

Code No: 133BJ

R16

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD

B.Tech II Year I Semester Examinations, May/June - 2019

NETWORK ANALYSIS
(Common to ECE, ETM)

Time: 3 Hours

Max. Marks: 75

Note: This question paper contains two parts A and B.

Part A is compulsory which carries 25 marks. Answer all questions in Part A.

Part B consists of 5 Units. Answer any one full question from each unit.

Each question carries 10 marks and may have a, b, c as sub questions.

PART - A

(25 Marks)

- 1.a) Define cutset matrix. [2]
- b) Two coupled coils of $L_1=0.8\text{H}$ and $L_2=0.2\text{H}$ have a coupling coefficient $K=0.9$. Find the mutual inductance? [3]
- c) Write the relation between Q factor and Bandwidth of parallel resonance circuit. [2]
- d) Write the condition for over damping of series RLC circuit. [3]
- e) Find Laplace transform of ramp function? [2]
- f) Find the one sided Laplace Transform of $Ku(t)$ where K is an unknown real constant. [3]
- g) Define all four admittance parameters of two port network. [2]
- h) Define a driving point impedance and driving point admittance of two port network. [3]
- i) Draw the circuit diagram of π attenuator. [2]
- j) State Foster's reactance theorem. [3]

PART - B

(50 Marks)

2. Draw the directed graph, tree, cutset matrix and tie set matrix for the network shown in figure 1. [10]

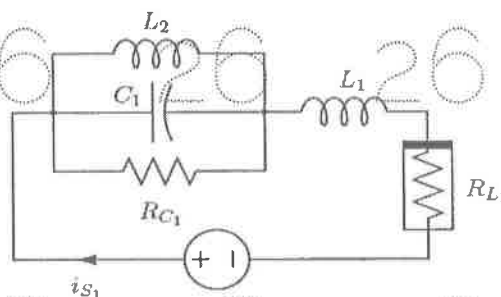


Figure: 1
OR

3. Find the coupling coefficient and energy stored in the inductors for the following circuit shown in figure 2. [10]

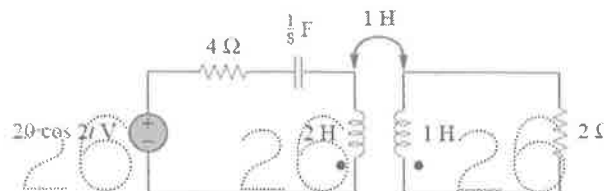


Figure: 2

4. The switch shown in figure 3 is at position 1 for $t < 0$. At $t = 0$ it moves to position 2. Sketch $v(t)$ as a function of time. [10]

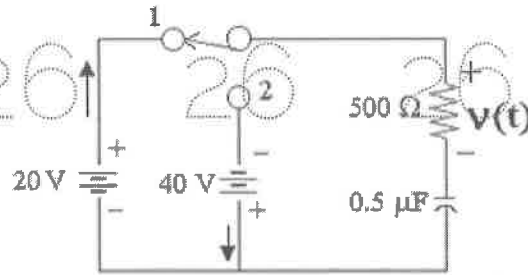


Figure: 3

OR

5. A series RLC circuit with $R = 50\Omega$, $L = 0.1\text{H}$ and $C = 50\mu\text{F}$ has a constant voltage $V = 100\text{V}$ applied at $t = 0$. Find the current transient assuming zero initial charge on the capacitor. [10]

6. Find v for the circuit using Laplace Transform shown in figure 4. [10]

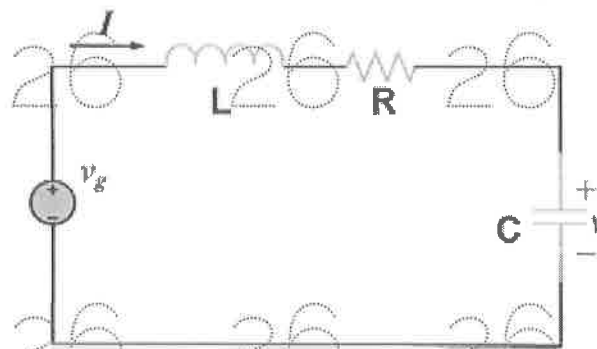


Figure: 4

OR

7. Consider the signal $h(t) = t^t u(t)$. Use the Laplace Transform multiplication theorem to find the response of this system to a unit step input $u(t)$ in Laplace Transform. [10]

8. Derive the relation between Z-parameters and Y-parameters and also ABCD parameters. [10]

OR

9. Define h-parameters for two port network and find them for the following circuit shown in figure 5. [10]

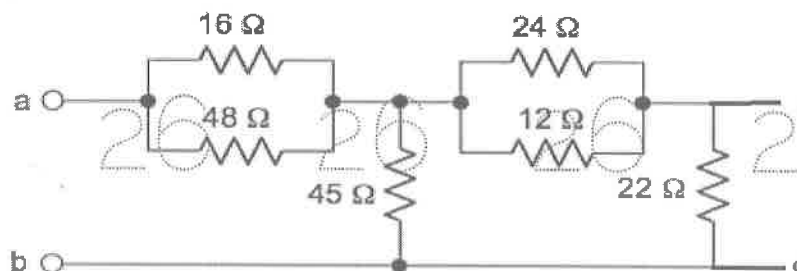


Figure: 5

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10.a) Explain how to convert T network to π network?

