Q. No. MEC - 401 004 ND/B.Tech./Even

Reg/2022-23

2022-23

DESIGN OF MACHINE ELEMENTS

MEC - 401

Full Marks : 60 Time : Three Hours

The figures in the margin indicate full marks.

Group - A

Answer any *three* questions.

1. (a) What do you understand from the following terminologies?

(i) Margin of safety, (ii) Factor of safety;

Explain with suitable examples.

(b) Develop an analytical relation between margin of safety and factor of safety.

(c) Mention, in short, the factors which appear to be important in deciding the numerical value of factor of safety.

(d) The principal stresses induced at a critical point in a machine element made of steel 50C4 are given below :

$$\sigma_1 = 200 \text{ MPa}, \ \sigma_2 = 150 \text{ MPa and } \sigma_3 = 0$$

P.T.O.

Calculate the value of factor of safety, using Maximum shear stress theory of failure.

Also give your comment on your computed result of factor of safety.

Assume that the yield strength of steel 50C4 material is 460 MPa. 2½+2+2½+3=10 [CO1]

2. (a) What are the advantages of a hollow shaft over a solid shaft? Explain with a suitable example.

(b) Determine the inside and outside diameters of a hollow shaft which will replace a solid shaft made of the same material. The hollow shaft should be equally strong in torsion, yet weigh half as much per meter length.

(c) What do you understand from the term "axle" in machine design? Explain with a suitable example.

2½+5+2½=10 [CO2]

3. (a) Distinguish between a thin cylinder and a thick cylinder with suitable examples.

(b) Derive an analytical expression for the wall thickness of a thick cylinder made of ductile material on the basis of maximum shear stress theory of failure. Assume that the ends of the cylinder are open.

(c) A solid steel shaft of 75 mm diameter is pushed into a steel jacket cylinder of 50 mm outside radius and of length 200 mm by applying a force. If a torque of 6 kN-m is required to just create relative rotation between the two. Find the diametral interference and maximum

tangential stress in jacket cylinder. Assume that the solid shaft and jacket cylinder are made of the same material.

Assume the following data :

Young's Modulus E for steel material = 2.1×10^5 MPa.

Coefficient of static friction $\mu = 0.3$

2½+3+4½=10 [CO3]

4. (a) Draw a neat sketch of any S-N diagram for steel material and explain the concept of endurance limit. Symbol S and symbol N indicate stress amplitude and fatigue life respectively for zero mean stress.

(b) Derive an analytical relation between S_N and N for finite high cycle fatigue life from 10^3 cycles to 10^6 cycles. S_N indicates stress amplitude with zero mean stress for fatigue life N.

(c) What is notch sensitivity? Explain with a suitable example.

3½+4+2½=10 [CO4]

5. (a) What is modulus of toughness? Compare the modulus of ductile material with that of brittle material.

(b) A crack is observed at the middle of a very long round steel rod shown in figure Fig. 5a after the weight W falls freely under gravity from a height h and strikes the pan. Subsequently the rod was redesigned as shown in figure Fig. 5b. Diameter of rod at the middle is increased from d to 2d. Give your comment on the modification of the design and analytically justify your comment.

P.T.O.

Symbol L and symbol K_1 indicate respectively the length of the rod and the theoretical stress concentration factor at the change of cross-sections of the rod.

(c) What do you understand from ductile to brittle transition of metals? 3+4½+2½=10 [CO4]

