

## Biotechnology Engineering(Ph.D.)

- The release of  $\text{Ca}^{2+}$  from endoplasmic reticulum to cytoplasm in response to stimulus is mediated by
  - cAMP
  - IP3
  - DAG
  - calmodulin
- Which one of the following 0.1M solution has the lowest pH
  - $\text{NaNO}_2$
  - $\text{NH}_4\text{Cl}$
  - $\text{NaCl}$
  - $\text{NH}_3$
- Shine-Delgarno sequence is a part of
  - Eukaryotic mRNA
  - Prokaryotic mRNA
  - Catenated tRNA
  - Eukaryotic rRNA
- Cori cycle integrates body metabolism to
  - Resynthesize glucose from lactate in the liver
  - Oxidize acetyl CoA in the muscle
  - Generate urea in the kidney
  - Generate glucose from acetyl CoA in the liver
- Blood group antigens are
  - Species specific
  - Isospecific
  - Autospecific
  - Organ specific
- if 1 mL of a solution of 0.01 M HCl is diluted to 100 mL at 25°C, the pH of the resulting solution will be
  - 2
  - 6
  - 4
  - 3
- Chromosome constitution in case of Turner's syndrome is
  - XXY
  - XYY
  - XO
  - XXX
- A person with increased interferon levels in his serum is likely to be suffering from
  - Tetanus
  - Malaria
  - Typhoid
  - Measles
- For glycolipoproteins, most commonly used probe
  - Interferons
  - Lectins
  - Antigens
  - Antibody
- Bt toxin, produced by *Bacillus thuringiensis*, does NOT kill the bacteria itself because the toxin is
  - Isolated in a special intracellular sac
  - In an inactive form inside the bacterial cell
  - Active only against eukaryotic ribosomes
  - Produced in very small quantities
- An enzyme shows highest activity in the pH range 2.0 - 3.0. At pH 4.0 and pH 7.0, the enzyme exhibits 50% and 1%, respectively, of its highest activity. Which of the following states of an amino acid residue in the catalytic site is most responsible for its activity profile?
  - A protonated Asp
  - A deprotonated Asp
  - A deprotonated Asn
  - A protonated Asn

12. The agglutinin test is used for
- A) Identification of isolated bacteria      B) Typing of bacterial species  
C) Study of antigenic structure of bacteria      D) All of these
13. Cephalin, a biological surfactant, is
- A) Cholinephosphoglyceride  
B) Ethanolamine phosphoglyceride  
C) Glycosphingolipid  
D) Sphingolipid
14.  $N$  and  $N_0$  represent the number of viable cells at time 't' during sterilization and at the start of sterilization ( $t=0$ ), respectively. Assuming that cell death follows first order kinetics and that  $k$  is the death rate constant, which of the following relationship(s) is/are correct?
- A)  $N = N_0 e^{kt}$       B)  $-\ln(N/N_0) = k t$   
C)  $N = N_0 k t^2$       D)  $N - N_0 = k t$
15. In an experiment conducted in the dark, isolated chloroplasts are kept in buffer (pH 4.0) at  $4^\circ\text{C}$  until their internal pH is equal to 4.0. Then, they are transferred to a buffer of pH 8.0, and ADP and  $\text{P}_i$  are added at the same time. Which of the following will happen?
- A) Chloroplasts will be destroyed  
B) Chlorophyll in the chloroplast will release bound Magnesium  
C) Chloroplasts will be intact but no ATP will be produced  
D) Chloroplasts will be intact and ATP will be produced
16. Two mammalian cell lines with doubling times of 12 h and 36 h were cultured with radioactive thymidine for 8 h. The cells were further cultured without the radioactive thymidine for 72 h. Incorporated radioactivity was measured in equal number of cells in each culture, which revealed that
- A) Both the cell lines had the same amount of radioactivity  
B) The fast growing cells had more radioactivity  
C) The slow growing cells had more radioactivity  
D) Neither of the cells had any radioactivity
17. The osmotic pressure of a solution containing 1.71 gm of sucrose (mol. wt. 342) dissolved to make a litre of solution at  $27^\circ\text{C}$  ( $R = 0.082 \text{ LatmK}^{-1}\text{mol}^{-1}$ ) is?
- A) 0.246      B) 0.0273      C) 0.164      D) 0.123
18. Given are the sequences of one strand of double-stranded DNA. The one with the highest melting point ( $T_m$ ) is
- A) GAGATCTCGAGATCTC      B) GAGATATCGATATCTC  
C) GAGATCTTGATATCTC      D) GAGATATCTATATCTC
19. The preferred system for large-scale production of influenza virus for vaccination is
- A) Genetically modified bacteria      B) Transgenic plant  
C) Chick embryo      D) Yeast culture

20. X-ray diffraction of wool shows repeated structural units spaced at 5.2 Å, which is changed to 7.0 Å on steaming. This is due to the conversion of secondary structure from
- A) β-sheet to random coil                      B) α-helix to random coil  
C) β-sheet to α-helix                              D) α-helix to β-sheet
21. Vasopressin, an antidiuretic hormone, responsible for increased absorption of water by the kidney, is secreted from
- A) Adrenal gland                                      B) Pituitary gland  
C) Thyroid gland                                      D) Parathyroid gland
22. *Helicobacter pylori* can survive in the highly acidic environment of human stomach because it
- A) Creates an alkaline microenvironment around itself by urease action  
B) Rapidly invades the stomach cells and escapes the acidic environment  
C) Is capsulated and hence, is protected from acidic stress  
D) Undergoes sporulation for self-protection
23. Pfu polymerase has
- A) Proof-reading activity                              B) False priming activity  
C) Exonuclease activity                              D) RNA polymerase activity
24. The molar absorptivity of a  $1 \times 10^{-4}$  M ATP solution, which has an absorbance of 0.20 and pathlength is 2.5 cm
- A) 750                                      B) 800                                      C) 600                                      D) 890
25. At  $E_t = 20$  nm and substrate concentration = 40 μM, the reaction velocity  $V_o$  of an enzyme is  $9.6 \mu\text{M s}^{-1}$ . Assuming  $k_{\text{cat}}$  to be  $600 \text{ s}^{-1}$ , the  $K_M$  will be
- A) 0.1 μM                                      B) 1 μM                                      C) 10 μM                                      D) 100 μM
26. A peptide Glu-His-Trp-Ser-Gly-Leu-Arg-Pro-Gly, having an isoelectric point of 7.8, is placed in an electric field at pH 3.0. It will migrate towards
- A) Anode    B) Cathode  
C) Both anode and cathode                              D) Neither anode nor cathode
27. Three amino acids of molecular weights 75, 89 and 105 Dalton each have a tripeptide. The molecular weight of tripeptide in Dalton will be
- A) 251                                      B) 233                                      C) 269                                      D) Cannot be predicted
28. Lysine is an amino acid with three ionizable groups. These are the α-COOH, α-amino and ε-amino groups with pKa values of 2.2, 9.2 and 10.8, respectively. The isoelectric point (pI) for the lysine is
- A) 5.7                                      B) 6.5                                      C) 10                                      D) 9.2
29. In a dihybrid test-cross, 200 recombinant phenotypes were observed among 2402 progeny. The distance between two genes is
- A) 2 cM (centiMorgan)                              B) 2.4 cM  
C) 8.5 cM                                      D) 10 cM

30. A phage infects bacteria at a multiplicity of infection (moi) of 0.1. This means that
- Every bacterium is infected by the phage
  - One out of 10 bacteria is infected by the phage
  - Ten phage infect one bacterium
  - Only 1/10 of the phage population is infectious
31. The specific productivity ( $q_p$ ) of cellulase production by *Aspergillus niger* follows a linear relationship with the specific growth rate ( $\mu$ ) and is of the form  $q_p = \alpha\mu + \beta$ , where  $\alpha$  and  $\beta$  are constants. Assuming that the values of  $\alpha$  and  $\beta$  are 0.006 and 25, respectively, which type of product formation kinetics is TRUE?
- Growth-dependent kinetics
  - Non-growth-dependent kinetics
  - Growth and non-growth-dependent kinetics
  - Inhibition kinetics
32. A disease manifests only in the homozygous recessive condition. A couple has two children. If both parents are heterozygous for the disease causing gene, what is the probability that both the children are normal? Assume that the disease causing gene is not sex linked.
- A) 1/16                      B) 3/16                      C) 9/16                      D) 12/16
33. A bacterial culture contained  $32 \times 10^6$  cells after 2.5 hours of exponential growth. If the doubling time was 30 min, what was the initial population number in this culture?
- $20 \times 10^4$  cells
  - $10 \times 10^5$  cells
  - $40 \times 10^5$  cells
  - $16 \times 10^6$  cells
34. When a number of genes are transcribed as one mRNA, such mRNA is termed as
- multimeric
  - polymeric
  - polycistronic
  - polysomal
35. Which one of the following is NOT true of RNA polymerase II?
- It requires a primer to initiate the transcription
  - It makes an RNA copy of only one strand of a double-stranded DNA at any given time
  - It does not synthesize rRNA and tRNA
  - It catalyzes the polymerization of RNA only in the 5'→3' direction
36. Choose the option that shows the correct pairing of the products with their corresponding microorganisms.
- |                         |                                  |
|-------------------------|----------------------------------|
| P. Citric acid          | i. <i>Micromonosporapurpurea</i> |
| Q. Polyhydroxyalkonates | ii. <i>Zymomonasmobilis</i>      |
| R. Gentamycin           | iii. <i>Aspergillus niger</i>    |
| S. Ethanol              | iv. <i>Ralstoniaeutropha</i>     |
- P-ii, Q-iii, R-i, S-iv
  - P-iv, Q-ii, R-iii, S-i
  - P-iii, Q-iv, R-i, S-ii
  - P-iii, Q-i, R-iv, S-ii
37. Choose the option that lists the correct sequence of steps involved in gene therapy.
- Injection of expression vector into patient
  - Wild-type gene is inserted into expression vector
  - Wild-type gene is isolated and cloned
  - Wild-type gene is transcribed and translated in the patient
- A) Q, S, P, R                      B) Q, P, R, S                      C) R, P, Q, S                      D) R, Q, P, S

38. Match the techniques in column I with their primary applications in Column II:
- |                                  |   |
|----------------------------------|---|
| (i) Circular Dichroism           | (P) Atomic resolution structure of proteins |
| (ii) Ion exchange chromatography | (q) Identifying protein-protein interaction |
| (iii) Immunoprecipitation        | (r) Secondary structure of proteins         |
| (iv) X-ray crystallography       | (s) Separation of protein mixtures          |
- A) (i)-(q), (ii)-(s), (iii)-(P), (iv)-(r)      B) (i)-(q), (ii)-(s), (iii)-(r), (iv)-(P)  
 C) (i)-(r), (ii)-(P), (iii)-(s), (iv)-(q)      D) (i)-(r), (ii)-(s), (iii)-(q), (iv)-(P)
39. The most preferred substrate for conversion into methane by methanogens is:
- A) Glucose      B) Butyrate      C) Acetate      D) CO<sub>2</sub>
40. How many moles of biodiesel are obtained from 1 mole of triolein
- A) 1      B) 3      C) 2      D) 4
41. What is the triglyceride and alcohol operating ratio generally used in transesterification reaction used for biodiesel production
- A) 1:3      B) 1:5      C) 1:4      D) 1:6
42. How much glucose can be obtained upon the hydrolysis of 1 mole of cellulose
- A) 180 g      B) 111.1 g      C) 100 g      D) 162 g
43. How much ethanol can be obtained upon fermentation with *Saccharomyces cerevisiae* from 1 mole of glucose
- A) 92.0 g      B) 88.0 g      C) 51.1 g      D) 48.8 g
44. How many ATP molecules are produced upon fermentation of 1 mole of glucose by *Zymomonas mobilis*
- A) 1      B) 36      C) 2      D) 38
45. How many moles of ethanol can be produced upon the fermentation of 1 mole of xylose
- A) 1      B) 2      C) 1.67      D) 2.67
46. Urea degrading bacteria is
- A) *Bacillus pasture*      B) *A. Niger*      C) *Micrococcus* sp.      D) *Mucor*
47. Contribution of CO<sub>2</sub> in the carbon cycle is by
- A) Respiration by microorganisms in the soil  
 B) Decarboxylation of amino acids in the soil  
 C) Splitting of free fatty acids by the Microorganisms in the soil  
 D) All of the above
48. Nitrogen cycle has linkage with
- A) Carbon cycle      B) Sulfur cycle  
 C) Phosphorus cycle      D) All of these

49. Which of the following is the most efficient biofiltration in the secondary treatment of the sewage?
- A) Sand filters  
B) Contact filters  
C) Trickling filters  
D) None of these
50. Pasteurization involves the
- A) Exposure of food to 71.1°C for 15 sec to destroy spoilage microorganisms  
B) Exposure of food to heat to inactivate enzymes that cause undesirable effects in foods during storage.  
C) Exposure of food to 71.1°C for 15 sec to destroy pathogenic microorganisms  
D) Use of irradiation to destroy certain pathogens in foods.

*x-x-x*

## Chemical Engineering(Ph.D)

- In a single tank system, the transfer function of level to inlet flow rate is
  - $R/\tau S$
  - $R/(\tau S + 1)$
  - $1/(\tau S + 1)$
  - $1/\tau S$
- Gain and proportional band are
  - Controller functions calibrated in time units
  - Two different control modes
  - Reciprocally related
  - Adjusted independently of one another.
- What is the ratio of adiabatic compressibility to isothermal compressibility?
  - 1
  - $< 1$
  - $> 1$
  - 0
- Duhring's plot' is of use in
  - Extractive distillation
  - Evaporation
  - Leaching
  - Absorption
- The Knudsen Diffusivity is dependent on the
  - Molecular velocity only
  - Pore radius of the catalyst only
  - Molecular mean free path only
  - Molecular velocity & pore radius of catalyst
- The residence time distribution of an ideal CSTR is
  - $\frac{1}{\tau} \exp(-t/\tau)$
  - $\tau \cdot \exp(-t/\tau)$
  - $\exp(-t/\tau)$
  - $\frac{1}{\tau}(-t/\tau)$
- With increase in temperature, the internal energy of a substance
  - Increases
  - Decreases
  - Remains unchanged
  - May increase or decrease; depends on the substance
- The reverse process of fractional crystallization is called
  - Stripping
  - Leaching
  - Differential distillation
  - Absorption
- Both asphalt and wax are produced by \_\_\_\_\_base crude oils.
  - Naphthenic
  - Asphalt
  - Paraffin
  - Mixed
- Maximum size of reduction in a ball mill is done by
  - Compression
  - Attrition
  - Cutting
  - Impact
- Assuming that  $\text{CO}_2$  obeys perfect gas law, calculate the density of  $\text{CO}_2$  (in  $\text{kg/m}^3$ ) at  $263^\circ\text{C}$  and 2 atm.
  - 1
  - 2
  - 3
  - 4
- The driving force for separation by distillation is the highest
  - At total reflux
  - At minimum reflux
  - At an intermediate reflux between the total and the minimum
  - At the point of intersection of the enriching section operating line with the equilibrium curve

