET UNTIL ASKED TO DO SO.

INSTRUCTIONS:

1. Write your Roll No. on the Questions Booklet and also on the OMR Answer Sheet in the space provided and nowhere else.
2. Enter the Question Booklet Serial No. on the OMR Answer Sheet. Darken the corresponding bubbles with **Black Ball Point/Black Gel Pen**.
3. Do not make any identification mark on the Answer Sheet or Question Booklet.
4. Please check that this Question Booklet contains **50** Questions. In case of any discrepancy, inform the Assistant Superintendent within 10 minutes of the start of Test.
5. Each question has four alternative answer (A,B,C,D) of which only one is correct. For each question, darken only one bubble (A or B or C or D), whichever you think is the correct answer, on the Answer Sheet with **Black Ball Point/Black Gel Pen. There shall be no negative marking for wrong answers.**
6. If you do not want to answer a question, leave all the bubbles corresponding to that question blank in the Answer Booklet. No marks will be deducted in such cases.
7. Darken the bubbles in the OMR Answer Sheet according to the Serial No. of the question given in the Question Booklet.
8. If you want to change an already marked answer, erase the shade in the darkened bubble completely.
9. For rough work only the blank sheet at the end of the Question Booklet be used.
10. The Answer Sheet is designed for computer evaluation. Therefore, if you do not follow the instructions given on the Answer Sheet, it may make evaluation by the computer difficult. **Any resultant loss to the candidate on the above account, i.e. not following the instructions completely, shall be of the candidate only.**
11. After the test, hand over the Question Booklet and the Answer Sheet to the Assistant Superintendent on duty.
12. In no case the Answer Sheet, the Question Booklet, or its part or any material copied/noted from this Booklet is to be taken out of the examination hall. Any candidate found doing so would be expelled from the examination.
13. A candidate who creates disturbance of any kind or changes his/her seat or is found in possession of any paper possibly of any assistant or found giving or receiving assistant or found using any other unfair means during the examination will be expelled from the examination by the Centre Superintendent/Observer whose decision shall be final.
14. **Communication equipment such as mobile phones, pager, wireless set, scanner, camera or any electronic/digital gadget etc., is not permitted inside the examination hall. Use of calculators is not allowed.**
15. The candidates will not be allowed to leave the Examination Hall/Room before the expiry of the allotted time.

1. The value of $\int_0^{5\pi}(2-\sin x)dx$ is

   A) > 0 B) 2   C) 0   D) Undefined

2. Differential equation, $\dfrac{d^2x}{dt^2}+10\dfrac{dx}{dt}+25x=0$ will have a solution of the form

   A) $C_1 e^{-2t}$

   B) $(C_1+C_2 t)\,e^{-5t}$

   C) $C_1 e^{-5t}+C_2 e^{5t}$

   D) $C_1 e^{-5t}+C_2 e^{2t}$

   where C_1 and C_2 are constants.

3. Distance of the centroid of a semi-circle of radius r from its base is

   A) $4r/3\pi$ B) $3r/4\pi$ C) $4\pi/3r$ D) $3\pi/4r$

4. For the two shafts connected in parallel, find which statement is true?

   A) Torque in each shaft is the same

   B) Shear stress in each shaft is the same

   C) Angle of twist in each shaft is the same

   D) Torsional stiffness of each shaft is the same

5. Mohr's stress circle for simple torsion test will be
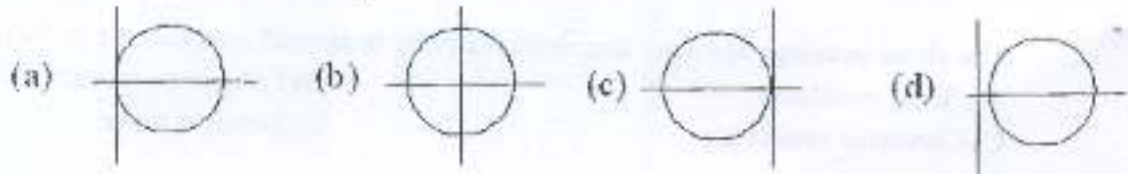
6. A steel rod 2.0 m long is heated through a temperature of $100°$ C. The coefficient of linear expansion is 6.5×10^{-6} /$°$ C and E = 200 GPa. The stress induced in the bar will be