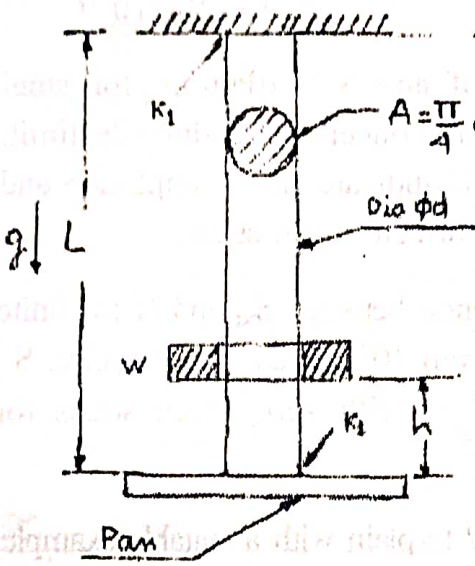


Fig. Q 5a

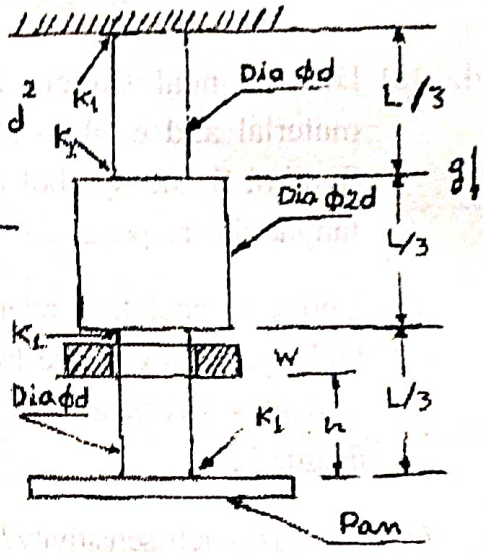


Fig. Q 5b

Group - B

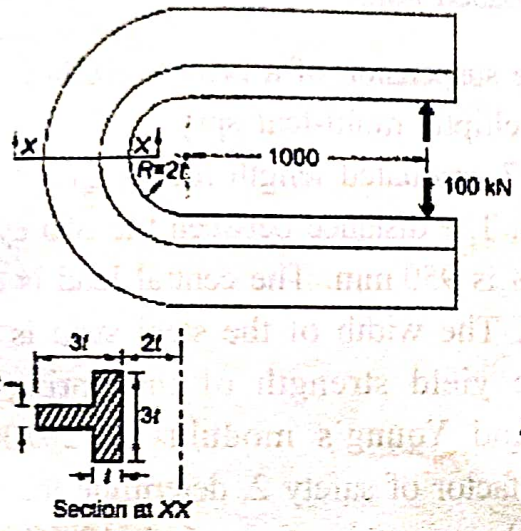
Answer any *three* questions.

6. (a) Briefly explain the advantages of standardization in respect of machine design.

(b) What are the factors to be considered for selection of material for a machine element?

(c) What is the purpose of shot peening in spring manufacturing?

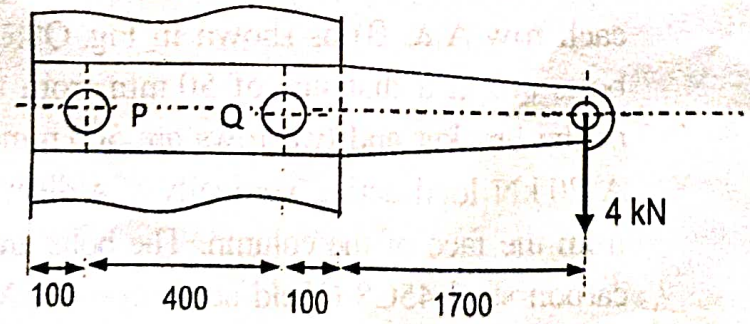
(d) The C-frame of a 100 kN capacity press is shown in Fig. Q6. The material of the frame is grey cast iron FG 220 (S_{ut} = 220 MPa) and the factor of safety is assumed to be 3. Determine the dimensions of the cross-section of the frame. 2+1½+1½+5=10 [CO1, CO2]



All dimensions are in mm

Fig. Q6

7. (a) A steel bar of 10×15 mm is cantilevered with two M12 bolts (P & Q) to support a static load of 4 kN as shown in Fig. Q7.



All dimensions are in mm

Fig. Q7

P.T.O.

(i) Draw equivalent load diagram. What are the different types of resisting loads will act on each bolt and find out direction and line of action?

(ii) Determine the magnitude, direction and line of action of resultant resisting force and induced stress on heavily loaded bolt.