13. Which of the following statements is correct?
- Cp can never be less than Cv
  - Cp is always equal to Cv
  - Cp may be less than Cv depending on the gas
  - Cp may be equal to or less than Cv
14. When a derivative mode is added to a proportional controller, it
- Eliminates offset and oscillations both
  - Eliminates offset only
  - Eliminates oscillations only
  - Reduces offset but eliminates oscillations
15. The units of thermal conductivity in SI unit are
- W/(m.K)
  - J/(m.K)
  - W/(m<sup>2</sup>.K)
  - J/(m<sup>2</sup>.K)
16. A series of equal payments (e.g., deposit or cost) made at equal intervals of time is known as
- Perpetuity
  - Capital charge factor
  - Annuity
  - Future worth
17. Prandtl number is defined as
- $\mu/k \cdot Cp$
  - $h \cdot D/k$
  - $\rho \cdot Cp/k$
  - $\mu \cdot Cp/k$
18. What is Vinegar?
- Dilute solution of acetic acid
  - Double distilled alcohol
  - Food grade phosphoric acid
  - 5% saline solution
19. For free settling of spherical particles in accordance with Newton's law, the drag coefficient is
- Constant
  - Directly proportional to the particle
  - Reynolds number inversely proportional to the particle Reynolds number
  - Inversely proportional to the 0.6 power of the particle Reynolds number
20. The most important process currently used for industrial production of carbon black is –
- Furnace black process
  - Channel black process
  - Lamp black process
  - Thermal black process
21. The segregation model will give the highest conversion for reaction order
- Less than one
  - Equal to one
  - Greater than one
  - Equal to zero
22. For a particular reaction, the plot of  $\ln K$  vs.  $1/T$  is a straight line.  $K$  is the equilibrium constant for the reaction. This means that
- Heat of reaction is zero
  - Heat of reaction is independent of temperature
  - The specific heats of the reactants and products are identical
  - Heat of reaction is a linear function of temperature



23. An ideal gas at 35 bar , 230 °C is throttled adiabatically to 5 bar. What is the change in specific entropy (J/mol.K) ?
- A) 0                      B) 32.39                      C) 0.587                      D) 103.77
24. Number of chemical species in a colloidal system is
- A) 1                      B) 2                      C) 3                      D) 4
25. The most conducive surface for dropwise condensation to occur is the \_\_\_\_\_ surface.
- A) Coated                      B) Oily                      C) Glazed and polished                      D) Smooth
26. With increase in temperature, the total emissivity of conductors
- A) Increases                      B) Decreases                      C) remains same                      D) Decreases linearly
27. For pumping slurry, one can use a \_\_\_\_\_ pump.
- A) Reciprocating                      B) Diaphragm                      C) Centrifugal                      D) Pneumatic
28. Solenoid valve works like \_\_\_\_ controller.
- A) P                      B) P-D                      C) P-I-D                      D) on-off
29. The open loop transfer function of a process is  $K \frac{(s+1)(s+4)}{(s+2)(s+3)}$ . In the root locus diagram, the poles will be at
- A) -1, -4                      B) 1,4                      C) -2,-3                      D) 2,3
30. Oxygen carrying pipelines in chemical industries are coloured with \_\_\_\_ colour.
- A) Yellow                      B) Black                      C) Blue                      D) Red
31. For an isothermal second order aqueous phase reaction,  $A \rightarrow B$ , the ratio of the time required for 90% conversion to the time required for 45% conversion is
- A) 2                      B) 4                      C) 11                      D) 22
32. Gibbs free energy per mole for a pure substance is equal to the
- A) Latent heat of vaporization                      B) Chemical potential  
C) Molal boiling point                      D) Heat capacity
33. Which is a state function?
- A) Specific volume                      (B) Work                      C) Pressure                      D) Temperature
34. In a solution containing 0.3 Kg mole of solute and 600 kg of solvent, the molality is
- A) 0.5                      B) 0.6                      C) 2                      D) 1
35. The lowest temperature to which water can be theoretically cooled in a cooling tower is \_\_\_\_\_ of the atmospheric air.
- A) Dry Bulb Temperature (DBT)                      B) Wet Bulb Temperature (WBT)  
C) Average of DBT & WBT                      D) Difference of DBT and WBT
36. In a binary system, separation is very efficient when the relative volatility is
- A) 1                      B) 0.5                      C) < 1                      D) > 1

37. If a feed of 500 tons/hr at 5% concentration is fed to a crystallizer, the product obtained at 25% concentration is equal to \_\_\_\_\_tons/hr.
- A) 75                      B) 100                      C) 150                      D) 200
38. Weight of 56 litres of ammonia at NTP is \_\_\_\_gm.
- A) 2.5                      B) 56                      C) 42.5                      D) 2800
39. The filter medium resistance is controlled by
- A) Pressure drop alone                      B) Flow rate alone  
C) Both pressure drop and flow rate                      D) Cake thickness
40. Which of the following is used to set the diameter of the distillation column?
- A) Number of theoretical plates  
B) Static Submergence  
C) Allowable vapour velocity  
D) Length of straight rectangular weir on cross-flow tray
41. Portland cement mainly consists of
- A) CaO & SiO<sub>2</sub>                      B) SiO<sub>2</sub> & Al<sub>2</sub>O<sub>3</sub>  
C) CaO & Al<sub>2</sub>O<sub>3</sub>                      D) CaO & Fe<sub>2</sub>O<sub>3</sub>
42. A centrifugal pump is operating at 1440 rpm. If the power is to be reduced to 75% of its existing power, the speed of the pump as per affinity law will be \_\_\_\_\_rpm.
- A) 360                      B) 540                      C) 1080                      D) 1308
43. Out of the following flow measuring devices, which one incurs maximum installation cost as well as pressure loss?
- A) Flow nozzle                      B) Venturimeter                      C) Rotameter                      D) Orifice meter
44. The gas which may cause explosion in sewer pipes is
- (A) CO                      B) H<sub>2</sub>S                      C) NH<sub>3</sub>                      D) CH<sub>4</sub>
45. Dissolved oxygen content in river/water streams is
- A) Minimum at noon                      B) Maximum at noon  
C) Maximum at midnight                      D) same throughout the day
46. Out of the following gas-liquid contacting devices, for a given set of operating conditions, gas pressure drop is the least in \_\_\_tower.
- A) Wetted Wall                      B) Bubble Cap  
C) Perforated Tray                      D) packed
47. The most common packing used in industrial operations is \_\_\_\_\_rings.
- A) Rasching                      B) Lessing                      C) Cross-partition                      D) Single spiral

48. Moisture can be removed from lubricating oil using

- |                       |                       |
|-----------------------|-----------------------|
| A) Tubular centrifuge | B) Clarifier          |
| C) Sparkler filter    | D) Vacuum leaf filter |

49. Which of the following is not categorized as a 'mechanical operation'?

- |                     |                   |
|---------------------|-------------------|
| A) Agitation        | B) Filtration     |
| C) Size enlargement | D) Humidification |

50. Carbon dioxide required in the Solvay process is obtained by

- |                           |                                  |
|---------------------------|----------------------------------|
| A) Burning 100% pure coke | B) Burning coal                  |
| C) Heating limestone      | D) Heating magnesium bicarbonate |

*x-x-x*

## Civil Engineering(Construction Technology & Management)(Ph.D.)

1. The minimum compressive strength of 1st class brick should be  
A) 75 kg/cm<sup>2</sup>      B) 90 kg/cm<sup>2</sup>      C) 105 kg/cm<sup>2</sup>      D) 120 kg/cm<sup>2</sup>
2. For construction of structure under water the type of lime used is  
A) Hydraulic lime      B) Fat lime      C) Quick lime      D) Pure lime
3. If the whole circle bearing of a line is 270°, its reduced bearing will be  
A) N 90° W      B) S 90° W      C) W 90°      D) 90° W
4. Plotting of inaccessible point on plane table is done by  
A) Intersection      B) Traversing      C) Radiation      D) None of these
5. The deformation of bar per unit length in the direction of the force is known as  
A) Linear strain      B) Lateral strain      C) Volumetric strain      D) Shear strain
6. The equivalent length of a column fixed at both ends is  
A) 0.5 L      B) 0.7 L      C) 2 L      D) 1.5 L

Where L is the clear span between fixed ends.

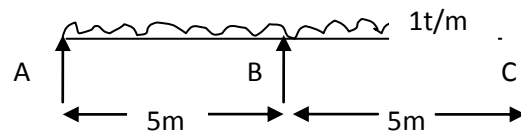
7. Beams of uniform strength are preferred to those of uniform section because these are economical for  
A) Large spans      B) Heavy weights  
C) Light weights      D) Small spans
8. The property of a material by which it can be beaten and rolled in plates is called  
A) Ductility      B) Malleability      C) Plasticity      D) Elasticity
9. Simple bending equation is  
A)  $\frac{M}{I} = \frac{R}{E} = \frac{f}{y}$       B)  $\frac{I}{M} = \frac{E}{R} = \frac{y}{f}$   
C)  $\frac{M}{I} = \frac{E}{R} = \frac{f}{y}$       D)  $\frac{M}{I} = \frac{E}{R} = \frac{y}{f}$
10. The velocity at which the laminar flow stops is known as  
A) Velocity of approach      B) Lower critical velocity  
C) Higher critical velocity      D) None of these

11. For keeping the stress wholly compressive the load may be applied on a circular column within a concentric circle of diameter
- A)  $\frac{d}{2}$                       B)  $\frac{d}{3}$                       C)  $\frac{d}{4}$                       D)  $\frac{d}{8}$

Where d is the dia of the circular column.

12. The reaction at support A of the beam shown in figure below is

- A) Zero                      B) 5t  
C) 10t                      D) 1t



13. The deflection due to couple M at the free end of a cantilever of length L is

- A)  $\frac{ML}{EI}$                       B)  $\frac{2ML}{EI}$                       C)  $\frac{ML^2}{2EI}$                       D)  $\frac{M^2 L}{2EI}$

14. Units of coefficient of kinematic viscosity are

- A) Length                      B) Depth                      C) Shape                      D) Both (B) and (C)

15. Hydraulic pressure on a dam depends upon its

- A)  $m^2/sec$                       B)  $NS/m^2$                       C)  $NS/m^3$                       D)  $kg/m - sec$

16. Flow in pipes is turbulent if Reynold's number is

- A)  $< 2100$                       B)  $> 3000$   
C) Between 2100 & 3000                      D) None of these

17. A floating body attains stable equilibrium if the metacentre is

- A) At the centroid                      B) Above the centroid  
C) Below the centroid                      D) Anywhere

18. Sullage does not contain waste from

- A) Bathroom                      B) Washbasin                      C) Kitchen sinks                      D) Toilets

19. If D.O. concentration falls down to zero anywhere in a natural drain, it indicates

- A) Zone of degradation                      B) Zone of active decomposition  
C) Zone of recovery                      D) Zone of clear water

20. Average temperature of sewage in India is

- A)  $10^\circ C$                       B)  $20^\circ C$                       C)  $15^\circ C$                       D)  $25^\circ C$

21. Standard BOD of water is taken for  
 A) 1 day                      B) 2 days                      C) 3 days                      D) 5 days
22. The detention time of a settling tank may be defined as the time required for  
 A) A particle to travel along its length  
 B) A particle to travel from top surface to bottom sludge zone.  
 C) The flow of sewage to fill the tank  
 D) None of the above
23. Cohesionless soil is  
 A) Sand                      B) Silt                      C) Clay                      D) clay and silt
24. The specific gravity and void ratio of a soil sample are 'G' and 'e' respectively. The critical hydraulic gradient 'L' is given by  
 A)  $\frac{G-1}{1+e}$                       B)  $\frac{G+1}{1+e}$                       C)  $\frac{G+1}{1-e}$                       D)  $\frac{1-G}{1+e}$
25. If the coefficient of active earth pressure  $K_a$  is  $\frac{1}{3}$ , then the coefficient of passive earth pressure  $K_p$  shall be  
 A)  $\frac{1}{3}$                       B)  $\frac{2}{3}$                       C) 3                      D)  $\frac{3}{2}$
26. The effective size of soil particles is defined by  
 A)  $D_{10}$                       B)  $D_{20}$                       C)  $D_{30}$                       D)  $D_{50}$
27. Minimum grade of concrete for construction under Sea water is  
 A)  $M_{20}$                       B)  $M_{30}$                       C)  $M_{35}$                       D)  $M_{15}$
28. A cantilever wall should not be used for heights more than  
 A) 4m                      B) 6m                      C) 8m                      D) 10m
29. Expansion joints are provided if length of concrete structure exceeds  
 A) 50m                      B) 45m                      C) 35m                      D) 40m
30. The shuttering of a wall measuring 4m x 5m can be removed after  
 A) 5 days                      B) 7 days                      C) 14 days                      D) 21 days
31. A piezometer tube is used only for measuring  
 A) Low pressure                      B) High pressure  
 C) Moderate pressure                      D) Vacuum pressure

32. The maximum shear stress  $q_{\max}$  in a rectangular beam section is  
 A)  $1.25 q_{\text{avg}}$                       B)  $1.5 q_{\text{avg}}$                       C)  $2 q_{\text{avg}}$                       D)  $2.5 q_{\text{avg}}$
- Where  $q_{\text{avg}}$  is average shear stress.
33. If the diameter of a reinforcing bar is 'd', the exchange value of hook shall be  
 A)  $4d$                       B)  $8d$                       C)  $12d$                       D)  $16d$
34. The diameter of longitudinal bars of a column should never be less than  
 A) 6mm                      B) 8mm                      C) 10mm                      D) 12mm
35. A flat slab is support  
 A) On beams                      B) On columns  
 C) On beams and columns                      D) On column monolithically
36. As the percentage of steel in beams increase  
 A) The depth of N.A. decreases                      B) The depth of N.A. increases  
 C) Lever arm decreases                      D) Lever arm increases
37. The shear reinforcement in R.C.C. is provided to resist  
 A) Vertical Shear                      B) Horizontal shear  
 C) Diagonal compression                      D) diagonal tension
38. Poisson's ratio for steel within elastic Limit ranges from  
 A) 15 to 20                      B) 25 to 33                      C) 33 to 35                      D) 45 to 50
39. If the moment of Inertia of a section about its N.A is I and its effective sectional area is A, its radii of gyration about N.A. is given by  
 A)  $r = \sqrt{\frac{A}{I}}$                       B)  $r = \sqrt{\frac{I}{A}}$                       C)  $r = \left(\frac{I}{A}\right)^{\frac{3}{2}}$                       D)  $r = \sqrt{\frac{I}{A+1}}$
40. For simply supported beam maximum permissible deflection is  
 A)  $\frac{1}{325}$  of the span                      B)  $\frac{1}{425}$  of the span  
 C)  $\frac{1}{150}$  of the span                      D)  $\frac{1}{36}$  of the span
41. The field capacity of soils depends upon  
 A) Capillary tension in soils                      B) Porosity of soils  
 C) Both (a) and (b)                      D) None

42. The difference in level between the top of a bank and FSL of water in canal is called  
A) Berm                      B) Free board                      C) Height of bank                      D) None
43. An outlet is said to be proportional if its flexibility is  
A) Zero                      B) Less than 1                      C) More than 1                      D) 1
44. In a Canal syphon, flow is  
A) Under atmospheric pressure                      B) Pipe flow  
C) With critical velocity                      D) Under negative pressure
45. In a Sharda type fall the rectangular crest may be used for discharge up to  
A) 6 cumec                      B) 10 cumec                      C) 14 cumec                      D) 20 cumec
46. On concrete roads camber provided is  
A) 1 in 20 to 1 in 24                      B) 1 in 36 to 1 in 48  
C) 1 in 60 to 1 in 72                      D) 1 in 48 to 1 in 60
47. The minimum width of pavement of a National Highway should be  
A) 4.7m                      B) 5.7m                      C) 6.7 m                      D) 8.0m
48. Bar Charts are suitable for  
A) Minor works                      B) Major works  
C) Very large projects                      D) All of these
49. For completion of a project the critical path network represents  
A) Minimum time                      B) Maximum time  
C) Minimum cost                      D) Maximum cost
50. The characteristic strength of concrete is the strength of material of the test result are not less than  
A) 5%                      B) 3%                      C) 10%                      D) 7%

x-x-x







19. The output of the following code would be, assume the language uses static scope:

```
int a=3;
void f1(){print (a);}
void f2(){int a=5; f1()}
void f3(){int a=7; f1()}
main()
{f1()
f2();
f3();}
```

- A) 3 3 3                      B) 3 5 7                      C) 5 5 7                      D) 7 7 5

20. Consider the following fragment of C code in which  $i, j$  and  $n$  are integer variables.

```
for(i=n,j=0;i>0;i/=2,j+=1);
```

