End Semester Exam

HS 102

Science, Technology and Society

Marks-45

Time- 180 mins

Answer the following questions-

1. According to Karl Marx what is Alienation? Name the types of Alienation? Give Examples. (3)

2. Bart was stuck in traffic. He just wanted his vehicle to move! Enraged at the situation, Bart pulled his car onto the shoulder and sped forward, not caring that he was clipping people's side mirrors as he tried to get ahead of the cars in front of him.
Which personality theory made Bart behave in such a manner in the traffic? Explain the theory. (2)

3. George Bernard Shaw said that science never solves a problem without creating ten more. Illustrate. (2)

4. What is the concept of social class according to Karl Marx? (3)

5. Explain Positivism and Logical Positivism? (2)

6. The inherent vice of capitalism is the unequal sharing of blessings; the inherent virtue of socialism is the equal sharing of miseries. Comment. (3)

7. What is postcolonialism? What do you understand by Eurocentric view of history? (2)

8. We live in a society exquisitely dependent on science and technology and yet have cleverly arranged things so that almost no one understands science and technology. Elaborate. (2)

9. Maggie couldn't remember the answer to test question no.12, even though she had studied. Nate was the smartest kid in the class, and from where Maggie sat, she could see his answers if she turned her head slightly. When Mrs. Archer turned her back, Maggie almost cheated, but her conscience stopped her because she knew it was wrong. Instead, Maggie took a guess at the answer and then turned in her paper.
Name the personality theory of Maggie and also explain the same. (2)

10. Write a short note on Nehruvian Science? (2)

11. What is FRS? Write about any three Indian Scientists who received the FRS before 1950. (2)

12. Katie's mom had given her $25 to purchase groceries for dinner that night. At the mall, Katie saw shoes that she really wanted, and was tempted to use the money from her mom to make the purchase. However, if she spent the money on shoes, she wouldn't have enough to buy the groceries, so she decided she better not buy the shoes.
Name the personality theory of Katie and also explain the same. (2)

13. What is BC/AD and BCE/CE? Why have some people adopted BCE/CE in place of BC/AD? (2)

14. What is Freudianism? Write a short note on Interpretation of Dreams. (2)

15. Describe Sigmund Freud's Personality Theory. (3)

16. What is the Oedipus Complex? Write a short note on the Greek mythology on Oedipus. (3)

17. What is Falsificationism theory? (2)

18. What is Electra Complex? Illustrate. (2)

19. What was the chemical found in the water and why was it a problem? How would you evaluate/justify the efforts by PG&E to "bury" the facts of what they were doing to the water in Hinckley? Was it done on purpose? (2)

20. In India, I personally believe yes, there is a clear fear of unknown; there's a lot of risk aversions in science and technology. They want predictability in everything they do, and it starts from people. It starts from investors. It starts from the regulators. You see that mindset across the society. Comment. (2)

Left (Set A)

BTech (CS/IT): Semester II
Introduction to Data Structure (CS102)
End-Semester Exam (Marks: 25) **Time: 100 Minutes**

Instructions:
(a). All questions are compulsory and carry equal marks.
(b). Answers should be written to the point in a minimum number of words.
(c). You may divide a page into multiple columns to avoid wastage of pages.
(d). Writing any type of word on the question paper during the exam is strictly prohibited.

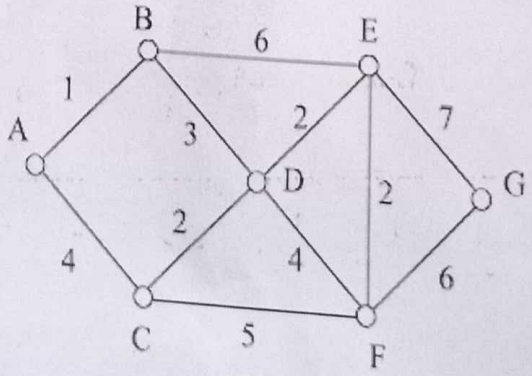
Questions

Q1. Write properties of RB Tree. Write all the cases in the RB-Tree insertion algorithm. Insert the following sequence of elements (one-by-one) into an empty R-B Tree: < 30, 20, 10, 15, 25, 23, 40, 35, 42, 1 >. Demonstrate the outcome of each element's insertion operation pictorially. (5)

Q2. Write an algorithm to find the number of components in a Graph. Give and discuss the time complexity of the algorithm. (5)

Q3. Why an infix form of expression is not used for evaluation in a machine? Consider the infix expression (A+B)*(C*D-E)*F/G and convert it into a Prefix expression. Write an algorithm to evaluate a Prefix form of an expression and give its time complexity. (5)