(b) The rear axle suspension of a heavy vehicle is provided with a semi-elliptic multi-leaf spring. The spring has 1 master leaf, 7 graduated length leaves and 2 extra full length leaves. The distance between the two eyes of the master leaves is 950 mm. The central load is estimated to be 22 kN. The width of the steel strip is given as 80 mm. The yield strength of the spring steel is 1480 MPa and Young's modulus is 207000 MPa. Assuming a factor of safety 2, determine the thickness of the spring leaves. 5+5=10 [CO3, CO2]

8. (a) What do you mean by tensile stress area of a screw and pre-load in bolted joint?

(b) A cast iron bracket is attached to a steel column by means of four identical bolts, in two rows (two bolts in each row A & B) as shown in Fig. Q8. Bottom row of bolts are at a distance of 50 mm from the lower edge of the bracket and two rows are 500 mm distance apart. A 20 kN load acting vertically at a distance of 400 mm from the face of the column. The bolts are made of plain carbon steel 45C8 (Yield strength = 400 MPa) and factor of safety is 3. Determine the size of the bolts.

3+7=10 [CO3]

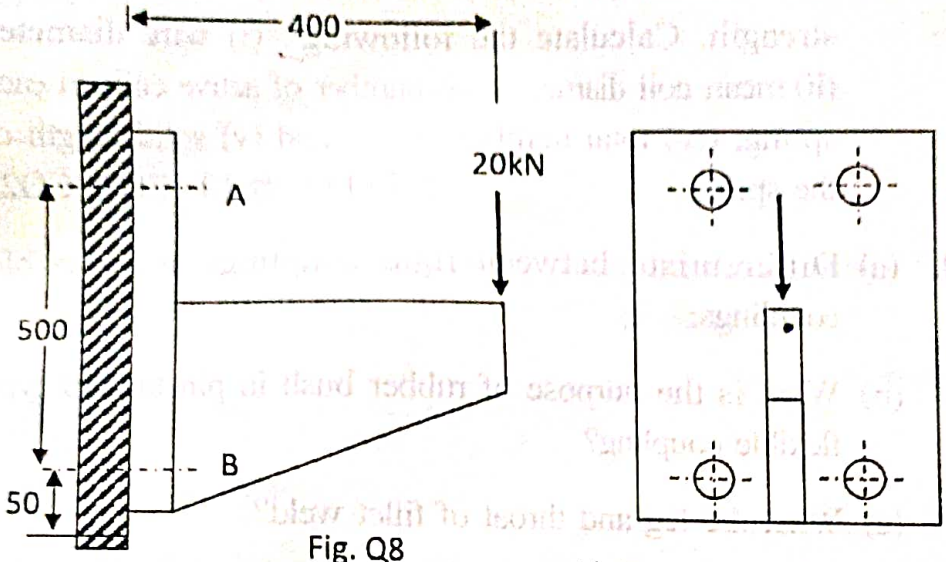


Fig. Q8

All dimensions are in mm

9. (a) How will you designate metric coarse series and fine series threads?

(b) Draw a metric V thread and show the (i) thread angle and (ii) pitch.

(c) What type of stress is induced in helical torsion spring?

(d) What are the applications of multi-leaf springs?

(e) A closed coil helical compression spring is subjected to an axial force, which varies from 1200 N to 2100 N. Over this range of force, the deflection of the spring should be 4.5 mm. The spring index can be taken as 5. The spring has square and ground ends. The spring is made of cold-drawn steel wire with ultimate tensile strength of 1050 MPa and modulus of rigidity of 81370 MPa. The permissible shear stress for the spring

P.T.O.

wire should be taken as 50% of the ultimate tensile strength. Calculate the following : (i) wire diameter, (ii) mean coil diameter, (iii) number of active coils in each spring, (iv) total number of coil and (v) solid length of the spring. 2+1+1+1+5=10 [CO3, CO2]

10. (a) Differentiate between rigid couplings and flexible couplings.