The value of  $j$  after the termination of for loop is

- A)  $n/2 + 1$                       B)  $n^2$   
C)  $\text{ceiling}(\log_2 n) + 1$                       D)  $\text{floor}(\log_2 n) + 1$

21. The number of substrings (all lengths inclusive) those could be formed from a character string of length  $s$  is

- A)  $s^2$                       B)  $s(s + 1)^2$                       C)  $s(s + 1)/2$                       D)  $s(s - 1)/2$

22. Consider a process of inserting an element into a Max Heap, where Max Heap is represented by an array. Suppose a binary search operation is performed on the path from the new leaf to the root to find the position for the newly inserted element, the number of comparisons performed is:

- A)  $\theta(\log_2 n)$                       B)  $\theta(\log_2 \log_2 n)$                       C)  $\theta(n)$                       D)  $\theta(n \log_2 n)$

23. Consider the following program segment:

```
struct CNode{
struct Cnode *leftchild;
int element;
struct Cnode *leftchild;}
int test(struct Cnode *ptr)
{
int n=0;
if (ptr!=NULL)
{if (ptr->leftchild!=NULL)
i. n=1+test(ptr->leftchild);
if (ptr->rightchild!=NULL)
ii. n=max(n, 1+test(ptr->rightchild));
}
return(n);
}
```

The value returned by the function test when a pointer to the root of nonempty tree is passed as an argument is

- A) The number of leaf nodes in the tree
- B) The number of nodes in the tree
- C) The number of internal nodes in the tree
- D) The height of the tree

24. The height of a complete binary tree is given as  $h$ . Consider the height of the tree as number of edges in the longest path from the root to the leaf. The minimum number of nodes possible in the tree is

- A)  $2^h$
- B)  $2^h - 1$
- C)  $2^h + 1$
- D)  $2^{h+1} - 1$

25. Suppose we store  $n$  elements in a  $m$ -slot hash table using chaining. However, each chain is stored using an AVL tree instead of linked list. If  $m=n$ , what is the worst case running time of insert, delete, and search in this hash table? (Simple uniform hashing is not used)

- A)  $O(1)$
- B)  $O(1 + \lg n)$
- C)  $O(\lg \lg n)$
- D)  $O(n)$

26. Let  $S$  be an NP-complete problem, and  $Q$  and  $R$  be two other problems not known to be in NP.  $Q \leq_p S$  and  $S \leq_p R$ . Which one of the following statements is TRUE?

- A)  $R$  is NP-Complete
- B)  $R$  is NP-hard
- C)  $Q$  is NP-Complete
- D)  $Q$  is NP-hard

27. Consider the following two functions:

$$f(n) = \begin{cases} n^3 & 0 \leq n \leq 10^4 \\ n^2 & n > 10^4 \end{cases}$$

$$g(n) = \begin{cases} n & 0 \leq n \leq 100 \\ n^3 & n > 100 \end{cases}$$

Which of the following is TRUE?

- A)  $f(n)$  is  $O(g(n))$
- B)  $f(n)$  is  $O(n^3)$
- C)  $g(n)$  is  $O(f(n))$
- D)  $g(n)$  is  $O(n)$

28. Consider a demand paged memory system with memory access time of  $125\mu\text{s}$ . The page fault service time is  $400\text{ ms}$ . If the page fault rate is  $0.1\%$ , then the effective access time is

- A)  $480\mu\text{s}$
- B)  $500\mu\text{s}$
- C)  $525\mu\text{s}$
- D)  $560\mu\text{s}$

29. Consider the three processes, all arriving at time zero, with burst time of 10, 20 and 30 units respectively. Each process spends first 20% of execution time doing I/O, the next 70% of time doing computation and the last 10% of time doing I/O again. The operating system uses a shortest remaining compute time first scheduling algorithm and schedules a new process either when running process gets blocked on I/O or when the running process finishes its compute burst. Assume that all I/O operations can be overlapped as much as possible. For what percentage of time does the CPU remain idle?

- A) 0%
- B) 9.6%
- C) 10.6%
- D) 23.4%

30. A computer uses FIFO policy for page replacement. It has 4 page frames and there is no pages loaded initially. If the system accesses 25 pages in some order and then assess the same 25 pages in reverse order. How many page faults would occur?
- A) 45                                      B) 46                                      C) 47                                      D) 48
31. Which of the following relational algebra expression executes fast?
- A)  $\sigma_P(R) \times \sigma_Q(S)$                                       B)  $\sigma_{P \wedge Q}(R \times S)$   
 C)  $\sigma_Q((\sigma_P(R) \times S))$                                       D)  $\sigma_P(R \times (\sigma_Q(S)))$
32. Choose the correct option for the following statements:
- i) Unique key can have NULL values  
 ii) The primary key of relation cannot contain NULL values
- A) Both are false                                      B) Only (i) is true  
 C) Only (ii) is true                                      D) Both (i) and (ii) are true
33. Consider the relation R with attributes {A, B, C} and having functional dependency set  $S = \{A \rightarrow B, A \rightarrow C\}$ . Then relation R can be decomposed into two relations:
- A)  $R_1 \{A, B\}, R_2 \{A, B, C\}$                                       B)  $R_1 \{A, C\}, R_2 \{A, B, C\}$   
 C)  $R_1 \{A, B\}, R_2 \{A, C\}$                                       D)  $R_1 \{A, B\}, R_2 \{B, C\}$
34. Consider the following schedules involving two transactions. Which of the following statements is TRUE?
- $S_1: r_1(X); r_1(Y); r_2(X); r_2(Y); w_2(Y); w_1(X)$   
 $S_2: r_1(X); r_2(X); r_2(Y); w_2(Y); r_1(Y); w_1(X)$
- A) Both  $S_1$  and  $S_2$  are conflict serializable  
 B) Both  $S_1$  and  $S_2$  are not conflict serializable  
 C)  $S_1$  is conflict serializable and  $S_2$  is not conflict serializable  
 D)  $S_1$  is not conflict serializable and  $S_2$  is conflict serializable
35. Consider a B+ tree in which maximum number of keys in a node is 7. What is the minimum number of keys in any non-root node?
- A) 1                                      B) 2                                      C) 3                                      D) 4
36. If we have 5 bubbles in level 1 DFD and each bubble is decomposed into 4 bubbles in level 2 DFD, then at most how many level 3 DFD can have?
- A) 4                                      B) 5                                      C) 6                                      D) 20
37. For a function of 4 variables, how many robust cases are to be generated?
- A) 16                                      B) 17                                      C) 25                                      D) 125



47. Let  $L_1$  be a regular language,  $L_2$  be a Deterministic CFL, and  $L_3$  a R.E., but not Recursive Language. Which one of the following statements is false?

A)  $L_1 \cap L_2$  is deterministic CFL

B)  $L_3 \cap L_1$  is recursive

C)  $L_1 \cup L_2$  is CFL

D)  $L_1 \cap L_2 \cap L_3$  is R.E.

48. What is the solution of the recurrence relation  $a_n = 10a_{n-1} - 33a_{n-2} + 36a_{n-3}$  with the initial conditions of  $a_0 = 1, a_1 = 9$  and  $a_2 = 48$ ?

A)  $a_n = (n + 2)3^n + 3 \cdot (4^n)$

B)  $a_n = (n - 2)3^n + 3 \cdot (4^n)$

C)  $a_n = n(3^n) + 4^n$

D)  $a_n = (n - 2)4^n + 3^{n+1}$

49. The truth value of  $f(x, y, z) = (x \vee \neg y) \wedge (\neg x \vee y) \wedge z$  is  $T$  if  $x, y, z$  has the truth values

A)  $T, T, T$

B)  $F, F, F$

C)  $T, F, F$

D)  $F, T, F$

50. The set of strings over  $\{a,b\}$  having exactly 3b's is represented by regular expression

A)  $a^*bbb$

B)  $a^*ba^*ba^*b$

C)  $ba^*ba^*b$

D)  $a^*ba^*ba^*ba^*$

$x-x-x$







18. If the rotor pf of a 3-phase induction motor is 0.866, then special displacement between the stator magnetic field and rotor magnetic field will be  
 A)  $30^{\circ}$                       B)  $90^{\circ}$                       C)  $120^{\circ}$                       D)  $150^{\circ}$
19. A pole pitch in electrical machines is  
 A)  $=180^{\circ}$  electrical                      B)  $=180^{\circ}$  mechanical  
 C) Greater than  $180^{\circ}$  electrical                      D) Less than  $180^{\circ}$  electrical
20. A synchronous machine has full-pitch coils having coil-span of 12 slots. For eliminating third harmonic, the coil-span should be  
 A) 6 slots                      B) 8 slots                      C) 9 slots                      D) 10 slots
21. Gas turbines can be brought to the bus bar from cold in about  
 A) 2 minutes                      B) 30 minutes                      C) 1 Hour                      D) 2 Hour
22. A 3-phase circuit breaker is rated at 2000 MVA, 33 KV, its making current will be  
 A) 35 KA                      B) 49 KA                      C) 70 KA                      D) 89 KA
23. SSR phenomenon is  
 A) Purely electrical                      B) Purely mechanical  
 C) Purely hydraulic                      D) (A) and (B)
24. Efficiency of a power transformer under no-load condition is approximately  
 A) 75%                      B) 50%                      C) 25%                      D) None of these
25. The voltage and current in a circuit are given by  

$$v = 10 \sin(\omega t - \pi/6)$$

$$i = 10 \sin(\omega t + \pi/6)$$
 The power consumed can be given as  
 A) 100 W                      B) 50W                      C) 86.6 W                      D) 25 W
26. The effect of series capacitance is  
 A) To decrease the virtual surge impedance  
 B) To decrease the effective length of the line  
 C) To increase the virtual surge impedance loading  
 D) All of the above
27. The main consideration for higher and higher operating voltage of transmission is to  
 A) Increase the efficiency of transmission  
 B) Reduce power losses  
 C) Increase power transfer capability  
 D) (A) and (B)

28. In a circuit the voltage and current is given by  $v = (10+j5)$  and  $i = (6+4j)$ . The circuit is  
 A) Inductive                      B) Capacitive                      C) Resistive                      D) (A) and (B)
29. An alternator has a phase sequence RYB for its phase voltage. In case the direction of rotation of alternator is reversed, the phase sequence will become  
 A) RBY                      B) RYB                      C) YRB                      D) None of these
30. The Buchholz relay protects a transformer from  
 A) All types of internal faults                      B) A turn to turn fault  
 C) Winding to winding fault                      D) None of them
31. A system is described by the state equation  $\dot{X} = AX + BU$   
 The output is given by  $Y = CX$  where  $A = \begin{bmatrix} -4 & -1 \\ 3 & -1 \end{bmatrix}$ ,  $B = \begin{bmatrix} 1 \\ 1 \end{bmatrix}$ ,  $C = [1 \ 0]$   
 Transfer function  $G(s)$  of the system is  
 A)  $\frac{s}{s^2+5s+7}$                       B)  $\frac{1}{s^2+5s+7}$                       C)  $\frac{s}{s^2+3s+2}$                       D)  $\frac{1}{s^2+3s+2}$
32. For  $\Phi(s) = \begin{bmatrix} \frac{s+6}{s^2+6s+5} & \frac{1}{s^2+6s+5} \\ \frac{-5}{s^2+6s+5} & \frac{s}{s^2+6s+5} \end{bmatrix}$ , the coefficient matrix A is  
 A)  $\begin{bmatrix} 6 & -5 \\ -6 & 0 \end{bmatrix}$                       B)  $\begin{bmatrix} 5 & -5 \\ 0 & -6 \end{bmatrix}$                       C)  $\begin{bmatrix} 6 & 0 \\ -5 & -6 \end{bmatrix}$                       D)  $\begin{bmatrix} 0 & 1 \\ -5 & -6 \end{bmatrix}$
33. A system is describe by state equation  

$$\begin{bmatrix} \dot{x}_1 \\ \dot{x}_2 \end{bmatrix} = \begin{bmatrix} 2 & 0 \\ 0 & 2 \end{bmatrix} \begin{bmatrix} x_1 \\ x_2 \end{bmatrix} + \begin{bmatrix} 1 \\ 1 \end{bmatrix} u$$
  
 The state transition matrix of the system is  
 A)  $\begin{bmatrix} e^{2t} & 0 \\ 0 & e^{2t} \end{bmatrix}$                       B)  $\begin{bmatrix} e^{-2t} & 0 \\ 0 & e^{-t} \end{bmatrix}$                       C)  $\begin{bmatrix} e^{2t} & 1 \\ 1 & e^{2t} \end{bmatrix}$                       D)  $\begin{bmatrix} e^{-2t} & 1 \\ 1 & e^{-t} \end{bmatrix}$
34. For the transfer function  $(s) = \left[ \frac{1}{s(s+1)(s+5)} \right]$ , the phase cross over frequency is  
 A) 0.5 rad/sec                      B) 0.707 rad/sec                      C) 1.732 rad/sec                      D) 2 rad/sec
35. Which of the following points is NOT on the root locus of a system with the open loop transfer function  $G(s)H(s) = \frac{K}{s(s+1)(s+3)}$   
 A)  $s = -j\sqrt{3}$                       B)  $s = -1.5$                       C)  $s = -3$                       D)  $s = -\infty$

36. The open loop transfer function of a feedback control system is

$$G(s)H(s) = \frac{1}{(s+1)^3}$$

The gain margin of the system is

- A) 2                                      B) 4                                      C) 8                                      D) 16

37. Consider the points  $s_1 = -3 + j4$  and  $s_2 = -3 - j2$  in the s-plane. Then, for a system with the open loop transfer function

$$G(s)H(s) = \frac{K}{(s+1)^4}$$

- A)  $s_1$  is on the root locus, but not  $s_2$                                       B)  $s_2$  is on the root locus, but not  $s_1$   
C) Both  $s_1$  and  $s_2$  is on the root locus                                      D) Neither  $s_1$  nor  $s_2$  is on the root locus

38. A system with characteristic equation

$$s^2 + 2s^3 + 11s^2 + 18s + 18 = 0$$

Will have closed loop poles such that

- A) all poles lies on the left half of the plane  
B) all poles lies on the right half of the plane  
C) two poles lies symmetrically on the imaginary axis of the s-plane  
D) no pole lies on the imaginary axis of the s-plane

39. The characteristic equation of a feedback control system is

$$2s^4 + s^3 + 3s^2 + 5s + 10 = 0$$

The number of roots in the right half of the s-plane is

- A) Zero                                      B) 1                                      C) 2                                      D) 3

40. A linear discrete time system has the characteristic equation

$$Z^3 - 0.81Z = 0$$

The system

- A) Is stable  
B) Is marginally stable  
C) Is unstable  
D) Stability cannot be assessed from the given information