Q4. Define Spanning Tree. Find the minimum cost spanning tree using Kruskal's algorithm in the following graph. (5)



Q5. Write Heap Sort algorithm. Sort the following sequence of elements < 30, 20, 10, 15, 25, 23, 40, 35, 42, 1 > using Heap sort. Demonstrate the outcome of each iteration. Give and discuss the time complexity of the Heap sort algorithm. (5)

----- Good Luck -----

INDIAN INSTITUTE OF INFORMATION TECHNOLOGY VADODARA

End Semester Examination (AY 2021-22, Winter Semester)
Course: EE100 Basic Electrical Engineering

Full Marks: 100 **Date:11/08/2022** **Time: 11:40 AM - 1:20PM**

Instructions:

1. *The exam is a closed book/resource.*
2. *Attempt **ALL** the questions.*
3. *Each question carries 20 marks.*
4. *Answer each question sequentially beginning on a new page.*
5. *Only a scientific calculator is permitted to use.*

Ques. 1: A core with three legs is shown in Fig.1 below. All the dimensions are provided in the figure and the core depth is 5 cm. There are 200 turns of copper wire on the leftmost leg and current of 2A is flowing through it. The relative permeability of the core can be assumed to be 1500 and constant. Assume a 4% increase in the effective area of the air gap due to fringing effects.

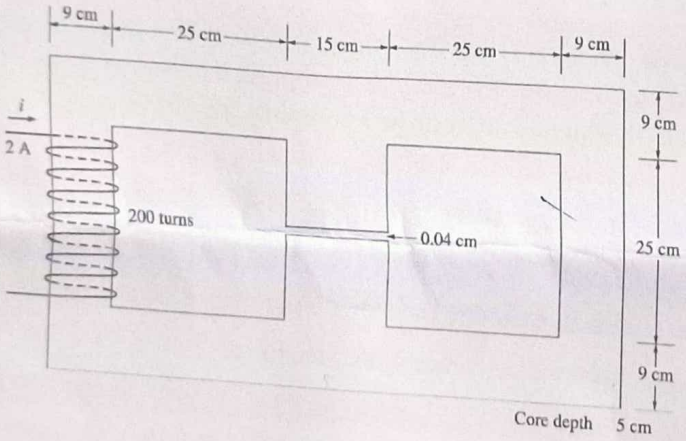


Fig. 1

Determine the followings:

a) Total reluctance of the core. ⇒ $\mathcal{R} = l/\mu A$

b) Total magnetic flux in the core.

c) Magnetic flux in each of the three legs of the core.

d) Magnetic flux density in each of the three legs of the core.

Ques. 2: A linear dc machine shown in Fig. 2 has a battery voltage of 240 V, an internal resistance of 5 Ω and a magnetic flux density of 0.5 T directed into the page.

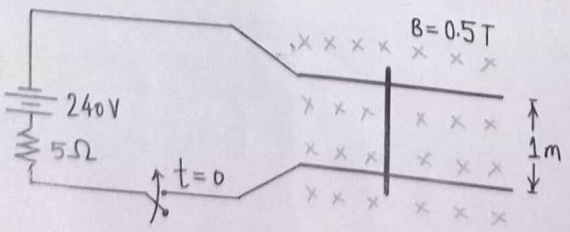


Fig. 2

a) What is this machine's maximum starting current? What is its steady-state velocity at no load?

b) Suppose that a 50 N force pointing to the right were applied to the bar. What would the steady-state speed be? How much power would the bar be producing or consuming? How much power would the battery be producing or consuming? Is this machine acting as a motor or as a generator?

c) Now suppose a 50 N force pointing to the left were applied to the bar. What would the new steady-state speed be? Is this machine a motor or a generator now?

d) Assume that a force pointing to the left is applied to the bar. Calculate speed of the bar as a function of the force for values from 0 N to 100 N in a uniform step of 10 N. Plot the velocity of the bar versus the applied force.

e) Assume that the bar is unloaded and that it suddenly runs into a region where the magnetic field is weakened to 0.1 T. How fast will the bar go now?

Ques. 3: You have been provided with single phase 220 V, 50 Hz power supply and a set of electrical coil windings with suitable power ratings. Answer the followings:

a) Is it possible to produce rotating magnetic flux density (in space) by powering the coil winding(s)?

b) If your answer to part a) is 'Yes' then justify with a suitable circuit and its analysis. However, if your answer is 'No' then propose additional requirements (if any) with a suitable circuit design and analysis to accomplish the above task.