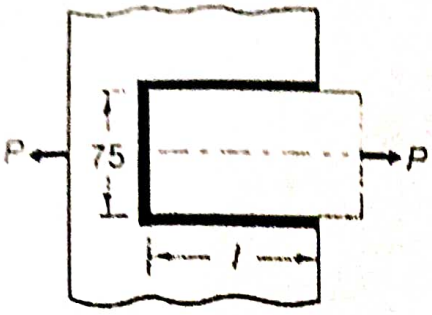
(b) What is the purpose of rubber bush in pin bushed type flexible coupling?

(c) What are leg and throat of fillet weld?

(d) A rigid flange coupling is used to transmit 20 kW power at 720 rpm. There are four bolts and the pitch circle diameter of bolts is 120 mm. Assume that bolts are fitted in reamed and ground holes. The bolts are made of plain C-steel 40C8 (Min. Yield strength = 380 MPa) and the factor of safety is 2.5. Determine the diameter of the shank of the bolts.

(e) A plate, 75 mm wide and 10 mm thick, is joined with another steel plate by means of single transverse and double parallel fillet welds, as shown in Fig. Q10. The joint is subjected to a maximum tensile force of 55 kN. The permissible tensile and shear stresses in the weld material are 70 MPa and 35 MPa respectively. Determine the required length (l) of each parallel fillet weld.

1+1+1+3+4=10 [CO3]



All dimensions are in mm

Fig. Q10

Course Outcomes :

CO1 : Acquire an idea about engineering materials in machine design.

CO2 : To learn the basic design procedure for different elementary machine elements.

CO3 : To learn about design of bolt and welded joints, pressure vessels etc.

CO4 : Introduction to fatigue design.

Q. No. MEC - 402 005 ND/B.Tech./Even

Reg/2022-23

2022-23

CASTING, FORMING AND WELDING

MEC - 402

Full Marks : 60 Time : Three Hours

The figures in the margin indicate full marks.

Answer *all* the questions.

Make a neat and well labelled diagram wherever necessary.

1. What is pattern? Explain following types of patterns with suitable diagram : (a) Gated pattern; (b) Loose piece pattern 5 [CO1]

2. Explain the requirements of good gating system. 5 [CO1]

3. Explain the use of Gates in casting. Define different types of gates with neat sketch used in casting. 5 [CO1]

4. What is liquid shrinkage? What is the role of riser during liquid shrinkage in casting? Define different types of risers with neat sketch used in casting. 5 [CO1]

5. Explain hot working and cold working process. List out the difference in both the processes. 5 [CO4]

6. Explain precision forging process with sketch. What is the difference between conventional and precision forging process? 5 [CO4]

7. Explain orbital forging method with suitable diagram. 5 [CO4]

8. Define ring rolling and thread rolling method with suitable diagram. 5 [CO4]

9. With a neat and well labelled diagram clearly show the different resistances that are active during Resistance Welding. Note: The diagram should be co-related with a basic Spot Welding set up. Make the diagram only, no explanations are needed. 10 [CO3]

10. Answer the following in brief : 3×3+1 (last part) [CO2]

    (a) For welding Aluminum components which type of polarity is generally used? Why?

    (b) Which portion of Arc welded component is most susceptible to failure? Why?

    (c) In case of Resistance Welding, for unsymmetrical heat input, which side does the weld nugget shifts? Why?

    (d) The electrode in GTAW is made of which material?

Course Outcomes :

CO1 : Learn different types of casting process.

CO2 : Select suitable manufacturing process for typical components.

CO3 : Learn the various welding process.

CO4 : Explain the concept of forging, rolling process and drawing.

Q. No. MEC - 403 004 ND/B.Tech./Even

Reg/2022-23

2022-23

HEAT AND MASS TRANSFER

MEC - 403

Full Marks : 60 Time : Three Hours

The figures in the margin indicate full marks.

Answer *all* the questions.

Assume suitable data if needed.

Notations have their usual meaning if not mentioned otherwise.