41. The intrinsic impedance  $\eta$  of a conducting medium for which  $\sigma=58\text{MS/m}$ ,  $\mu_r=1$  at a frequency  $f=100\text{MHz}$ , is
- A)  $2.14 \times 10^5 \angle 45^\circ \Omega$                       B)  $1.84 \times 10^{-3} \angle -45^\circ \Omega$   
 C)  $3.69 \times 10^{-3} \angle 45^\circ \Omega$                       D)  $3.69 \times 10^{-3} \angle -45^\circ \Omega$
42. The polarization of wave with electric field vector  $E = E_0 e^{j(\omega t + \beta z)} (a_x + a_y)$  is
- A) Linear    B) Elliptical  
 C) Left hand circular                              D) Right hand circular
43. For a short circuited coaxial transmission line,  $Z_0 = 35 + j49 \Omega$ ,  $\gamma = 1.4 + j5$  and the length of line is 0.4m, The input impedance of the line is
- A)  $82 + j39 \Omega$                       B)  $41 + j78 \Omega$                       C)  $68 + j46 \Omega$                       D)  $34 + j23 \Omega$
44. Divergence ( $\nabla \cdot A$ ) at  $(\frac{1}{2}, \frac{\pi}{2}, 0)$  when the vector field  $A = r \sin \theta a_r + r^2 \cos \theta a_\theta + 2r e^{-5z} a_z$ , will be
- A)  $\frac{5}{2}$     B)  $-\frac{5}{2}$     C)  $\frac{7}{2}$     D)  $-\frac{7}{2}$
45. A plane electromagnetic wave is travelling in an unbounded loss-less dielectric having  $\epsilon_r=4$  and  $\mu_r=1$ . The time averaged poynting vector of the wave is  $5 \text{ W/m}^2$ . The phase velocity  $v_p$  is
- A)  $1.5 \times 10^8 \text{ m/s}$                               B)  $3 \times 10^8 \text{ m/s}$   
 C)  $2.5 \times 10^8 \text{ m/s}$                               D)  $0.5 \times 10^8 \text{ m/s}$
46. An electromagnetic wave is obliquely incident at the surface of dielectric medium 2 ( $\epsilon_2 \mu_0$ ) from medium 1 ( $\epsilon_1, \mu_0$ ). The angle of incident is  $\theta_1$  and  $\theta_2$  is the critical angle. Then the phenomenon of total internal reflection occurs when
- A)  $\epsilon_1 > \epsilon_2$  and  $\theta_1 < \theta_2$                       B)  $\epsilon_1 < \epsilon_2$  and  $\theta_1 > \theta_2$   
 C)  $\epsilon_1 < \epsilon_2$  and  $\theta_1 < \theta_2$                       D)  $\epsilon_1 > \epsilon_2$  and  $\theta_1 > \theta_2$
47. For an existing transmission line the string efficiency is 80%. Now if dc voltage is supplied for the same set up, the string efficiency will be
- A) 80%    B) More than 80%                      C) Less than 80%                      D) 100%
48. In case of a 3-phase short circuit in a system, the power fed into the system is
- A) Mostly reactive                                      B) Mostly active  
 C) Active and reactive both equal                      D) Reactive only

49. The load flow solution is always assured in case of
- A) Newton-Raphson method
  - B) Gauss method
  - C) Gauss-seidal method
  - D) None of these methods guarantees
50. The inertia constant H of a machine of 200 MVA is 2 pu its value corresponding to 400 MVA will be
- A) 4.0
  - B) 2.0
  - C) 1.0
  - D) 0.5

*x-x-x*



10. Two point charges  $A = 20 \text{ nC}$  and  $B = 10 \text{ nC}$  are separated from each other by a distance of 25 cm in free space. What is the electric field at point P that is 15 cm away from A and 20 cm from B is
- A) 6.31 kV/m                      B) 7.31 kV/m                      C) 8.31 kV/m                      D) 9.31 kV/m
11. The average value of the half-wave rectifier sine wave of amplitude  $A_m$  is
- (a)  $\frac{A_m}{\pi}$                                $\frac{A_m}{\sqrt{2}}$                                $\frac{A_m}{2}$                                $\frac{2A_m}{\pi}$
12. The Z-transform of a signal is given by  $\frac{z^{-1}(1-z^{-4})}{4(1-z^{-1})^2}$ . Its final value is
- A)  $\frac{1}{4}$                               B) 0                              C) 1                              D)  $\infty$
13. An autotransformer having a transformation ratio of 0.8 supplies a load of 10 kW. The power transferred inductively from the primary to the secondary is
- A) 10 kW                              B) 8 kW                              C) 2 kW                              D) Zero
14. Two transformers of identical voltages but of different capacities are operating in parallel. For satisfactory load sharing
- A) Impedances must be equal  
 B) Per unit impedances must be equal  
 C) Per unit impedances and X/R ratios must be equal  
 D) Impedances and X/R ratios must be equal
15. Distributed winding and short circuit chording employed in AC machine will result in
- A) Increase in emf and reduction in harmonics  
 B) Reduction in emf and increase in harmonics  
 C) Increase in both emf and harmonics  
 D) Reduction in both emf and harmonics
16. The dc motor which can provide zero speed regulation at full load without any controller is
- A) Series                              B) Shunt  
 C) Cumulative compound                              D) Differential compound
17. An initially RC-series circuit network with  $R = 2 \text{ M}\Omega$  and  $C = 1 \mu\text{F}$  is switched on to a 10 V step input. The voltage across the capacitor after 2 seconds will be
- A) Zero                              B) 3.68 V                              C) 6.32 V                              D) 10 V



18. The depth of penetration of wave in a lossy dielectric increases with increasing
- Purely resistive
  - Purely inductive
  - Complex with a capacitive component
  - Complex with inductive component
19. If two identical lossless series motors connected in series across a dc supply voltage, run at speeds of  $N_1$  and  $N_2$  then ratio of their output powers will be
- $N_1^2 : N_2^2$
  - 1:1
  - $N_1 : N_2$
  - $N_2 : N_1$
20. A 250 kVA, 230/115 V, 50 Hz transformer has  $r_1=0.12 \Omega$ ,  $r_2=0.04 \Omega$ ,  $X_1=0.2 \Omega$  and  $X_2=0.05\Omega$ . What is transformer loading which will make the primary induced emf equal in magnitude to the primary terminal voltage when the transformer is carrying the full load current? Neglect magnetizing current.
- 15.57 kW
  - 16.57 kW
  - 17.57 kW
  - 19.57 kW
21. A 100 KVA, 400/200 V single phase transformer with 10% impedance draws a steady state short circuit line current of
- 50 A
  - 150 A
  - 250 A
  - 350 A
22. The ratio of reset to pick up current for an induction cup relay is approximately
- 0.99
  - 1.0
  - 0.75
  - 1.25
23. In protection of transformers, harmonic restraint is used to guard against
- Magnetizing inrush current
  - Unbalanced operation
  - Lightning
  - Switching over voltages
24. A 50 Hz , 320 km lossless line has sending end voltage of 1.0 pu. The receiving end voltage at no-load is
- 1.1 p.u
  - 1.088 p.u
  - 1.116 p.u
  - 1.111 p.u
25. A transformer rated for 500 kVA, 11 kV/0.4 kV has an impedance at 10% connected to an infinite bus. The fault level of the transformer is
- 500 kVA
  - 5000 kVA
  - $500*1.732$  kVA
  - 10000 kVA
26. The critical clearing time of fault in a power systems is related to
- Reactive power limit
  - Short circuit limit
  - Steady state stability limit
  - Transient stability limit

27. Steady state stability of a power system is the ability of the power system to
- Maintain voltage at the rated voltage level
  - Maintain frequency exactly at 50 Hz
  - Maintain a spinning reserve margin at all times
  - Maintains the synchronous between machines and on external ties
28. A distribution station has a peak load of 3000 kW and total annual energy of  $10^7$  kWh. The peak power loss is 220 kW. The loss factor is:
- 0.215
  - 0.285
  - 0.325
  - 0.356
29. A surge voltage rising at  $100 \text{ kV}/\mu\text{sec}$  travels along a loss-less open circuited transmission line. It takes  $10 \mu \text{ sec}$  to reach the open end. The reflected wave from the open end, will be rising at
- $100 \text{ kV}/\mu\text{s}$
  - $200 \text{ kV}/\mu\text{s}$
  - $1000 \text{ kV}/\mu\text{s}$
  - $2000 \text{ kV}/\mu\text{s}$
30. A plant has the following transfer function  $G(s) = \frac{1}{(s^2 + 0.2s + 1)}$ , For a step input it is required that the response settles to within 2% of its final value. The plant settling time is
- 20 sec
  - 40 sec
  - 35 sec
  - 45 sec
31. A system has transfer function  $\frac{1-s}{(1+s)}$  it is called
- Low pass filter
  - High pass filter
  - All pass filter
  - None of these
32. A system is represented by  $\frac{dy}{dt} + 2y = 4tu(t)$ . The ramp component in the forced response will be
- $tu(t)$
  - $2tu(t)$
  - $3tu(t)$
  - $4tu(t)$
33. Sinusoidal oscillators are
- Stable
  - Unstable
  - Marginally stable
  - Conditionally stable
34. The number of roots of  $s^3 + 5s^2 + 7s + 3 = 0$  in the right half of  $s$ -plane is
- 0
  - 1
  - 2
  - 3
35. The phase margin of a system with open loop transfer function  $G(s)H(s) = \frac{(1-s)}{(1+s)(2+s)}$  is
- $0^\circ$
  - $63.4^\circ$
  - $90^\circ$
  - Infinite
36. The gain margin of the transfer function  $G(s) = \frac{0.75s}{(1+s)(2+s)}$  is
- 4 dB
  - 8 dB
  - 12 dB
  - 16 dB

37. A meter has a full scale deflection of  $90^\circ$  at a current of 1A. The response of the meter is square law. Assuming spring control, the current for a deflection at  $45^\circ$  will be
- A) 0.25 A                      B) 0.50 A                      C) 0.67 A                      D) 0.707 A
38. A 1000 ohms/V meter is used to measure a resistance on 150 V scale. The meter resistance is
- A) 150 k $\Omega$                       B) 1 k $\Omega$                       C) 6.67  $\Omega$                       D) 0.001  $\Omega$
39. One single phase wattmeter operating on 230 V and 5A for 5 hours makes 1940 revolutions. Meter constant in revolutions is 400. The power factor of load is
- A) 1                      B) 0.8                      C) 0.7                      D) 0.6
40. Which of the following meter is most suitable for measuring radio frequency currents?
- A) Moving coil meter                      B) Moving iron meter  
C) Thermocouple meter                      D) VTVM
41. A digital voltmeter measures
- A) Peak value                      B) Peak-to-peak value                      C) Rms value                      D) Average value
42. Which of the meter is suitable for measurement of 10 mV at 50 Hz?
- A) Moving iron type                      B) VTVM  
C) C.R.O.                      D) Electrostatic voltmeter
43. To obtain very high input and output impedances in a feedback amplifier, the topology must be
- A) Voltage- series                      B) Current-series  
C) Voltage-shunt                      D) Current-shunt
44. A two stage amplifier with negative feedback has an overshoot when damping factor  $k$  is
- A) Less than unity                      B) Greater than unity  
C) Zero                      D) Negative
45. The MOSFET switch in its on-state may be considered equivalent to
- A) Resistor                      B) Inductor                      C) Capacitor                      D) Battery
46. Class AB operation is often used in power(large signal) amplifiers in order to
- A) Get maximum efficiency                      B) Remove even harmonics  
C) Overcome a cross-over distortion                      D) Reduce collector dissipation
47. Which of the following can be used to change data from special code for temporal code?
- A) Shift registers                      B) Counters  
C) A/D converters                      D) Combinational circuits

48. In time division multiplexing

- A) Time is doubled between bits of a byte
- B) Time slicing at CPU level takes place
- C) Total time available in channel is divided between several users and each users is allotted a time slice
- D) None of these

49. The inverter is used to control the speed of three phase induction motor

- A) By varying the frequency of supply
- B) By varying the voltage frequency
- C) By varying the resistance of stator winding
- D) By varying none of the above

50. A single phase full wave midpoint thyristor converter uses a 230/200 V transformer with centre tap on secondary side. The P.I.V per thyristor is

- A) 100 V
- B) 141.4 V
- C) 200 V
- D) 282.8 V

*x-x-x*

## Electronics & Communication Engineering(Ph.D.)

1. A silicon bar is doped with donor impurities  $N_D = 2.25 \times 10^{15}$  atoms /  $\text{cm}^3$ . Given the intrinsic carrier concentration of silicon at  $T = 300$  K is  $n_i = 1.5 \times 10^{10} \text{ cm}^{-3}$ . Assuming complete impurity ionization, the equilibrium electron and hole concentrations are
  - A)  $n_0 = 1.5 \times 10^{16} \text{ cm}^{-3}$ ,  $p_0 = 1.5 \times 10^5 \text{ cm}^{-3}$
  - B)  $n_0 = 1.5 \times 10^{10} \text{ cm}^{-3}$ ,  $p_0 = 1.5 \times 10^{15} \text{ cm}^{-3}$
  - C)  $n_0 = 2.25 \times 10^{15} \text{ cm}^{-3}$ ,  $p_0 = 1.5 \times 10^{10} \text{ cm}^{-3}$
  - D)  $n_0 = 2.25 \times 10^{15} \text{ cm}^{-3}$ ,  $p_0 = 1 \times 10^5 \text{ cm}^{-3}$
2. In a  $P^+n$  junction diode under reverse bias the magnitude of electric field is maximum at
  - A) The edge of the depletion region on the P side.
  - B) The edge of the depletion region on the n side.
  - C) The  $P^+n$  junction
  - D) The centre of the depletion region on the n-side
3. The Early-effect in a bipolar junction transistor is caused by
  - A) Fast-turn-on
  - B) Fast-turn-off
  - C) Large collector-base reverse bias
  - D) Large emitter-base forward bias
4. Consider the following two statements about the internal conditions in an n-channel MOSFET operating in the active region.  
 $S_1$ : The inversion charge decreases from source to drain.  
 $S_2$ : The channel potential increases from source to drain  
 which of the following is correct.
  - A) Only  $S_2$  is true
  - B) Both  $S_1$  and  $S_2$  are false
  - C) Both  $S_1$  and  $S_2$  are true, but  $S_2$  is not a reason for  $S_1$
  - D) Both  $S_1$  and  $S_2$  are true, and  $S_2$  is a reason for  $S_1$
5. In IC technology, dry oxidation (using dry oxygen) as compared to wet oxidation (using steam or water vapor) produces
  - A) superior quality oxide with a higher growth rate
  - B) inferior quality oxide with a higher growth rate
  - C) inferior quality oxide with a lower growth rate
  - D) superior quality oxide with a lower growth rate
6. The root locus plot for a system is given in Fig. 1. The open loop transfer function corresponding to this plot is given by

- A)  $G(s)H(s) = k \frac{s(s+1)}{(s+2)(s+3)}$
- B)  $G(s)H(s) = k \frac{s(s+1)}{s(s+2)(s+3)^2}$
- C)  $G(s)H(s) = k \frac{1}{s(s-1)(s+2)(s+3)}$
- D)  $G(s)H(s) = k \frac{s(s+1)}{s(s+2)(s+3)}$

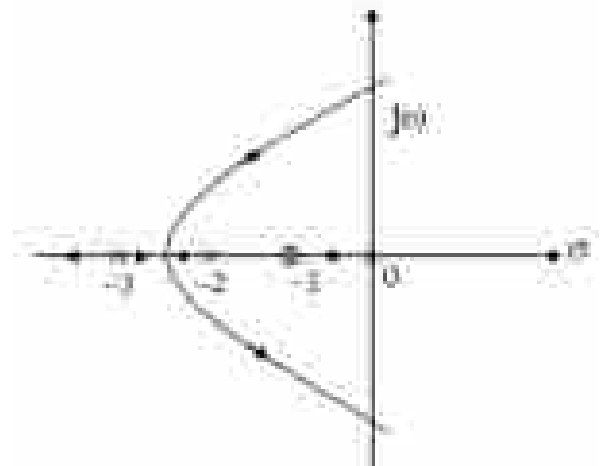


Fig. 1

7. Consider a unity-gain feedback control system whose open-loop transfer function is  $G(s) = \frac{as+1}{s^2}$ . With the value of “a” set for a phase-margin of  $\pi/4$ , the value of unit-impulseresponse of the open-loop system at  $t = 1$  second is equal to
- A) 3.40                      B) 2.40                      C) 1.84                      D) 1.74

8. The transfer function  $Y(s)/U(s)$  of a system described by the state equations
- $$\dot{x}(t) = -2x(t) + 2u(t)$$
- $$y(t) = 0.5x(t)$$

- A)  $\frac{0.5}{(s-2)}$                       B)  $\frac{1}{(s-2)}$                       C)  $\frac{0.5}{(s+2)}$                       D)  $\frac{1}{(s+2)}$