Ques. 4: For a synchronous generator, answer the following questions:

a) What is armature reaction? What is its effect?

b) How can the effects of armature reaction on the phase voltage be modeled?

c) What is the synchronous reactance of the machine?

d) What is the full equivalent circuit of a three-phase synchronous generator?

e) What is the phasor diagram at (*i*) unity, (*ii*) lagging and (*iii*) leading power factors ?

f) Why for a given field current and magnitude of load current, the terminal voltage is lower for lagging loads and higher for leading loads?

Ques. 5: For an induction motor, answer the following questions:

a) What are the two different types of induction motor rotors? Discuss their design principles and discuss the physical mechanism through which torque is induced in the rotor.

b) Why does an induction motor speed up to near-synchronous speed, but never reach to synchronous speed? Express the mechanical speed of the rotor shaft in terms of synchronous speed and slip.

c) Why are induction motors sometimes called a rotating transformer?

d) How the frequency of induced voltage in the rotor is related to mechanical speed and sync speed of the machine ?

e) How does rotor current depend on rotor speed? Draw the characteristics curve.

f) Plot and discuss the output torque-versus-speed characteristic of an induction motor?

MA102: Mathematics II: Intro. to Discrete Mathematics

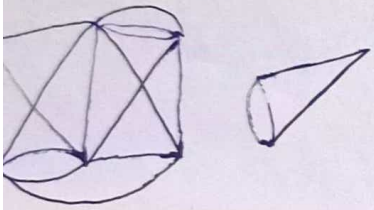
Endsem (Pen-Paper) Examination — Marks: 60

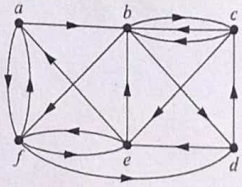
Question Paper: **Right** — Date: August 12, 2022

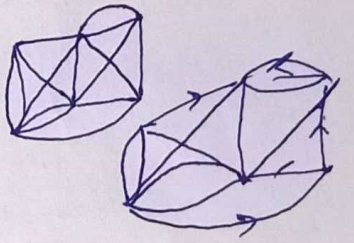
Instructions: Clearly write Left/Right, your name and roll number on the top of question paper and Answersheet. Solutions must be written clearly. Each question carries 5 marks.

---

1. Determine whether the picture shown below can be drawn with a pen in a continuous motion without lifting the pen or retracing part of the picture. If yes then give path. Follow the directions while drawing. Give justification.







2. Determine whether this argument, taken from Kalish and Montague is valid. Explain. If Superman were able and willing to prevent evil, he would do so. If Superman were unable to prevent evil, he would be impotent; if he were unwilling to prevent evil, he would be malevolent. Superman does not prevent evil. If Superman exists, he is neither impotent nor malevolent. Therefore, Superman does not exist.

3. A tree is a connected graph without cycles/loops. Find no. of edges of a tree with 10+i no. of vertices, where i is the last digit of your student id. Generalise your observation?

4. Find a recurrence relation for the number of bit strings of length n with three consecutive ones.

5. Prove that [-i, i] and (-i, i) have same cardinality, where $i = 2+$ last digit of your student id. What kind of proof did you use?

6. Write down an algorithm for printing all permutations of $1, 2, 3, \ldots, n$. Apply it to $n = 3$.

7. Display all the partial orders on a set with four elements with the help of Hasse diagram. How many of them are lattices, well ordered set, linearly ordered set?

8. How many solutions in positive integers are there to the equation given below. Give justifiation.

$$x_1 + x_2 + x_3 = 10 \text{ with } 2 < x_1 < 6, 3 < x_2 < 10, 0 < x_3 < 5$$

9. A simple directed graph is called special if for all u and v distinct vertices in the graph. exactly one of (u, v) and (v, u) is an edge of the graph. Show that every special graph has a Hamilton path.

10. How many nonisomorphic simple connected graphs with four vertices are there? Draw all of them and give justification.