Section - A

1. Argue that a conducting layer, heat engine and refrigerator exhibit at least some qualitative similarities with a simple one-dimensional insulating system. Now show that the insulation system is best effective when work extraction is achieved at the mid-point of the insulation. 5 [CO1, CO5]

2. Realized that it is possible to cast a general differential equation to represent a generalized conservation principle for any transport variable. Write down the general conservation principle for a dependent variable (transport quantity) and hence explain the physical meaning of different terms. Observing the qualitative similarity, express the conservation of turbulent kinetic energy for the two-equation $(k-\varepsilon)$ turbulent model. 5 [CO2, CO3, CO4]

P.T.O.

3. In a steady two-dimensional situation for the generalized transport equation, convection and diffusion competes with each other. Show that the solution of the problem is a parametric function of *Péclet number* (*Pe*). Hence comment that the non-dimensional group represented by the *Péclet number* also exhibits the same competition between two mechanisms of heat transfer : convection and diffusion.

5 [CO2, CO3]

4. The density variation of a fluid can be given by a two parameter model of the functional form $\rho = \rho(T, P)$ where ρ is the local density at a temperature T and pressure P. From a large number of experiments it is learnt that for most of the natural convection configurations in engineering applications the contribution to the density due to pressure variation is negligible. On following *Oberbeck-Boussinesq* approximation prove that for a purely natural convection configuration the buoyancy force scales with $g\beta\Delta T$ where g and β are gravitational acceleration and coefficient of volumetric thermal expansion, respectively. 5 [CO3]

Section - B

5. Write the definition of mass transfer.

   Write Fick's law of diffusion.

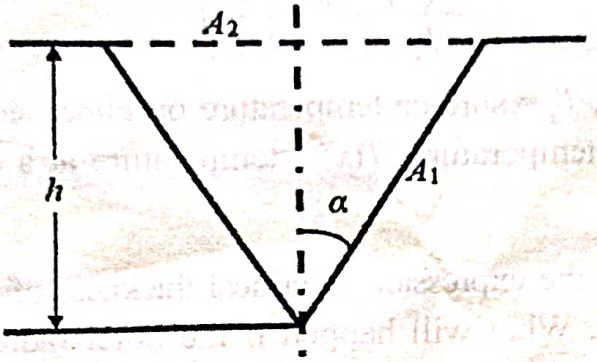
   Explain the effect of adding N number of radiation shields on the net heat transfer. 5 [CO5]

6. What do you mean by surface radiative resistance and space resistance?

$$\frac{\theta}{\theta_0} = \frac{\sinh m(L-x) + \frac{h}{mk}\cosh m(L-x)}{\frac{h}{mk}\sinh mL + \cosh mL}$$

$$\frac{e^{Pe} - 1}{e^{Pe} - 1} \qquad \frac{\rho u L}{\Gamma}$$

Calculate the view factor of the inner surface of a conical cavity (shown in Fig. below) with respect to itself. The cavity has a semi-vertex angle α and height h. 5 [CO4]



7. Derive an expression for the net radiation exchange (q_{12}) for two long infinite concentric cylinders.

   Calculate the rate at which heat is lost by radiation from a 2 cm diameter opening in the wall of an electrical furnace. The furnace is at a temperature of 1000°C and the surrounding surfaces are at 27°C. Assume the opening to act like a black surface. 5 [CO4]

8. Sketch and explain the Oppenheim's network representation for a three-surface enclosure with one surface reradiating. 5 [CO4]

Section - C

9. (a) What is contact resistance? How does it affect the heat transfer process? Mention about the different methods of minimizing contact resistance. 3 [CO2]

P.T.O.

(b) Derive the non-dimensional form of temperature for a plane wall of thickness $2L$ with uniform heat generation q per unit volume as

$$\frac{T(x)-T_0}{T_s-T_0}=\left(\frac{x}{L}\right)^2$$

where, T_s = surface temperature on either side, T_0 = mid-plane temperature, $T(x)$ = temperature at a distance x. 4 [CO2]

(c) Derive the expression of critical thickness of insulation on a pipe. What will happen if the outer radius of pipe is smaller than the critical radius of insulation? 3 [CO2]

10. (a) Starting from the energy balance, derive the expression of non-dimensional form of temperature for an infinitely long cylindrical fin of diameter 'd', base temperature 'T_0', convective heat transfer coefficient 'h' and temperature of ambient condition 'T_a'. Derive also the expression of heat conducted through the base of the fin. 5 [CO2]