9. For a second order system, damping ratio ( $\xi$ ), is  $0 < \xi < 1$ , then the roots of the characteristic polynomial are
- A) Real but not equal  
 B) Real and equal  
 C) Complex conjugates  
 D) Imaginary

10. Negative feedback in a closed loop control system DOES NOT
- A) Reduce the overall gain  
 B) Reduce bandwidth  
 C) Improve disturbance rejection  
 D) Reduce sensitivity to parameter variation

11. The circuit shown in Fig. 2 is best described as a
- A) Bridge rectifier  
 B) Ring modulator  
 C) Frequency discriminatory  
 D) Voltage doubler

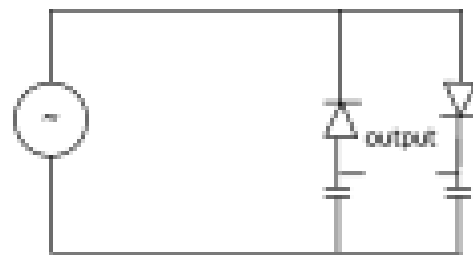


Fig. 2

12. In a bipolar transistor at room temperature, if the emitter current is doubled the voltage across its base-emitter junction
- A) Doubles  
 B) Halves  
 C) Increase by about 20 mV  
 D) Decrease by about 20 mv

13. For an n-channel MOSFET and its transfer curve shown in Fig. 3, the threshold voltage is
- A) 1 V and the device is in active region.
  - B) -1 V and the device is in saturation region.
  - C) 1 V and the device is in saturation region.
  - D) -1 V and the device is in active region

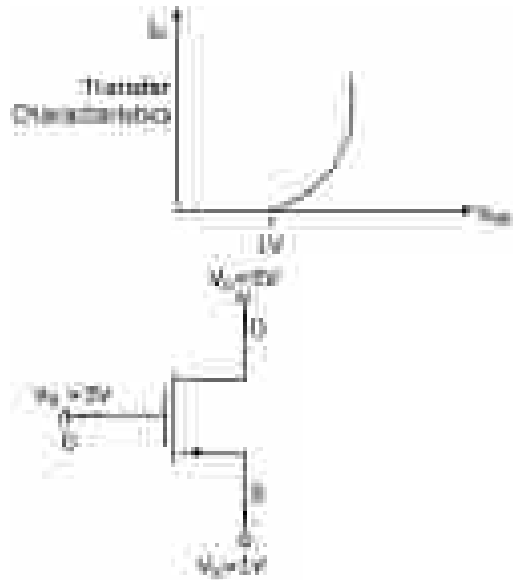


Fig. 3

14. In CMOS technology, shallow P-well or N-well regions can be formed using
- A) low pressure chemical vapour deposition
  - B) low energy sputtering
  - C) low temperature dry oxidation
  - D) low energy ion-implantation

15. The circuit shown in Fig. 4 implements a filter between the input current  $i_1$  and the output voltage  $v_o$ . Assume that the op-amp is ideal. The filter implemented is a

- A) low pass filter
- B) band pass filter
- C) band stop filter
- D) high pass filter

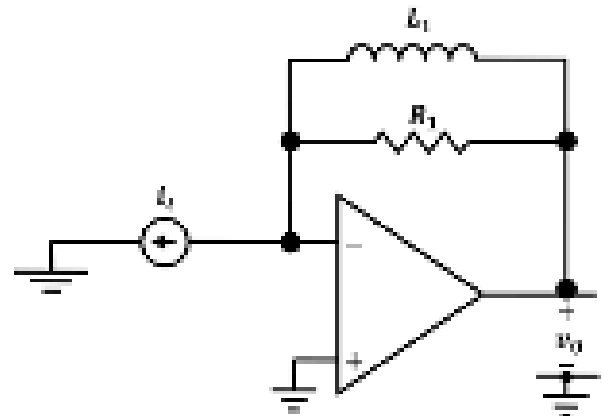


Fig. 4

16. A good buffer has
- A) Low input impedance and low output impedance
  - B) Low input impedance and high output impedance
  - C) High input impedance and low output impedance
  - D) High input impedance and high output impedance

17. A new Binary Coded Pentary (BCP) number system is proposed in which every digit of a base-5 number is represented by its corresponding 3-bit binary code. For example, the base-5 number 24 will be represented by its BCP code 010100. In this numbering system, the BCP code 100010011001 corresponds to the following number in base-5 system

- A) 423
- B) 1324
- C) 2201
- D) 4231

18. In the circuit shown in Fig. 5, the Norton equivalent current in amperes with respect to the terminals P and Q is

- A)  $6.4 - j4.8$
- B)  $6.56 - j7.87$
- C)  $10 + j0$
- D)  $16 + j0$

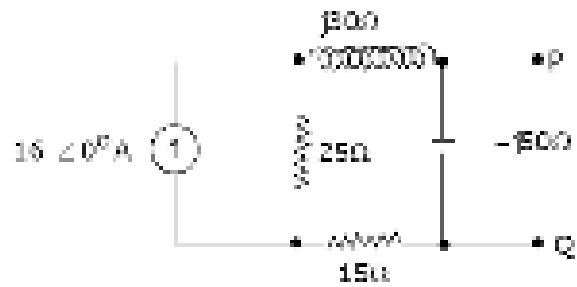


Fig. 5

19. The y-parameters of a 2-port network are

$$[y] = \begin{bmatrix} 5 & 3 \\ 1 & 2 \end{bmatrix} S$$

A resistor of 1 ohm is connected across as shown in Fig. 6. The new y-parameter would be

- A)  $\begin{bmatrix} 6 & 4 \\ 2 & 3 \end{bmatrix} S$
- B)  $\begin{bmatrix} 6 & 2 \\ 0 & 3 \end{bmatrix} S$
- C)  $\begin{bmatrix} 5 & 4 \\ 2 & 2 \end{bmatrix} S$
- D)  $\begin{bmatrix} 4 & 4 \\ 2 & 1 \end{bmatrix} S$

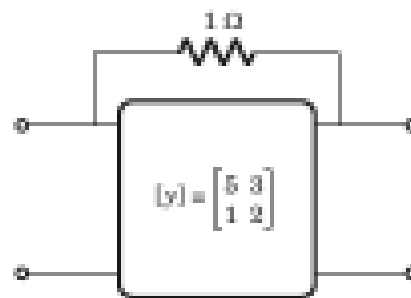


Fig. 6

20. The divergence of the vector field  $\vec{A} = x\hat{a}_x + y\hat{a}_y + z\hat{a}_z$  is

- A) 0
- B)  $1/3$
- C) 1
- D) 3

21. Which one of the following statements is NOT TRUE for a continuous time causal and stable LTI system?

- A) All the poles of the system must lie on the left side of the  $j\omega$  axis
- B) Zeros of the system can lie anywhere in the s-plane
- C) All the poles must lie within  $|s| = 1$
- D) All the roots of the characteristic equation must be located on the left side of the  $j\omega$  axis

22. The Boolean function f implemented in Fig. 7 using two input multiplexers is

- A)  $\overline{A}BC + A\overline{B}\overline{C}$
- B)  $ABC + \overline{A}\overline{B}\overline{C}$
- C)  $\overline{A}BC + \overline{A}BC$
- D)  $\overline{A}BC + \overline{A}BC$

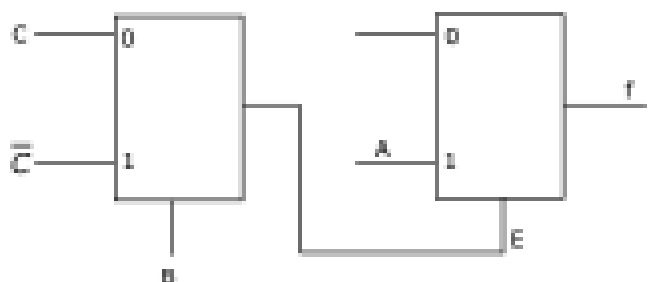


Fig. 7

23. The output Y of a 2-bit comparator is logic 1 whenever the 2-bit input A is greater than the 2-bit input B. The number of combinations for which the output is logic 1, is

- A) 4
- B) 6
- C) 8
- D) 10





30. Two independent random variables  $X$  and  $Y$  are uniformly distributed in the interval  $[1, 1]$ . The probability that  $\max[X, Y]$  is less than  $1/2$  is  
 A)  $3/4$                       B)  $9/16$                       C)  $1/4$                       D)  $2/3$
31. A transmission line with a characteristic impedance of  $100 \Omega$  is used to match a  $50 \Omega$  section to a  $200 \Omega$  section. If the matching is to be done both at  $429 \text{ MHz}$  and  $1 \text{ GHz}$ , the length of the transmission line can be approximately  
 A)  $82.5 \text{ cm}$                       B)  $1.05 \text{ m}$                       C)  $1.58 \text{ m}$                       D)  $1.75 \text{ m}$
32. The input  $x(t)$  and output  $y(t)$  of a system are related as  $y(t) = \int_{-\infty}^t x(\tau) \cos(3\tau) d\tau$ . The system is  
 A) Time-invariant and stable                      B) Stable and not time-invariant  
 C) Time-invariant and not stable                      D) Not time-invariant and not stable
33. The Fourier transform of a signal  $h(t)$  is  $H(j\omega) = (2 \cos \omega) (\sin 2\omega)/\omega$ . The value of  $h(0)$  is  
 A)  $1/4$                       B)  $1/2$                       C)  $1$                       D)  $2$
34. A PLA can be  
 A) As a microprocessor                      B) As a dynamic memory  
 C) To realize a sequential logic                      D) To realize a combinational logic
35. The minimum number of MOS transistors required to make a dynamic RAM cell is  
 A)  $1$                       B)  $2$                       C)  $3$                       D)  $4$
36. The gate delay of an NMOS inverter is dominated by charge time rather than discharge time because  
 A) The driver transistor has a larger threshold voltage than the load transistor  
 B) The driver transistor has larger leakage currents compared to the load transistor  
 C) The load transistor has a smaller  $W/L$  ratio compared to the driver transistor  
 D) None of the above
37. Commercially available ECL gates use two ground lines and one negative supply in order to  
 A) Reduce power dissipation  
 B) Increase fan-out  
 C) Reduce loading effect  
 D) Eliminate the effect of power line glitches or the biasing circuit
38. The advantage of using a dual slope ADC in a digital voltmeter is that  
 A) Its conversion time is small                      B) Its accuracy is high  
 C) It gives output in BCD format                      D) It does not require a comparator
39. The resolution of a 4-bit counting ADC is  $0.5 \text{ Volts}$ . For an analog input of  $6.6 \text{ Volts}$ , the digital output of the ADC will be  
 A)  $1011$                       B)  $1101$                       C)  $1100$                       D)  $1110$

40. A microprocessor with a 16-bit address bus is used in a linear memory selection configuration (i.e. Address bus lines are directly used as chip selects of memory chips) with 4 memory chips. The maximum addressable memory space is  
 A) 64k                      B) 16k                      C) 8k                      D) 4k
41. In an 8085 microprocessor system, the RST instruction will cause an interrupt  
 A) Only if an interrupt service routine is not being executed  
 B) Only if a bit in the interrupt mask is made 0  
 C) Only if interrupt have been enabled by an EI instruction  
 D) None of the above
42. A 8085 microprocessor based system uses 4K×8 RAM, whose starting address is AA00H. What is the address of the last byte in this memory?  
 A) AFFFH                      B) B9FFH                      C) BFFFH                      D) A9FFH
43. The total number of memory accesses involved (inclusive of the op-code fetch) when an 8085 processor executes the instruction LDA 2003 is  
 A) 1                      B) 2                      C) 3                      D) 4
44. The following instructions have been executed by an 8085  $\mu$ P  
 ADDRESS INSTRUCTION  
 (HEX)  
 6010:                      LXIH, 8A79H  
 6013:                      MOV A, L  
 6015:                      ADD H  
 6016:                      DAA  
 6017:                      MOV H, A  
 6018:                      PCHL  
 From which address will the next instruction be fetched?  
 A) 6019                      B) 0379                      C) 6979                      D) None of these
45. The final value theorem is used to find the  
 A) Steady state value of the system output  
 B) Initial value of the system output  
 C) Transient behaviour of the system output  
 D) None of these
46. The amplitude spectrum of a Gaussian pulse is  
 A) Uniform                      B) A sine function  
 C) Gaussian                      D) An impulse function
47. Compression in PCM refers to relative compensation of  
 A) Higher signal amplitudes                      B) Lower signal amplitudes  
 C) Lower signal frequencies                      D) Higher signal frequencies

48. The electric field component of a time harmonic plane EM wave traveling in a non-magnetic lossless dielectric medium has amplitude of 1 V/m. If the relative permittivity of the medium is 4, the magnitude of the time-average power density vector (in  $\text{W/m}^2$ ) is

- A)  $1/30\pi$                       B)  $1/60\pi$                       C)  $1/120\pi$                       D)  $1/240\pi$

49. An antenna when radiating has a highly directional radiation pattern. When the antenna is receiving its radiation pattern

- A) Is more directive                      B) Is less directive  
 C) Is the same                      D) Exhibits no directivity at all

50. In the following graph (Fig. 9), the number of trees (P) and the number of cut-sets (Q) are

- A)  $P = 2, Q = 2$   
 B)  $P = 2, Q = 6$   
 C)  $P = 4, Q = 6$   
 D)  $P = 4, Q = 10$

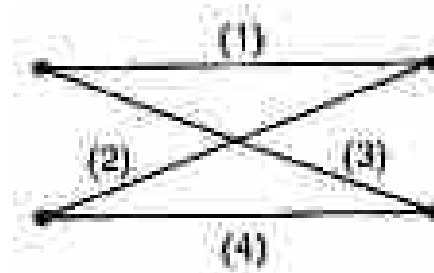


Fig. 9

x-x-x

**Information Technology (1076)**

1	Context Sensitive Grammars are accepted by A) Deterministic Finite Automata B) Non-deterministic Finite Automata C) Push Down Automata D) Linear Bounded Automata
2	Context Free Languages are not closed under A) Union B) Intersection C) Homomorphism D) Substitution
3	According to Arden's theorem, the solution to $R=Q+RP$ is A) $R=QP^*$ B) $R=P^*Q$ C) $P=RQ^*$ D) $P=Q^*R$
4	Bottom-Up parsing is also known as A) Recursive Predictive Parsing B) LL Parsing C) Shift Reduce Parsing D) Non-Recursive Predictive Parsing
5	The application of finite automata include A) lexical analyzers B) query optimization C) parsers D) operating systems
6	Which of the following information is not included in Process Control Block A) Program Counter B) Critical Section C) Accounting Information D) CPU-scheduling information
7	Which of the following statement is not true A) Register values are not shared across threads in a multithreaded process B) Heap memory is shared across threads in a multithreaded process C) Global variables are shared across threads in a multithreaded process D) Stack memory is shared across threads in a multithreaded process
8	Which of the following pair of scheduling algorithms could result in starvation A) First-come, first-served and Round Robin B) Multilevel Feedback-Queue Scheduling and Round Robin C) Shortest Job First and Priority-based D) First-come, first-served and Multilevel Feedback-Queue Scheduling
9	Bounded – Buffer problem is also known as A) Producer-Consumer problem B) Dining – Philosophers problem C) Readers – Writers problem D) Sleeping Barber problem