   A) 110 MPa   B) 120 MPa   C) 130 MPa   D) 140 MPa

7. Consider the following statements:

   Coriolis component of acceleration depends on

   1. Velocity of slider
   2. Angular velocity of the link
   3. Acceleration of slider
   4. Angular acceleration of the link

   Of these statement

   A) 1 and 2 are correct

   B) 1 and 3 are correct

   C) 2 and 4 are correct

   D) 1 and 4 are correct

8. A fixed gear having 100 teeth meshes with another gear having 25 teeth. The center line of both the gear being joined by an arm so as to form an epicyclic gear train. The number of rotations made by the smaller gear for one rotation of the arm is

   A) 3   B) 4   C) 5   D) 6

9. The equation $m\dfrac{d^2x}{dt^2} + C\dfrac{dx}{dt} + Kx = 0$ represents

   A) Free vibration   B) Forced vibration
   C) Free and forced vibration   D) Free and damping vibration

10. When $\omega/\omega_n > \sqrt{2}$, then transmissibility will be

    A) >1   B) <1   C) =1   D) None of these

11. In a single degree of freedom vibration system, the undamped natural frequency is _____ the damped natural frequency.

    A) Less   B) Equal   C) Greater   D) Uncertain

12. The fatigue life of a part can be improved by

    A) Electroplating   B) Polishing   C) Coating   D) Shot peening

13. Buttress thread is used where power is to be transmitted in

    A) One direction only   B) Two directions
    C) Any one of the above   D) None of these

14. The sliver bearings are used almost exclusively in aircraft engines due to their excellent

    A) Wear resistance   B) Fatigue resistance
    C) Corrosive resistance   D) None of these

15. The efficiency of self-locking screw is

    A) > 50 %   B) = 50 %   C) < 50 %   D) None of these

16. Match List-I with the List-II and select the correct answer from the codes given below the lists:

List-I	List-II
a) Strain rosette	1. Critical speed
b) Section modulus	2. Mohr's circle
c) Whal's stress factor	3. Coil springs
d) Fatigue	4. Flexural rigidity
	5. Endurance limit

    Codes:

	a	b	c	d
A)	1	2	3	5
B)	1	2	4	3
C)	2	4	3	5
D)	5	4	3	2

17. Power is transmitted through a considerable distance by means of water under pressure, the maximum power is transmitted when the frictional loss of head is
A) 1/3 of the total head supplied
B) 1/2 of the total head supplied
C) 1/10 of the total head supplied
D) 1/4 of the total head supplied

18. In steady state flow of a fluid, the acceleration of any fluid particle is
A) Zero
B) Constant
C) Variable
D) Never zero

19. For an irrotational flow, the equation $\frac{d^2\phi}{dx^2} + \frac{d^2\phi}{dx^2} = 0$ is known as
A) Bernoulli's equations
B) Cauchy Riemann's equation
C) Laplace equation
D) Euler's equation

20. Centre of pressure of an inclined plane is
A) At the centroid
B) Above the centroid
C) Below the centroid
D) At the meta centre

21. A 10 kg solid at 100° C with a specific heat of 0.8 kJ/kg-°C is immersed in 40 kg of 20° C liquid with a specific heat of 4.0 kJ/kg-°C. The temperature after a long time, if the container is insulated will be
A) 30° C
B) 28° C
C) 26° C
D) 24° C

22. The ratio of surface convection resistance to internal conduction resistance is known as
A) Grashoff number
B) Biot number
C) Stanton number
D) Prandtl number

23. In M, L, T and θ system, the dimension of energy conversion factor is
A) T^{-1}
B) θ^{-1}
C) MLTθ
D) None of these

24. Automobile radiator is a heat exchanger of
A) Counter flow type
B) Parallel flow type
C) Regenerator type
D) Cross flow type

25. Internal energy of a perfect gas depends upon
A) Temperature and pressure
B) Temperature
C) Temperature, pressure and specific heats
D) None of these

26. Kelvin-Plank's law deals with
A) onversion of work into heat
B) Conversion of heat into work
C) Conversion of work
D) Conversion of heat