(b) Two rods A and B of equal diameter and equal length, but of different materials are used as fins. The both rods are attached to a plain wall maintained at 160°C, while they are exposed to air at 30°C. The end temperature of rod A is 100°C, while that of the rod B is 80°C. If the thermal conductivity of rod A is 380 W/m.K, calculate the thermal conductivity of rod B. This fin can be assumed as short with end insulated. 5 [CO2]

Q. No. EEC - 432 006 ND/B.Tech./Even

Reg/2022-23

2022-23

ELECTRICAL MACHINES

EEC - 432

Full Marks : 60 Time : Three Hours

The figures in the margin indicate full marks.

Answer any *five* questions.

1. (a) Describe the working principle of a transformer.

   (b) Define efficiency of a transformer. State and prove the condition for maximum efficiency of a transformer.

   (c) The primary and secondary windings of a 500 kVA, 6000/400 V single-phase transformer have resistances of 0.4 Ω and 0.0015 Ω respectively. The iron loss is 3.2 kW. Calculate the efficiency at (i) full-load and (ii) half-load, assuming the power factor of the load to be 0.8. 3+(1+3)+5 [CO1, CO2 & CO4]

2. (a) Draw and explain the equivalent circuit of a single-phase transformer. How can the parameters of the equivalent circuit of a single-phase transformer be found from open-circuit and short-circuit tests?

   (b) Draw the phasor diagram of a transformer for lagging pf load.

P.T.O.

(c) A 100 kVA, 2200/220 V, 50 Hz single-phase transformer gave the following test results :

O.C. test (HV winding open) : 220V, 10 A, 440 W

S.C. test (LV winding short-circuited): 100 V, 20 A, 800 W

Find the parameters of the equivalent circuit as referred to LV side. 5+2+5 [CO1, CO2 & CO4]

3. (a) Classify DC machines based on the methods of excitation. Draw and explain the open-circuit and load characteristics of a DC shunt generator.

(b) Explain the methods of speed control of a DC shunt motor and show how the speed may be varied above and below the rated value.

(c) A 4-pole shunt generator with lap connected armature having field and armature resistances of 50Ω and 0.1Ω respectively supplies a 2400 W load at a terminal voltage of 100 V. Calculate the total armature current, the current per armature path and the generated emf.

4+4+4 [CO2, CO3 & CO5]

4. (a) What is the necessity of starter for starting of a DC motor?

(b) Derive the expressions for speed and torque of a DC motor. Explain the speed-current, torque-current, and speed-torque characteristics of DC shunt motor.

(c) A 230V DC shunt motor is taking a current of 50 A. Resistance of shunt field is 46Ω and the resistance of

the armature is 0.02Ω. There is a resistance of 0.6Ω in series with the armature and the speed is 800 rpm. What alteration must be made in the armature circuit to raise the speed to 850 rpm, if the torque remains the same? 2+(3+2)+5 [CO2, CO3 & CO5]

5. (a) Explain how rotating magnetic field is produced in a 3-phase induction motor. Why does an induction motor never run on synchronous speed?

   (b) A 440 V, 50 Hz, 6-pole, three-phase induction motor draws an input power of 76 kW from the mains. The rotor e.m.f. makes 120 complete cycles per minute. Its stator losses are 1 kW and rotor current per phase is 62 A. Calculate(i) rotor copper losses per phase; (ii) rotor resistance per phase and (iii) the developed torque. (4+2)+6 [CO2 & CO3]

6. (a) What is the effect of introducing resistance in the rotor circuit of an induction motor? In which type of motor is it possible? Deduce the condition of maximum torque at starting.

   (b) Draw and explain the torque-slip characteristics of a three-phase induction motor.

   (c) A 3-phase induction motor takes a starting current which is 5 times full-load current at normal voltage. Its full-load slip is 4%. What auto-transformer ratio would enable the motor to be started with not more than twice the full-load current drawn from the supply? What would be the starting torque under this condition?