11. Find a bijective function between $\mathbb{Z} \times \mathbb{Z}$ and $\mathbb{Z}$.

12. Using generating function solve $(n+1)a_{n+1} = a_n + \frac{1}{n!}$ with $a_0 = 1$.

End-semester Examination (Pen and paper mode) 2022

PH110: Waves and Electromagnetics

Time: 100 Minutes **Marks: 45**

- **All questions are compulsory and their marks is indicated in square bracket.**
- **All questions needs to be answered sequentially without fail. Non-compliance of instruction will invite deduction in marks.**
- **In case you feel any question/s is/are incorrect or have insufficient instruction then write in the answer book with your justification without wasting any time**

---

1. (a) Write down Maxwell's equations for regions of space where there is no charge or current. Using these equations, estimate the speed of electromagnetic waves for the given region. Now, if we consider a matter (linear media) of regions where there is no free charge or free current, what is new speed of electromagnetic wave? [5 Marks]

(b) Suppose

$$\mathbf{E}(r,\theta,\phi,t) = A\frac{\sin\theta}{r}\left[\cos(kr-\omega t) - (1/kr)\sin(kr-\omega t)\right]\hat{\boldsymbol{\phi}}, \quad \text{with } \frac{\omega}{k} = c.$$

For notational convenience, let $(kr - \omega t) \equiv u$ in your calculations.

(i) Show that **E** obeys all four of Maxwell's equations, in vacuum, and find the associated magnetic field.

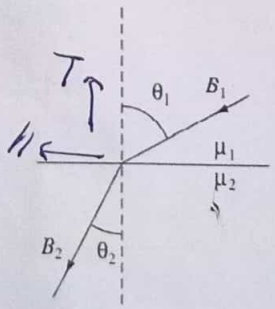
(ii) Calculate the Poynting vector. Average **S** over a full cycle to get the intensity vector **I**.

(iii) Determine the total power radiated over a spherical surface.

[10 Marks]

2. (a) Physically interpret the volume and surface bound currents. Utilizing this, can you write down the Ampere's law for magnetized materials? [4 Marks]

(b) At the interface between one linear magnetic material and another, the magnetic field lines bend (as shown in figure below). Show that $\tan\theta_2 / \tan\theta_1 = \mu_2/\mu_1$, assuming there is no free current at the boundary.



$B_1^{\perp} = B_2^{\perp}$

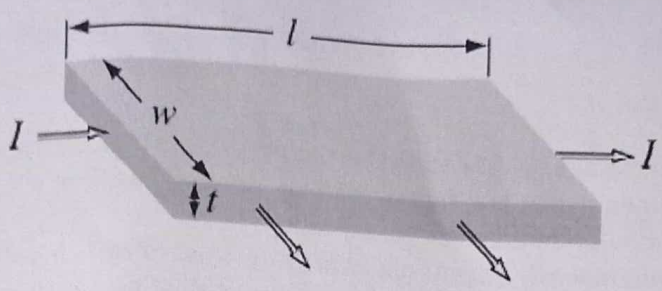
$\frac{B_1^{\parallel}}{\mu_1} = \frac{B_2^{\parallel}}{\mu_2}$

[5 Marks]

(c) A current I flows to the right through a rectangular bar of conducting material, in the presence of a uniform magnetic field **B** pointing out of the page as shown in figure below.

$\frac{\tan\theta_2}{\tan\theta_1} = \frac{B_2^{\perp}/B_2^{\parallel}}{B_1^{\perp}/B_1^{\parallel}}$

$= \frac{\mu_2}{\mu_1}$



B

(i) If the moving charges are positive, in which direction are they deflected by the magnetic field? This deflection results in an accumulation of charge on the upper and lower surfaces of the bar, which in turn produces an electric force to counteract the magnetic one. Equilibrium occurs when the two exactly cancel.

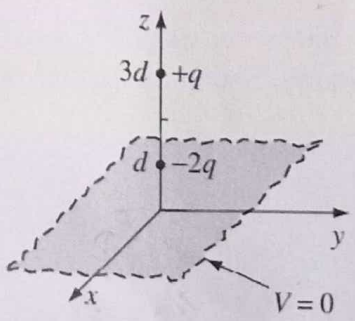
(ii) Find the resulting potential difference between the top and bottom of the bar, in terms of B, v (the speed of the charges), and the relevant dimensions of the bar.

(iii) How would your analysis change if the moving charges were negative? [6 Marks]

3. (a) How bound charges are generated? Physically discuss about volume and surface charges. Utilizing it, deduce Gauss's law in presence of dielectrics. [5 Marks]

(b) In a linear dielectric, the polarization is proportional to the field: $\boldsymbol{P} = \varepsilon_0 \chi_e \boldsymbol{E}$. If the material consists of atoms (or nonpolar molecules), the induced dipole moment of each one is likewise proportional to the field $\boldsymbol{p} = \alpha \boldsymbol{E}$. What is the relation between the atomic polarizability α and the susceptibility χ_e? [5 Marks]

(c) Find the force on the charge +q in given below figure:



[5 Marks]

End