27. A reversible process
   A) Must pass through a continuous series of equilibrium states
   B) Leaves no history of the events in surrounding
   C) Must pass through the same state on reversed path as on the forward path
   D) All the above

28. A heat engine is supplied with 250 kJ/s of heat at a constant fixed temperature of 227° C. The heat is rejected at 27° C. The cycle is reversible, if the amount of heat rejected is
   A) 273 kJ/s   B) 200 kJ/s   C) 180 kJ/s   D) 150 kJ/s

29. Humidity ratio is also known as
   A) Relative humidity   B) Absolute humidity
   C) Specific humidity   D) Percentage humidity

30. The specific speed of a hydraulic turbine is given by

$$\frac{N\sqrt{P}}{H^{\frac{5}{4}}} \qquad \frac{P\sqrt{N}}{H^{\frac{5}{4}}} \qquad \frac{NP}{H^{\frac{5}{4}}} \qquad \frac{\sqrt{NP}}{H^{\frac{5}{4}}}$$

31. A Francis turbine under a head of 25 m produces 2000 kW at 250 rpm. The power produced under a head of 1 meter will be
   A) 2 kW   B) 10 kW   C) 16 kW   D) 25 kW

32. Raw material for all iron and steel product is
   A) Cast iron   B) Wrought iron   C) Pig iron   D) Steel

33. 18-4-1 High Speed Steel contains maximum percentage of _____.
   A) Vanadium   B) Chromium   C) Tungsten   D) Iron

34. Which of the following is used for imitation jewelry?
   A) Duralumin   B) Aluminum and bronze
   C) Gun metal   D) Silicon bronze

35. The area enclosed by a hysteresis loop is a measure of
   A) Retentivity   B) Susceptibility
   C) Permeability   D) Energy loss per cycle

36. The addition of coal dust to the green moulding sand is to improve
   A) Permeability   B) Surface finish
   C) Mouldability   D) Green strength

37. In order to facilitate withdrawal of pattern
   A) Pattern is made smooth
   B) Water is applied on the pattern surface
   C) Allowances are made on pattern
   D) Draft is provided on pattern

38. Blanking and piercing operations can be performed simultaneously in
   A) Simple   B) Progressive die
   C) Compound die   D) Combination die

39. The welding process in which two pieces to be joined are overlapped and placed between two electrodes, is called
   A) Spot welding   B) Projection welding
   C) Seam welding   D) Butt welding

40. In Thermit welding, aluminum and iron oxide are mixed in the proportion of
   A) 1:1   B) 1:3   C) 3:1   D) 1:2

41. Gray cast iron is generally welded by
   A) Gas welding   B) Arc welding
   C) TIG welding   D) MIG welding

42. When material is ductile and cutting speed is low, then chips formed are
   A) Continuous   B) Discontinuous
   C) Continuous with built up edge   D) None of these

43. For copper, the rake angle provided is
   A) Positive   B) Zero   C) Negative   D) None of these

44. Tool life is mostly affected by
   A) Cutting speed   B) Tool geometry
   C) Feed and depth   D) Micro-structure of material being cut

45. A device, which holds, locate work-piece, guide and control one or more cutting tools is called
   A) Jig   B) Fixture   C) Template   D) Lathe

46. On a triple start screw thread
   A) Lead = pitch   B) Lead = $3 \times$ pitch
   C) Lead = $1/3 \times$ pitch   D) Lead = $9 \times$ pitch

47. A shaft (diameter $20^{+0.05/-0.15}$ mm) and a hole (diameter $20^{+0.20/-0.10}$ mm) when assembled will give
   A) Transition fit
   B) Clearance fit
   C) Interference fit
   D) None of these

48. The demand for the last year's four months is 3, 4, 6 and 5 Tones of ingots. What is the general equation of demand?
   A) $2.5 + 0.8t$ B) $2.0 + 0.8t$ C) $2.5 + 0.4t$ D) $3.0 + 0.8t$

49. Mean rate of consumption during lead time (R) multiplied by mean lead time (L) is equal to
   A) Buffer stock   B) Reserve stock   C) Safety stock   D) None of these

50. The difference between time available to do the job and the time required to do the job is called
   A) Event   B) Duration   C) Float   D) Constrained

x-x-x