10	<p>Consider a disk queue with requests for I/O to blocks on cylinders: 98 183 37 122 14 124 65 67</p> <p>Considering FCFS scheduling, what is the total number of head movements if the disk head is initially at 53</p> <p>A) 600                      B) 620                      C) 630                      D) 640</p>
11	<p>Address Resolution Protocol (ARP) is used</p> <p>A) to map IP network addresses to the hardware addresses used by a data link protocol</p> <p>B) to map hardware addresses used by a data link protocol to the physical layer</p> <p>C) to map hardware addresses used by a data link protocol to the transport layer</p> <p>D) to map IP network addresses to the addresses used by a transport layer protocol</p>
12	<p>The default subnet mask for class A networks is</p> <p>A) 255.255.255.0</p> <p>B) 255.0.0.0</p> <p>C) 255.255.0.0</p> <p>D) 255.255.255.255</p>
13	<p>Which of the following is the prime task of Data Link Layer</p> <p>A) Synchronization</p> <p>B) Conversion of data to bits</p> <p>C) Controlling Connection</p> <p>D) Framing</p>
14	<p>EDGE stands for</p> <p>A) Enhanced Data GPS Evolution</p> <p>B) Enhanced Data Global Evolution</p> <p>C) Enhanced Data rates for GSM Evolution</p> <p>D) Enhanced Data rates for Global Evolution</p>
15	<p>Piggybacking is the technique of</p> <p>A) temporarily delaying outgoing acknowledgements so that they can be hooked onto the next outgoing data frame</p> <p>B) synchronizing receiver and transmitter to ensure that receiver never gets packets out of order</p> <p>C) reducing congestion over the network by sending control signals in packets along with outbound data</p> <p>D) keeping multiple small frames in a single packet</p>
16	<p>For a queue defined as a structure with n number of elements, the insertion of an element e can be performed by which of the following operation</p> <p>A) <code>queue.element[queue.rear--]=e;</code></p> <p>B) <code>queue.element[++queue.rear]=e;</code></p> <p>C) <code>queue.element[queue.rear]=e;</code></p> <p>D) <code>queue.element[queue.rear]++=e;</code></p>
17	<p>Which of the following is not an advantage of linked lists over arrays</p> <p>A) insertion operation is easy to perform</p> <p>B) deletion operation is easy to perform</p> <p>C) searching operation is easy to perform</p> <p>D) linked lists make better use of memory</p>

18	<p>Which of the following types of tree has the leaves at the same level</p> <p>A) AVL tree  B) Expression tree  C) B-tree  D) Binary tree</p>
19	<p>The postfix notation of expression <math>(A + B) * C - (D - E) * (F + G)</math> is</p> <p>A) <math>AB*C-DE-FG+*-</math>  B) <math>AB+C-D*EFG+*</math>  C) <math>AB+C*D-EFG+*</math>  D) <math>AB+C*DE-FG+*-</math></p>
20	<p>If <math>4(\log_9 3) + 9(\log_2 4) = 10(\log_x 81)</math>, then x is</p> <p>A) 9  B) 7  C) 5  D) 11</p>
21	<p>In ER modelling, total participation is also called</p> <p>A) structural dependency  B) existence dependency  C) uniqueness constraint  D) entity constraint</p>
22	<p>Which of the following relational algebraic operation produces a new relation with only some of the attributes of a relation, and removes duplicate tuples</p> <p>A) CARTESIAN PRODUCT  B) SELECT  C) PROJECT  D) DIVISION</p>
23	<p>Which of the following is pseudotransitive rule</p> <p>A) If <math>X \rightarrow Y</math> and <math>WY \rightarrow Z</math> then <math>WX \rightarrow Z</math>  B) If <math>X \rightarrow Y</math> then <math>XZ \rightarrow YZ</math>  C) If <math>X \rightarrow Y</math> and <math>Y \rightarrow Z</math> then <math>X \rightarrow Z</math>  D) If <math>X \rightarrow Y</math> and <math>X \rightarrow Z</math> then <math>X \rightarrow YZ</math></p>
24	<p>Join selection factor</p> <p>A) is the fraction of records in one file that will be joined with records in the other file with respect to an equijoin condition with another file  B) is the fraction of records produced in inner join to the records produced in outer join  C) is the average number of records that will be produced as a result of join operations  D) is the maximum number of records that will be produced as a result of join operations</p>
25	<p>In which of the following variation of 2PL, a transaction locks all the items it accesses before it begins execution, by predeclaring its read-set and write-set</p> <p>A) Basic 2PL  B) Rigorous 2PL  C) Strict 2PL  D) Conservative 2PL</p>

26	Which of the following is not a structural diagram in UML A) Class Diagram B) Sequence Diagram C) Component Diagram D) Deployment Diagram
27	A program module M calls two sub-modules M1 and M2. M1 can fail 30% times and M2 can fail 20% times. The program module M can fail A) 60%                      B) 30%                      C) 44%                      D) 50%
28	Pick the odd one out A) Basis Path Testing B) Equivalent Partitioning C) Cause Effect Graphing D) Boundary Value Testing
29	In CMM, which of the following are Level 5 KPAs A) Software Quality Management and Organization Process Definition B) Configuration Management and Project Planning C) Training Program and Peer Reviews D) Defect Prevention and Process Change Management
30	Which of the following is more desirable kind of cohesion A) Sequential Cohesion B) Functional Cohesion C) Procedural Cohesion D) Logical Cohesion
31	The worst case and average case performance of Quicksort algorithm is A) $O(n^2)$ and $O(n^2)$ B) $O(n^2)$ and $O(\log n)$ C) $O(n \log n)$ and $O(n \log n)$ D) $O(n^2)$ and $O(n \log n)$
32	Which of the following represents the correct sequence of complexities in descending order A) exponential-polynomial-logarithmic-linear B) exponential-polynomial-linear-logarithmic C) polynomial-exponential-linear-logarithmic D) polynomial-exponential-logarithmic-linear
33	The expression for the runtime $T(n)$ for recurrence $T(n) = 4T(n/2) + n^2$ as per Master Theorem is A) $T(n) = \Theta(n^2 \log n)$ B) $T(n) = \Theta(n^2)$ C) $T(n) = \Theta(2^n)$ D) $T(n) = \Theta(n \log n)$
34	Which of the following represents the expression for minimum number of nodes in a binary tree of depth n if the root is considered at level 0 A) n                              B) $2^n - 1$ C) n+1                              D) $2^{n+1}$



35	<p>Which of the following algorithm pair has the same worst-case complexity</p> <p>A) Insertion sort and Merge sort  B) Bubble sort and Insertion sort  C) Merge sort and Quick sort  D) Bubble sort and Merge sort</p>
36	<p>Which of the following is not a characteristics of RISC architecture</p> <p>A) Variable length instruction format  B) Memory access is limited to load and store instructions  C) Single cycle instruction execution  D) Hardwired rather than micro-programmed</p>
37	<p>Which of the following type of pipeline conflict is caused by access to memory by two segments at the same time</p> <p>A) Target Conflict  B) Data Dependency Conflict  C) Branch Conflict  D) Resource Conflict</p>
38	<p>Which of the following statement is not true about Input-Output Processor (IOP)</p> <p>A) IOP is similar to CPU except that it is designed to handle the details of I/O processing  B) The IOP cannot fetch and execute its own instructions  C) The IOP provides a path for transfer of data between peripheral devices and memory unit  D) IOP can perform processing tasks like arithmetic, logic, branching and code translation</p>
39	<p>The signed-2's complement representation of <math>-7</math> is</p> <p>A) 11111111                      B) 10000111                      C) 11111001                      D) 11111000</p>
40	<p>Floating point numbers in a computer are represented by a 10 bit mantissa (including sign bit) and a 6 bit exponent (including sign bit). The approximate value of the maximum number that can be represented is: (assume the mantissa is stored in normalized form)</p> <p>A) <math>2^{32}</math>                                      B) <math>2^{64}</math>                                      C) <math>2^{63}</math>                                      D) <math>2^{31}</math></p>
41	<p>In which of the following type of projections, all lines perpendicular to the projection plane are projected with no change in length</p> <p>A) Isometric projections  B) Cabinet projections  C) Cavalier projections  D) Orthogonal projections</p>
42	<p>Which of the following algorithm does not employ image space approach</p> <p>A) Back face removal  B) Depth sort method  C) Scan line method  D) Depth buffer method</p>

43	<p>The size of 1280 x 960 image at 240 pixels per inch is</p> <p>A) <math>8/3 \times 2</math> inches  B) <math>16/3 \times 4</math> inches  C) <math>8/3 \times 4</math> inches  D) <math>16/3 \times 2</math> inches</p>
44	<p>The 45 degree anticlockwise rotation of point A (1, 1) is</p> <p>A) <math>(\sqrt{2}, 0)</math>  B) <math>(-\sqrt{2}, \sqrt{2})</math>  C) <math>(-\sqrt{2}, 0)</math>  D) <math>(0, \sqrt{2})</math></p>
45	<p>The minimum size of the frame buffer for resolution 800 x 600 with 48 bits per pixel is</p> <p>A) 3.75 MB  B) 4.75 MB  C) 2.75 MB  D) 1.75MB</p>
46	<p>Which of the following is a data link layer protocol</p> <p>A) SMTP  B) PPP  C) BGP  D) ICMP</p>
47	<p>Which of the following statement is true</p> <p>A) The hamming distance between 001111 and 010011 is 3.  B) HDLC is not a bit oriented protocol.  C) End-to-end connectivity is provided from host-to-host in network layer  D) Railway track is an example of simplex</p>
48	<p>In OLTP</p> <p>A) data comes from various diverse sources compared to OLAP  B) often complex queries are processed involving aggregations  C) database design is highly normalized with many tables  D) processing speed is slow compared to OLAP</p>
49	<p>Which of the following is a spatial indexing method</p> <p>A) I-trees  B) S-trees  C) B-trees  D) R-trees</p>
50	<p>A cryptographic hash function is a hash function which</p> <p>A) takes block of data as input and returns a variable-size string  B) takes block of data as input and returns a fixed-size string  C) takes block of data as input and returns either 0 or 1  D) takes block of data as input and returns data for input to another hash function</p>

### Mechanical Engineering (1076)

1. The property of a material which enables it to resist fracture due to high impact loads is known as  
A) Elasticity                      B) Endurance                      C) Strength                      D) Toughness
2. Plastic deformation results from the following  
A) Slip                      B) Twinning                      C) Both                      D) None
3. When a body slides down an inclined surface, inclined at an angle  $\beta$ , the acceleration 'a' of the body is given by  
A)  $a = g$                       B)  $a = g \sin\beta$                       C)  $a = g \cos\beta$                       D)  $a = g \tan\beta$
4. Longitudinal stress in a thin cylinder is  
A) Equal to the hoop stress                      B) Twice the hoop stress  
C) Half of the hoop stress                      D) One fourth of hoop stress
5. A boiler shell 200 cm diameter and plate thickness 1.5 cm is subjected to internal pressure of 1.5 MN/m, then the hoop stress will be  
A) 30 MN/m<sup>2</sup>                      B) 50 MN/m<sup>2</sup>                      C) 100 MN/m<sup>2</sup>                      D) 200 MN/m<sup>2</sup>
6. A link must be a  
A) Rigid body                      B) Resistant body  
C) Rigid as well as resistant body                      D) None of these
7. In a slider crank chain, the numbers of possible inversions are  
A) Three                      B) Four                      C) Five                      D) Six
8. The type of threads used to transmit power in one direction only is  
A) Acme                      B) Trapezoidal                      C) Buttress                      D) V thread
9. The Coefficient of fluctuation of energy of flywheel is given a  
Where  $E_{\max}$  = Maximum Kinetic energy of the Flywheel  
 $E_{\min}$  = Minimum Kinetic energy of the Flywheel  
A)  $(E_{\max} - E_{\min})/\text{Work done per cycle}$                       B)  $(E_{\max} + E_{\min})/\text{Work done per cycle}$   
C)  $(E_{\max} - E_{\min}) \times \text{Work done per cycle}$                       D)  $(E_{\max} + E_{\min}) \times \text{Work done per cycle}$
10. A fixed gear having 200 teeth is in mesh with another gear having 50 teeth. The two gears are connected by an arm. The number of turns made by the smaller gear for one revolution of arm about the centre of bigger gear is  
A) 2                      B) 4                      C) 3                      D) None of these
11. A metric thread of pitch 2mm and thread angle 60° is inspected for its pitch diameter using 3-wire method. The diameter of the best size wire in mm is  
A) 0.86                      B) 1.0                      C) 1.15                      D) 2.0

12. Two shafts A and B under pure torsion are of identical length and identical weight and are made of the same material. The shaft A is solid and the shaft B is hollow. We can say that  
 A) Shaft B is better than shaft A                      B) Shaft A is better than shaft B  
 C) Both the shafts are equally good                  D) None of these
13. The maximum shear stress theory is used for  
 A) Brittle materials                                      B) Ductile materials  
 C) Plastic materials                                      D) Non-ferrous materials
14. Soderberg relation is based on \_\_\_\_\_ of the material whereas all other failure relation for dynamic loading are based on ultimate strength of the material  
 A) Elastic strength                                      B) Yield strength  
 C) Shear strength                                        D) All of these
15. In grey cast iron, carbon is present in the form of  
 A) Cementite                      B) Free carbon                      C) Flakes                      D) Spheroids
16. Cyaniding is the process of  
 A) Dipping steel in cyanide bath  
 B) Reacting steel surface with cyanide salts  
 C) Adding carbon and nitrogen by heat treatment of steel to increase its surface hardness  
 D) Obtaining cyanide salts
17. Cupola produces following material  
 A) Cast iron                      B) Pig iron                      C) Wrought iron                      D) Malleable iron
18. As the shear angle increases, the plastic deformation of chip  
 A) Increases                      B) Decreases                      C) Remains same                      D) None of these
19. Cutting forces at the cutting tool can be measured by  
 A) A dynamometer    B) A viscosity meter    C) A sine bar                      D) A combination set
20. The clearance angle is provided on the tools with a view to  
 A) Strengthen the tool  
 B) Shear off the metal  
 C) Facilitate easy flow of chips  
 D) Prevent the tool from rubbing on work piece
21. On a lathe machine, the spindle speed is lowest during  
 A) Taper turning                      B) Threading                      C) Parting off                      D) Knurling
22. In oxidizing flame, the inner core attains a temperature of ..... °C  
 A) 2100                      B) 2800                      C) 3150                      D) 3500

23. Plastic bottles are manufactured using the process of  
 A) Blow moulding  
 B) Injection moulding  
 C) Atomizing  
 D) die casting
24. Using the Taylor equation  $VT^n = c$ , calculate the percentage increase in tool life when the cutting speed is reduced by 50% ( $n = 0.5$  and  $c = 400$ )  
 A) 300  
 B) 400%  
 C) 100%  
 D) 50%
25. In a rolling process, the state of stress of the material undergoing deformation is  
 A) Pure compression  
 B) Pure shear  
 C) Compression and shear  
 D) Tension and shear
26. The process that improves the machinability of steels, but lowers the hardness and tensile strength is  
 A) Normalizing  
 B) Annealing  
 C) Tempering  
 D) Hardening
27. When the front wheels are not parallel to each other and moved further away at the top it is termed as  
 A) Positive camber  
 B) Negative camber  
 C) Roll out  
 D) Roll in
28. The dry bulb temperature lines of psychometric chart are  
 A) Vertical  
 B) Horizontal  
 C) Inclined  
 D) Curved
29. The inlet valve of a four stroke cycle I.C engine remains open for nearly  
 A)  $180^\circ$   
 B)  $125^\circ$   
 C)  $235^\circ$   
 D)  $200^\circ$
30. In orthographic projections, the rays are assumed to  
 A) Diverge from station point  
 B) Converge from station point  
 C) Be parallel  
 D) None of these
31. A Composite plane wall is made up of two different materials of the same thickness and having thermal conductivities of  $k_1$  and  $k_2$  respectively. The equivalent thermal conductivity of the slab is  
 A)  $k_1 + k_2$   
 B)  $k_1.k_2$   
 C)  $\frac{k_1+k_2}{k_1.k_2}$   
 D)  $\frac{2k_1.k_2}{k_1+k_2}$
32. Waste heat can be effectively used in which one of the following refrigeration systems  
 A) Vapour compression refrigeration cycle  
 B) Air refrigeration cycle  
 C) Vapour absorption refrigeration cycle  
 D) Vortex refrigeration cycle
33. Flaring is performed accurately by using a  
 A) Ball peen hammer  
 B) Chisel  
 C) Flaring block  
 D) Torch to soften the metal