(2+1+2)+3+4 [CO2, CO3 & CO5]

P.T.O.

7. (a) Distinguish the salient pole and non-salient pole type rotor of synchronous machines.

(b) Explain the principle of operation of a synchronous motor. A synchronous motor is not a self-starting — give reason.

(c) A 1200 KVA, 3300 V, 50 Hz, three-phase, star connected alternator has armature resistance of 0.25 ohms. A field current of 40 A produces a short circuit current of 200 A and open circuit emf of 1100 V. Calculate the voltage regulation on (i) full load 0.8 power factor lagging, and (ii) full load 0.8 power factor leading.

3+(2+2)+5 [CO2, CO3 & CO5]

Course Outcomes :

CO1 : Theory of electromechanical energy conversion, the concepts of voltage generation and fundamental torque equation.

CO2 : Basic understanding of the principles of operation and construction of direct and alternating current machines and transformers.

CO3: A study of theory and concept of Electric Machines (AC & DC).

CO4 : Deriving equivalent circuit of electrical machines.

CO5 : Studying the performance and characteristics of Electrical machines (AC & DC).

Q. No. CSO - 441 0 61

ND/B.Tech./Even

Reg/2022-23

2022-23

DATA STRUCTURE AND ALGORITHM

CSO - 441

Full Marks : 60 Time : Three Hours

The figures in the margin indicate full marks.

Answer the questions in the order they appear in the question paper.

Group - A

1. Linked lists are best suited :

   (a) for relatively permanent collections

   (b) when the size of structure is constantly changing

   (c) for both the above situations

   (d) for none of the above 1 [CO1]

2. Which of the following data-structures are indexed structures?

   (a) linear arrays

   (b) linked lists

   (c) both of the above

   (d) none of the above 1 [CO2]

P.T.O.

3. What is the time complexity of adding 2 numbers as a linked list?

   (a) O(max(n, m)) // n and m are sizes of the list

   (b) O(n + m)

   (c) O(min(n, m))

   (d) None of the above 1 [CO1]

4. Which of the following algorithms is of divide and conquer type?

   (a) bubble-sort

   (b) insertion sort

   (c) quick sort

   (d) all of the above 1 [CO5]

5. The time complexity of the following algorithm is :

   sum(a, n) {s = 0; for i = 1 to n{s = s+a[i]; } return s;}

   (a) 3n+2

   (b) 2n+3

   (c) n+1

   (d) 2n+2 1 [CO3]

6. In a normal queue, the underflow situation occurs when :

   (a) rear = max – 1

(b) front = – 1

(c) rear = front

(d) rear = size – 1 1 [CO2]

7. What will be the output of the following Python code snippet?

d = {"john":40, "peter":45}

(a) "john", 40, 45, and "peter"

(b) "john" and "peter"

(c) 40 and 45

(d) d = (40:"john", 45:"peter") 1 [CO1]

8. To merge 4 sorted files having 10,10,10 and 10 records. How much time it will take?

(a) O (100)

(b) O (64)

(c) O (40)

(d) O (10000) 1 [CO6]

9. Which of the following creates a worst-case scenario for linear search?

(a) The element to be searched is at the first position

(b) The element to be searched is at the middle position in the list

P.T.O.

(c) The element to be searched is either at the last position in the list or not in the list

(d) The element to be searched is at the second position in the list 1 [CO5]

10. Choose the correct option with reference to below Python code.

```
def fn(a):
        print(a)
x=90
fn(x)
```

(a) x is the formal argument.

(b) a is the actual argument.

(c) fn(x) is the function signature.

(d) x is the actual argument. 1 [CO3]

Group - B

11. Find the output of the given Python program.

```
a = 25
if a < 15:
    print("Hi")
if a <= 30:
    print("Hello")
else:
    print("Know Program")
```

(a) Hi

(b) Hello

(c) Know Program

(d) Compiled Successfully, No Output. 2 [CO1]

12. What will be the output of the following code snippet for the list 1->2->3->4->5?

```
void solve (ListNode* head) {
   while (head != NULL)  {
                    print ( head -> data)
                    head = head -> next
        }
}
```

(a) 1 2 3 4 5

(b) 5 4 3 2 1

(c) 1 3 5 2 4

(d) 2 4 1 3 5 2 [CO1]

13. What will this given code do?

```
def POP(stack):
if len(stack)= =0:
print("Underflow")
else:
stack.pop()
```

(a) Will delete first element from given stack

(b) Will delete last element from given stack

P.T.O.