34. A negative loop in the P.V diagram of an I.C engine is due to  
 A) Pre ignition in the engine                      B) Suction of air for engine  
 C) Pre opening of the exhaust valve              D) High pressure in the cylinder
35. A 1 ton capacity water cooler cools water steadily from 35°C to 20°C. The specific heat of water is 4.18 KJ/kg-K. The water flow rate will be nearly.  
 A) 13.33 litre/hr      B) 33.3 litre/hr      C) 200 litre/hr      D) 250 litre/hr
36. Which of the following is a non positive displacement type of compressor  
 A) Reciprocating compressor                      B) Centrifugal compressor  
 C) Root blower                                      D) Vane type compressor
37. The Stefan Boltzman law states that  
 A)  $E \propto T$                       B)  $E \propto T^2$                       C)  $E \propto T^3$                       D)  $E \propto T^4$
38. Streamlines, path lines and streak lines are virtually identical for  
 A) Uniform flow                                      B) Flow for ideal fluids  
 C) Steady flow                                      D) Non uniform flow
39. Eutectic reaction for iron- carbon system occurs at  
 A) 600 °C                      B) 723 °C                      C) 1147 °C                      D) 1490 °C
40. The crystal structure of  $\alpha$  iron is  
 A) Simple Cubic                                      B) Face centered cubic  
 C) Body centered cubic                              D) Close packed hexagonal
41. To show the internal parts of machine components, the section lines are drawn at angle of  
 A) 45°                      B) 0°                      C) 60°                      D) 90°
42. Which of the following statements are FALSE about the buoyancy of an object  
 A) The force of buoyancy on a ship is equal to the weight of the water displaced by the ship and its cargo.  
 B) Buoyancy explains why it is easier to lift an object in water than it is in air.  
 C) An object only has buoyancy in air.  
 D) An object only has buoyancy in liquids.
43. Cavitations in centrifugal pumps can be reduced by  
 A) Reducing the discharge                      B) Reducing the suction head  
 C) Throttling the discharge                      D) Increasing the flow velocity
44. The Weber number in dimensionless system is expressed as  
 A)  $\frac{v}{\sqrt{\sigma / \rho L}}$                       B)  $\frac{v}{\sigma \sqrt{\rho L}}$                       C)  $\frac{\sigma v}{\sqrt{\rho L}}$                       D)  $\frac{\sqrt{\sigma / \rho L}}{v}$

Where  $\sigma$  is surface tension per unit length.

(4)

45. The heat is absorbed by  
 A) Condenser            B) Evaporator            C) Compressor            D) Thermostat
46. Work study includes  
 A) Method study            B) Motion study            C) Time study            D) All of these
47. At break even point  
 A) Fixed costs are recovered            B) Variable costs are recovered  
 C) Total costs are recovered            D) Some costs are recovered
48. The time period of a simple pendulum is given by the relation  
 A)  $T = 2\pi\sqrt{\frac{l}{g}}$             B)  $T = \pi\sqrt{\frac{l}{g}}$   
 C)  $T = 2\pi\sqrt{\frac{g}{l}}$             D)  $T = \frac{\pi}{2}\sqrt{\frac{l}{g}}$
49. Thermocouples are generally used for temperature measurements upto  
 A) 500 °C            B) 1000 °C            C) 1500 °C            D) 2000 °C
50. The stream function for a two dimensional flow is given by  
 $\psi = 2xy + \text{constant}$ . The flow between stream lines at (1, 1) and (2, 2) would be  
 A) 3 units            B) 5 units            C) 6 units            D) 10 units

x-x-x

**Mechanical Engineering(Manufacturing Technology) (1076)**

1. Which of the following welding processes is best suited for joining two stainless steel foils of thickness 0.1 mm each?  
A) MIG                      B) TIG                      C) Plasma Arc                      D) Gas Welding
2. In foundry sand, bentonite is used:  
A) As a plasticizer                      B) For improving surface finish  
C) As a refractory material                      D) As a binder
3. Chaplets are:  
A) Core projections                      B) Core binders  
C) Core supports                      D) Mould seats to support cores
4. A sprue is:  
A) Used to control the rate of solidification  
B) Used to act as a reservoir of molten metal  
C) The horizontal path of the molten metal before the ingate  
D) None of the above
5. Blow holes in castings are due to:  
A) Low permeability of sand                      B) Very fine sand grains  
D) High moisture content of the sand                      D) Any of the above
6. The ductility of a material with work hardening:  
A) Increases                      B) Decreases  
C) Remains unaffected                      D) Unpredictable
7. Which of the following statements is wrong:  
A) Larger side rake angle produces chipping.  
B) Smaller rake angle produces excessive wear and deformation in tool.  
C) The side cutting edge angle (less than  $15^0$ ) increases tool life.  
D) Increase in nose radius decreases tool life.
8. Hardness of carbon tool steels can be increased by alloying with  
A) Tungsten                      B) Nickel  
C) Chromium and Vanadium                      D) Manganese
9. Collapsible toothpaste tubes are made by ..... process.  
A) Injection moulding                      B) Indirect extrusion  
C) Direct extrusion                      D) Impact extrusion



10. The factor responsible for the formation of discontinuous chips is
- A) Low cutting speed and small rake angle      B) Low cutting speed and large rake angle  
 C) High cutting speed and large rake angle      D) High cutting speed and small rake angle
11. In metal cutting operations, shear angle is the angle made by the shear plane with the
- A) Direction of the tool axis  
 B) Direction of tool travel  
 C) Perpendicular to the direction of the tool axis  
 D) Central plane of the workpiece
12. Flank wear depends upon the:
- A) Hardness of the workpiece and tool material at the operating temperature  
 B) Amount and distribution of hard constituents in the work material  
 C) Degree of strain hardening in the chip  
 D) All of these
13. For the same tool life, the maximum material per minute is removed by
- A) Increasing the cutting speed                      B) Decreasing the cutting speed  
 C) Increasing the depth of cut                      D) Increasing the feed rate
14. The correct sequence of the following parameters in order of their maximum to minimum influence on tool life is
- A) Feed rate, depth of cut, cutting speed      B) Depth of cut, cutting speed, feed rate  
 C) Cutting speed, feed rate, depth of cut      D) Feed rate, cutting speed, depth of cut
15. In the relation  $V T^n = C$ , the value of  $n$  for carbide tools is
- A) 0.1 to 0.2                      B) 0.20 to 0.25                      C) 0.25 to 0.40                      D) 0.40 to 0.55
16. In oblique cutting system, the chip thickness is
- A) Uniform throughout                      B) Minimum at middle  
 C) Maximum at middle                      D) Maximum at sides
17. A 60 tonnes press implies that
- A) It can handle work weighing upto 60 tonnes  
 B) Weight of the press is 60 tonnes  
 C) It can handle die weighing upto 60 tonnes  
 D) It can exert pressure upto 60 tonnes

- 18.** Size of the smallest hole that can be punched is given by  
A)  $4 t (f_s / f_c)$                       B)  $3 t (f_s / f_c)$                       C)  $4 t (f_c / f_s)$                       D)  $2 t (f_c / f_s)$   
Where  $t$  = sheet thickness  
 $f_c$  = allowable compressive stress on the punch  
 $f_s$  = ultimate shear strength of the sheet
- 19.** In piercing and punching operations, the angle of shear is provided on  
A) Die    B) Punch  
C) Half on die and half on punch                      D) May be provided anywhere
- 20.** The alloying element which can replace tungsten in high speed steels is  
A) Nickel    B) Silicon    C) Molybdenum                      D) Cobalt
- 21.** The machining of titanium is difficult due to  
A) High thermal conductivity of titanium  
B) Chemical reaction between tool and work  
C) Low tool-chip contact area  
D) None of these
- 22.** The different spindle speeds on a lathe form  
A) Arithmetical progression  
B) Geometrical progression  
C) Harmonical progression  
D) Any one of these
- 23.** In hot machining, tool is made of  
A) Tungsten carbide  
B) Brass or copper  
C) Diamond  
D) Stainless steel
- 24.** Grinding wheels should be tested for balance  
A) Only at the time of manufacture  
B) Before starting the grinding operation  
C) At the end of grinding operation  
D) Occasionally

- 25.** Trepanning is an operation of
- A) Making a cone-shaped enlargement of the end of a hole
  - B) Smoothing and squaring the surface around a hole
  - C) Sizing and finishing a small diameter hole
  - D) Producing a hole by removing metal along the circumference of a hollow cutting tool
- 26.** The factor responsible for the formation of continuous chips with built up edge is
- A) Low cutting speed and large rake angle
  - B) Low cutting speed and small rake angle
  - C) High cutting speed and large rake angle
  - D) High cutting speed and small rake angle
- 27.** The angle on which the strength of the tool depends is
- A) Rake angle
  - B) Cutting angle
  - C) Clearance angle
  - D) Lip angle
- 28.** In metal machining, the work-tool contact zone is a zone where heat is generated due to
- A). Plastic deformation of metal
  - B). Burnishing friction
  - C). Friction between the moving chip and the tool face
  - D). None of the above
- 29.** Threading is an operation of
- A) Smoothing and squaring the surface around a hole
  - B) Sizing and finishing a small diameter hole
  - C) Producing a hole by removing metal along the circumference of a hollow cutting tool
  - D) Cutting helical grooves on the external cylindrical surface

- 30.** The hardness of a grinding wheel is specified by
- A) Brinell hardness number
  - B) Rockwell hardness number
  - C) Vickers pyramid number
  - D) Letter of alphabet
- 31.** Down milling is also called
- A) Conventional milling
  - B) Climb milling
  - C) End milling
  - D) Face milling
- 32.** The type of tool used on lathe, shaper and planer is
- A) Single point cutting tool
  - B) Two point cutting tool
  - C) Three point cutting tool
  - D) Multi-point cutting tool
- 33.** The relation between tool life ( $T$ ) and cutting speed ( $V$ ) is  $VT^n = \text{Constant}$ . In this relation, the value of  $n$  depends upon
- A) Work material
  - B) Tool material
  - C) Working conditions
  - D) Type of chip produced
- 34.** A drill bit of 20 mm diameter rotating at 500r.p.m. with a feed rate of 0.2 mm/revolution is used to drill a through-hole in a mild steel plate 20 mm thickness. The depth of cut in this drilling operation will be:
- A) 0.2 mm
  - B) 10 mm
  - C) 20 mm
  - D) 100 mm

35. In Electrical discharge machining, the temperature developed is of the order of:  
 A)  $2000^{\circ}\text{C}$                       B)  $6000^{\circ}\text{C}$                       C)  $10000^{\circ}\text{C}$                       D)  $14000^{\circ}\text{C}$

36. In Electron beam machining, workpiece is held in  
 A) Vacuum chamber                      B) Dielectric medium  
 C) Electrolyte                      D) None of these

37. In plasma arc welding, the maximum temperature is of the order of  
 A)  $1800^{\circ}\text{C}$                       B)  $2000^{\circ}\text{C}$                       C)  $2800^{\circ}\text{C}$                       D)  $3500^{\circ}\text{C}$

38. Which of the following process is based on Faradays law of Electrolysis?  
 A) Electron beam Machining                      B) Laser beam machining  
 C) Electrical discharge Machining                      D) Electrochemical Machining

39. In ECM, a square hole of dimension  $5\text{ mm} \times 10\text{mm}$  is drilled in a block of copper. The current used is 5000 A, Atomic weight of copper is 63 and valency of dissolution is 1. Faradays constant is 96500 coulomb. The material removal rate in gram/sec will be:  
 A) 0.326                      B) 3.26                      C) 3150                      D) 315000

40. Match the correct combination for following metal working processes:

Processes	Associated state of stress
P : Blanking	1. Tension
Q : Stretch Forming	2. Compression
R : Coining	3. Shear
S : Deep Drawing	4. Tension and compression
	5. Tension and shear

A) P-2, Q-1, R-3, S-4                      B) P-3, Q-4, R-1, S-5  
 C) P-5, Q-4, R-3, S-1                      D) P-3, Q-1, R-2, S-4

41. The shear strength of a sheet metal is 300 MPa. The blanking force required to produce a blank of 100 mm diameter from a 1.5 mm thick sheet is close to  
 A) 45 KN                      B) 70 KN                      C) 141 KN                      D) 3500 KN

42. In a rolling process, the state of stress of the material undergoing deformation is  
 A) Pure compression                      B) Pure shear  
 C) Compression and shear                      D) Tension and shear

43. In a rolling process, sheet of 25 mm thickness is rolled to 20 mm thickness. Roll is of diameter 600 mm and it rotates at 100 rpm. The roll strip contact length will be:

- A) 5 mm                      B) 39 mm                      C) 78 mm                      D) 120 mm

44. Match the items in columns I and II.

Column I	Column II
P) Wrinkling	1) Yield point elongation
Q) Orange peel	2) Anisotropy
R) Stretcher strains	3) Large grain size
S) Earing	4) Insufficient blank holding force
	5) Fine grain size
	6) Excessive blank holding force

- A) P-6 Q-3 R-1 S-2                      B) P-4 Q-5 R-6 S-1  
 C) P-2 Q-5 R-3 S-4                      D) P-4 Q-3 R-1 S-2

45. A 4 mm thick sheet is rolled with 300 mm diameter rolls to reduce thickness without any change in its width. The friction coefficient at the work-roll interface is 0.1. The minimum possible thickness of the sheet that can be produced that can be produced in a single pass will be:

- A) 1.0 mm                      B) 1.5 mm                      C) 2.5 mm                      D) 3.7 mm

46. A 2 mm thick metal sheet is to be bent at an angle of one radian with a bend of 100 mm. If the stretch factor is 0.5, the bend allowance is



- A) 99 mm                      B) 100 mm                      C) 101 mm                      D) 102 mm

47. The neutral axis of the cross-section of a beam is that axis at which the bending stress is

- A) Zero
- B) Minimum
- C) Maximum
- D) Infinity

48. Strain energy is the

- A) Energy stored in a body when strained within elastic limits
- B) Energy stored in a body when strained up to the breaking of a specimen
- C) Maximum strain energy which can be stored in a body
- D) Proof resilience per unit volume of a material

49. A steel bar of 5 mm is heated from 15° C to 40° C and it is free to expand. The bar will induce

- A) No stress
- B) Shear stress
- C) Tensile stress
- D) Compressive stress

50. The stress induced in a body, when suddenly loaded, is \_\_\_\_\_ the stress induced when the same load is applied gradually.

- A) Equal to
- B) One-half
- C) Twice
- D) Four times

x-x-x

**Ph. D. Entrance Test – 2016****Subject: Food Technology****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*

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O.M.R. Answer Sheet Serial No.

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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:**

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1.	Most preferred material of construction in food processing equipments:	
	A) Stainless steel	B) High carbon steel
	C) Copper	D) Aluminium
2.	The dimensions of A2×1/2 Can is expressed as:	
	A) 401×411	B) 603×700
	C) 301×411	D) 211×411
3.	The thermal diffusivity is expressed as:	
	A) m/s	B) Pa.s
	C) m <sup>2</sup> /s	D) Dimensionless number
4.	Food laws are essential to:	
	A) Control food poisoning	B) Limit the sale of sub standard products
	C) Promote the health products	D) All of these
5.	The law governing the cream separation in milk is:	
	A) Newtons law	B) Bernoullis law
	C) Stokes law	D) Ficks law
6.	The unit of viscosity is expressed as:	
	A) Erg	B) Pa
	C) N.s/m <sup>2</sup>	D) N.s
7.	Jelly may be classified as:	
	A) Newtonian	B) Solid
	C) Viscoelastic	D) None of these
8.	Which one of these technologies are useful for removal of microbes only from surfaces of the foods?	
	A) Infrared heating	B) Microwave
	C) High pressure processing	D) UV light
9.	The SI units of force is:	
	A) m.kg.s <sup>-2</sup>	B) mol.kg.s <sup>-1</sup>
	C) m <sup>2</sup> .kg.s <sup>-1</sup>	D) None of these
10.	Solvent extraction of oil follow	
	A) Diffusion process	B) Leaching
	C) Centrifugation	D) Osmosis
11.	Y = exp (-k t) is a:	
	A) Linear equation	B) Non-linear equation
	C) Quadratic equation	D) Polynomial equation

12.	Which one is not a food packaging material	
A)	Polyethylene	B) Polypropylene
C)	Bi-axially oriented	D) Acetylene
13.	China, India, Indonesia, Bangladesh are major producer of	
A)	Mango	B) Poultry
C)	Rubber	D) Paddy
14.	Animal fat is extracted by	
A)	Distillation	B) Mechanical extraction
C)	Rendering	D) None of these
15.	The most heat resistant microorganism is	
A)	Str. cremoris	B) Saccharomyces cerevase
C)	Lactobacillus bulgaricus	D) Clostridium botulinum
16.	Potassium metabisulfite in processed food acts as	
A)	Antioxidant	B) Preservative
C)	Color additive	D) Favoring compound
17.	Lecithin is the by-product of	
A)	Sugar industry	B) Wine industry
C)	Oil industry	D) Meat industry
18.	Hedonic test pertains to:	
A)	Total solids evaluation	B) Total soluble solids evaluation
C)	Sensory evaluation	D) Total size evaluation
19.	Bulging of can is due to	
A)	H <sub>2</sub> gas production	B) Expansion of food product
C)	N <sub>2</sub> production	D) CO <sub>2</sub> production
20.	Maillard browning is due to	
A)	Non-enzymatic browning	B) Reaction of amino acid and sugar
C)	Reaction of glucose and amino acid	D) All of these
21.	Which of the following analytical methods can be used to distinguish flavor compounds?	
A)	Polarimetry	B) Gas chromatography
C)	Spectroscopy	D) Hydrometry
22.	Chemical name of pectin is	
A)	Methoxyl ester of poly-galactouronic acid	B) Methyl ester of poly-galactouronic acid
C)	Methyl ester of glutamic acid	D) Methoxyl ester of glutamic acid

23.	Caffeine is absent in			
	A)	Tea	B)	Coffee
	C)	Fresh fruit juice	D)	Cola drinks
24.	Heat sensitive foods should preferably be processed:			
	A)	Below atmospheric pressure	B)	At atmospheric pressure
	C)	Above the atmospheric pressure	D)	None of these
25.	The Reynolds number for turbulent fluid flow in a pipe is:			
	A)	Less than 2100	B)	Greater than 2100
	C)	Greater than 4000	D)	Greater than 10,000
26.	80°C is equal to:			
	A)	156F	B)	166F
	C)	176F	D)	186F
27.	One atmospheric pressure is equal to:			
	A)	100.135 kPa	B)	101.135 kPa
	C)	1 kPa	D)	1000 kPa
28.	Which of the following process results in least residual oil content in oil bearing materials:			
	A)	Ghani	B)	Expeller
	C)	Solvent extraction	D)	Hydraulic press
29.	Drying takes place only when dry bulb temperature of hot air is:			
	A)	Less than its wet bulb temperature	B)	Equal to its wet bulb temperature
	C)	Greater than wet bulb temperature	D)	Zero
30.	Various properties of air vapour mixture are given in			
	A)	P-V chart	B)	Hasley's Chart
	C)	Psychrometric Chart	D)	None of these
31.	Which of the following is a non-distilled beverage:			
	A)	Rum	B)	Whisky
	C)	Brandy	D)	Beer
32.	PET is:			
	A)	Polyethylene terephthalate	B)	Para ethyl toluene
	C)	Poly ethylene tube	D)	None of the above
33.	'Yield stress' term is related with			
	A)	Leaching	B)	Rheology
	C)	Newtonian fluids	D)	Solids

34.	Which one of these is a gram positive bacteria?	
	A) Pseudomonas	B) Salmonella
	C) Proteus	D) Bacillus
35.	The SPC per ml of the pasteurized milk should be:	
	A) Less than 10000	B) Less than 20000
	C) Less than 30000	D) Less than 40000
36.	The current production of wheat in India is approximately:	
	A) 200 million tonnes	B) 300 million tonnes
	C) 50 million tonnes	D) 95 million tonnes
37.	<i>C. botulinum</i> does not grow in foods having pH below:	
	A) 4.0	B) 4.6
	C) 5.0	D) 5.5
38.	Parboiling of rice is a :	
	A) Thermal treatment	B) Blanching treatment
	C) Pressure treatment	D) Hydrothermal treatment
39.	Viscosity of water is:	
	A) 1 mPa.s	B) 100 mPa.s
	C) 1 MPa.s	D) 100 MPa.s
40.	The SI units of measurement is:	
	A) ft, lb, s, °F	B) cm, g, s, °C
	C) m, kg, s, K	D) m, kg, s, °C
41.	Kitchen-top microwave oven operates at:	
	A) 915 MHz	B) 9150 MHz
	C) 245 MHz	D) 2450 MHz
42.	Water activity of foods during constant rate of drying is:	
	A) =1	B) <1
	C) >1	D) 0
43.	Recommended dryer for strawberry is:	
	A) Tray dryer	B) Fluidized bed dryer
	C) Deep bed dryer	D) Freeze dryer
44.	Activation energy is computed using:	
	A) Fick's law	B) Arrhenius law
	C) Fourier's law	D) Char's law

45.	Activation energy is expressed in:			
	A)	kJ/mol	B)	kJ/kg
	C)	kJ/L	D)	kJ/mol.K
46.	Pasteurization of milk is carried out to			
	A)	Destroy all microorganisms	B)	Destroy all pathogens
	C)	Destroy	D)	Delay growth of microorganisms
47.	Ratio of convective heat transfer to heat transfer due to conduction is			
	A)	Reynolds number	B)	Nusselt number
	C)	Prandtl number	D)	Grasshoff number
48.	Ratio of molecular diffusivity of momentum to molecular diffusivity of heat is			
	A)	Reynolds number	B)	Nusselt number
	C)	Prandtl number	D)	Grasshoff number
49.	Mango is			
	A)	Climacteric fruit	B)	Non-Climacteric fruit
	C)	Both Climacteric & Non-Climacteric fruit	D)	None of these
50.	Following gas is responsible for ripening of fruits			
	A)	Oxygen	B)	Carbon dioxide
	C)	Nitrogen	D)	Ethylene

x-x-x

**Ph. D. Entrance Test – 2016**  
**Subject: Industrial Chemistry**  
**Paper – I**

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- Q.1 Which one of the following is incombustible?  
A)  $H_2$   
B)  $CCl_4$   
C)  $C_2H_2$   
D) S
- Q.2 The following type of bonding is strongly directional in solids.  
A) Vander Waal's  
B) Ionic  
C) Metallic  
D) Covalant
- Q.3. Evaporative cooling process employs a combination of cooling and humidification in which the  
A) sensible heat is added.  
B) sensible heat is removed and the latent heat is added.  
C) latent heat is removed.  
D) sensible heat is added and latent heat is removed.
- Q.4. Brinell hardness number (BHN) of a material is a number, which has  
A) no dimension.  
B) unit of length.  
C) unity of force/area.  
D) unit of force/length.
- Q.5. Air is best heated with steam in a heat exchanger of  
A) plate type.  
B) double pipe type with fin on steam side.  
C) double pipe type with fin on air side.  
D) shell and tube type.
- Q.6. With increase in porosity, the thermal conductivity of a solid substance  
A) Increases  
B) Decreases  
C) remains unchanged  
D) may increase or decrease; depends on the solid
- Q.7. For an ideal black body  
A) absorptivity = 1  
B) reflectivity = 1  
C) emissivity = 0  
D) transmissivity = 1
- Q.8. With the increase of temperature, the Colburn jH factor  
A) increases.  
B) decreases.  
C) remains unchanged.  
D) may increase or decrease; depending on temperature.

- Q.9. Baffles in the shell side of a shell and tube heat exchanger
- increase the cross-section of the shell side liquid.
  - force the liquid to flow parallel to the bank.
  - increase the shell side heat transfer co-efficient.
  - decrease the shell side heat transfer co-efficient.
- Q.10. The heat transfer by radiation from a mild steel surface is to be reduced by reducing the emissivity of the surface. This can be best achieved by
- painting the surface black.
  - painting the surface white (with aluminium paint).
  - giving the surface a mirror finish.
  - roughening the surface.
- Q.11. Internal energy change of a system over one complete cycle in a cyclic process is
- zero
  - +ve
  - ve
  - dependent on the path
- Q.12. Solubility of a substance which dissolves with an increase in volume and liberation of heat will be favoured by the
- low pressure and high temperature.
  - low pressure and low temperature.
  - high pressure and low temperature.
  - high pressure and high temperature.
- Q.13. For a spontaneous process, free energy
- is zero
  - increases
  - decreases whereas the entropy increases
  - and entropy both decrease
- Q.14. "At the absolute zero temperature, the entropy of every perfectly crystalline substance becomes zero". This follows from the
- third law of thermodynamics
  - second law of thermodynamics
  - Nernst heat theorem
  - Maxwell's relations
- Q.15. Ammonia synthesis gas is produced from natural gas by
- thermal cracking
  - steam reforming
  - partial oxidation
  - hydrogenation
- Q.16. Urea is represented as
- $\text{NH}_2\cdot\text{CO}\cdot\text{NH}_2$
  - $\text{NH}_3\text{CO}\cdot\text{CH}_3$
  - $\text{NH}\cdot\text{CO}_2\cdot\text{NH}$
  - $\text{NH}_3\cdot\text{CO}_2\cdot\text{NH}_3$



- Q.17. The monomer of poly vinyl chloride (PVC) is
- A) chloroethene
  - B) ethylene dichloride
  - C) ethyl chloride
  - D) chloroform
- Q.18. Buna-S is also known as
- A) teflon
  - B) PTFE
  - C) SBR
  - D) polycrylates
- Q.19. Epoxy resin is
- A) not used for surface coating.
  - B) a good abrasive.
  - C) an elastomer.
  - D) a polyester.
- Q.20. Oxidation of  $\text{SO}_2$  to  $\text{SO}_3$  is favoured by
- A) low temperature and low pressure.
  - B) low temperature and high pressure.
  - C) high temperature and low pressure.
  - D) high temperature and high pressure.
- Q.21. Starting raw material for the manufacture of alum is
- A) alumina
  - B) gypsum
  - C) bauxite
  - D) ammonium bicarbonate
- Q.22. Which of the following is not produced commercially from sea water?
- A) Magnesium & potassium compounds
  - B) Common salt
  - C) Bromine
  - D) Iodine
- Q.23. Salt is the basic raw material for the manufacture of
- A) cement
  - B) glass
  - C) potteries
  - D) caustic soda
- Q.24. Blue colour is imparted to glass by the addition of
- A)  $\text{FeSO}_4$
  - B)  $\text{PbO}$
  - C)  $\text{CaO}$
  - D)  $\text{NaOH}$

- Q.25. Which is the most undesirable component in kerosene?  
A) Aromatics  
B) i-paraffins  
C) n-paraffins  
D) Naphthenes
- Q.26. Visbreaking process is used mainly for making  
A) high cetane diesel  
B) high octane gasoline  
C) fuel oil  
D) smoke free kerosene
- Q.27. Which of the following has the lowest viscosity (at a given temperature) of all?  
A) Naphtha  
B) Kerosene  
C) Diesel  
D) Lube oil
- Q.28. Which of the following reactions is undesirable in the production of catalytically reformed gasoline?  
A) Dehydrogenation of naphthene  
B) Dehydrogenation of lower paraffins  
C) Dehydrocyclisation of higher paraffins  
D) Isomerisation of paraffins
- Q.29. Which of the following is not a sulphur compound present in petroleum?  
A) Thiophenes  
B) Mercaptans  
C) Sulphones  
D) Pyroles
- Q.30. Softness of silver can be converted into hardness by alloying it with small quantity of  
A) copper & nickel  
B) zinc  
C) aluminium  
D) tin
- Q.31. The addition of antimony in tin-based alloys improves its  
A) rupture strength and hot hardness.  
B) impact strength and bonding strength.  
C) deformation resistance.  
D) wear resistance.
- Q.32. Percentage elongation of a material is a measure of its  
A) ductility  
B) brittleness  
C) toughness  
D) malleability

- Q.33. The metals occurring at the lower most position in the electromotive series
- A) do not resist corrosion.
  - B) resist corrosion very strongly.
  - C) are very brittle.
  - D) are heat insulators.
- Q.34. Most efficient and suitable dust removal equipment for removal of flyash from flue gas in a thermal power plant is the
- A) gravity settling chamber
  - B) cyclone separator
  - C) electrostatic precipitator
  - D) bag filter
- Q.35. The main industrial source of emission of hydrogen sulphide air pollutant is
- A) petroleum refineries.
  - B) coal based thermal power plants.
  - C) pulp and paper plant.
  - D) metallurgical roasting & smelting plant.
- Q.36. Which of the following is the most severe air pollutant ?
- A) hydrocarbons
  - B)  $\text{NO}_x$
  - C)  $\text{SO}_2$
  - D) CO
- Q.37. Presence of bacteria in potable (drinking) water causes
- A) turbidity
  - B) disease
  - C) bad odour
  - D) bad taste & colour
- Q.38. Pollution by particulate matter emission in the atmosphere does not take place during
- A) grinding
  - B) machining
  - C) cutting
  - D) polishing
- Q.39. Carbonaceous particles having size less than  $1 \mu\text{m}$  are called
- A) grit
  - B) aggregates
  - C) aerosols
  - D) smoke
- Q.40. Irradiation of water by ultraviolet light of suitable wavelength is commonly used for disinfection of water in
- A) food industry.
  - B) municipal sewage treatment.
  - C) petroleum refinery.
  - D) iron & steel plant.

- Q.41. Presence of a certain minimum quantity of flourine is desirable in potable water to prevent
- A) dental cavities
  - B) scale formation
  - C) water-borne disease
  - D) corrosion
- Q.42. Which is the most efficient dust removal equipment for removal of sub-micronic dust particles from blast furnace gas?
- A) Packed scrubber
  - B) Gravity settling chamber
  - C) Electrostatic precipitator
  - D) Hydrocyclone
- Q.43. White smoke coming out of the chimney of a furnace indicates the use of
- A) low excess air.
  - B) very high excess air.
  - C) gaseous fuel in the furnace.
  - D) liquid fuel in the furnace.
- Q.44. Which of the following is a secondary air pollutant?
- A) Photochemical smog
  - B) Sulphur dioxide
  - C) Nitrogen dioxide
  - D) Dust particles
- Q.45. The term Biological Oxygen Demand (BOD) is used in relation to
- A) potable water
  - B) cooling water
  - C) distilled water
  - D) industrial effluents
- Q.46. The destruction of water-borne pathogens is termed as disinfection of water. Which of the following is a water disinfectant?
- A) Chlorine
  - B) Alkalis
  - C) Benzene hexachloride
  - D) Alkyl benzene sulphonate (ABS)
- Q.47. Which of the following processes is involved in the biochemical treatment of sewage effluents?
- A) Oxidation
  - B) Reduction
  - C) Dehydration
  - D) Fermentation

- Q.48. Presence of nitrogen and phosphorous in waste water discharged into lakes and ponds causes
- A) foaming
  - B) odour nuisances
  - C) undesirable plant growth
  - D) turbidity
- Q.49. Cement Kiln is a
- A) rotary Kiln
  - B) tunnel Kiln
  - C) natural draft furnace
  - D) batch furnace
- Q.50. Which of the following is a heat treatment furnace?
- A) Muffle furnace
  - B) Annealing furnace
  - C) Reheating furnace
  - D) Rotary kiln