(c) Will produce error as no index is passed to pop

(d) Will delete all the elements from given stack 2 [CO2]

14. What does the following code snippet do?

```
int solve (ListNode* list) {
   ListNode* fast = list
      ListNode* slow = list
      While (fast -> next != NULL && fast -> next ->
      next != NULL) {
         fast = fast -> next -> next
         slow = slow -> next
      }
      return slow -> data
}
```

(a) Find middle element in the linked list

(b) Find last element in the linked list

(c) Find first element in the linked list

(d) None of the above 2 [CO2]

15. Predict the output of given code :

```
R = 0
Numlist [3.4.6]
Numlist.append(2)
R=r+numlist.pop()
R=r+numlist.pop()
```

(a) 8

(b) 7

(c) 0

(d) Error

2 [CO3]

16. Apply Bubble sort on the following array and find out what will be the intermediate sequence of 37, 54, 21, 85, 68, 12, 9, and 57 after the second pass?

(a) 21, 37, 12, 9, 54, 57, 68, 85

(b) 37, 21, 54, 68, 12, 9, 57, 85

(c) 21, 12, 9, 37, 54, 57, 68, 85

(d) 21, 37, 54, 12, 9, 57, 68, 85

2 [CO6]

17. The following python code is best suitable for :

```
for(int j=arr.length-1; j>=0; j--)
{
    for(int k=0; k<j; k++)
    {
        if(arr[k] > arr[k+1])
        {
            int temp = arr[k];
            arr[k] = arr[k+1];
            arr[k+1] = temp;
        }
    }
}
```

P.T.O.

(a) Linear search

(b) Bubble Sort

(c) Merge Sort

(d) None of the above 2 [CO5]

18. What will be the value of "sum" after the following code snippet terminates?

```
void solve(ListNode* root)  {
  sum = 0
  while (root != NULL)  {
     sum += root -> val
     root = root -> next
  }
  Print(sum)
}
```

(a) 20

(b) 25

(c) 15

(d) 1 2 [CO2]

19. What is the output of the following code?

```
for i in range (5):
  if i == 3:
     continue
  print(i)
```

(a) 0,1,2

(b) 0,1,2,3

(c) 1,2,3

(d) 0,1,2,4 2 [CO3]

20. What does the following code snippet do?

```
int solve (ListNode* list)  {
   ListNode* fast = list;
      ListNode* slow = list;
      while(fast -> next != NULL && fast-> next ->
      next != NULL)
{
         fast = fast -> next -> next;
         slow = slow -> next;
      }
      return slow -> data;
}
```

(a) Find middle element in the linked list

(b) Find last element in the linked list

(c) Find first element in the linked list

(d) None of the above 2 [CO1]

P.T.O.

Group - C

Answer any *six*.

21. Write a program/pseudo code to implement Merge Sort. Explain its working principle using with an example. 5 [CO5]

22. Write a program/pseudo code to insert a new element at the first and last position of a doubly linked list. 5 [CO1]

23. Write a program/pseudo code to implement Binary Search. Explain its working principle using with an example. 5 [CO6]

24. Create a STACK of n elements using list in python and write a python program/pseudo code to implement the following operations on that STACK :

    - PUSH
    - POP
    - OVERFLOW & UNDERFLOW

    5 [CO2]

25. Write down a python program/pseudo to implement bubble sort and compute its complexity. Explain its working principle using with an example. 5 [CO5]

26. Write a python program to count a total number of duplicate elements in a list. 5 [CO2]

27. Write a program to compute the power of any number (for example 2^5) using recursion. 5 [CO1]

28. Write a python program to display the Fibonacci sequence using Recursion and compute its complexity. 5 [CO6]