b) A π -pad attenuator is required to reduce the level of an audio signal by 12dB while matching the impedance of the 500Ω network. Calculate the values of the three resistors required. [5+5]

26 26 26 OR 26 26 26

11.a) Draw the low pass T filter and draw its frequency response.

b) Design a constant k high pass π filter with cut off frequency of 2 kHz. [5+5]

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R16

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD

B.Tech II Year I Semester Examinations, May/June - 2019

MATHEMATICAL FOUNDATIONS OF COMPUTER SCIENCE

(Common to CSE, IT)

Time: 3 Hours

Max. Marks: 75

Note: This question paper contains two parts A and B.
Part A is compulsory which carries 25 marks. Answer all questions in Part A.
Part B consists of 5 Units. Answer any one full question from each unit.
Each question carries 10 marks and may have a, b, c as sub questions.

PART - A

- 1.a) Find the negative of $p \rightarrow q$. (25 Marks)
- b) Test the validity of the following argument
 $p \wedge r \rightarrow \neg q, \neg q \rightarrow r \therefore p \wedge r \rightarrow r$ [2]
- c) If $f(x) = x^2 - 6 = y$, then find $f^{-1}(y)$. [3]
- d) If $f: G_1 \rightarrow G_2$ is a homomorphism and $a \in G$ then prove that $[f(a)]^{-1} = f(a^{-1})$. [2]
- e) How many 5 digit numbers are possible, which are greater than 40000 with the digits 1, 2, 3, 4, 5. [3]
- f) Find the number of positive integer solutions of $x + y + z = 12$. [2]
- g) Solve the recurrence relation $u_{n+2} - u_{n+1} - 6u_n = 0$. [3]
- h) Find the generating function of the sequence 1, 3, 3^2 , 3^3 , [2]
- i) If the adjacency matrix of the Graph is $\begin{bmatrix} 0 & 1 & 0 & 1 \\ 1 & 0 & 1 & 1 \\ 0 & 1 & 0 & 0 \\ 1 & 1 & 0 & 0 \end{bmatrix}$, then draw the graph. [2]
- j) If G is a k regular graph with 18 edges and the order of the graph is 9. Find the value of k. [3]

PART - B

- 2.a) Test the validity of the following argument. (50 Marks)
- If I study, I will not fail in the examination.
If I do not watch TV in the evenings, I will study.
I failed in the examination.
Therefore I must watch TV in the evenings.
- b) Prove that the following argument is valid.
 $\neg \exists x(p(x) \wedge q(x))$
 $p(a)$
 $\neg q(a)$

OR

[5+5]

- 3.a) Prove that $(p \uparrow q) \rightarrow r$ and $(p \wedge q) \vee r$ are logically equivalent.
- b) Prove that the following argument is valid.
- $$\forall x p(x) \rightarrow \neg q(x)$$
- $$\neg \exists x ((r(x) \vee s(x)) \wedge \neg q(x))$$
- $$r(a)$$

$\therefore \neg p(a)$

- 4.a) Let $X = \{1, 2, 3\}$ and f, g, h and s be functions from X to X given by $f = \{(1, 2), (2, 3), (3, 1)\}$, $g = \{(1, 2), (2, 1), (3, 3)\}$ $h = \{(1, 1), (2, 2), (3, 1)\}$ Find $f \circ g$, $f \circ h \circ g$.
- b) If $f: G_1 \rightarrow G_2$ is an isomorphism, then prove that $f^{-1}: G_2 \rightarrow G_1$ is also an isomorphism.

[5+5]

OR

- 5.a) Prove that the relation a congruent to b mod H is an equivalence relation.
- b) Prove that the set of even integers forms a group under addition.

[5+5]

- 6.a) Find the number of solutions of $x_1 + x_2 + x_3 = 19$ with the condition $x_1 > 1, x_2 > 2, x_3 > 1$.
- b) Prove that if 11 integers are selected from among $\{1, 2, \dots, 20\}$, then the selection includes integer a and b such that $a - b = 2$.

[5+5]

OR

- 7.a) Find the number of integers < 250 and divisible by 3 or 5 or 11.
- b) Suppose 14 students in a class appear at a university examination. Prove that there exists at least two among them whose seat number differ by a multiple of 13.

[5+5]

8. Solve the recurrence relation. $u_n - 2u_{n-1} - 3u_{n-2} = 5^n, n \geq 2, u_0 = 1, u_1 = 1$

[10]

OR

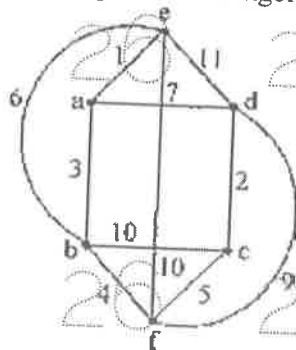
9. Solve the recurrence relation using generating function. $u_{n+2} - 2u_{n+1} + u_n = 2^n, u_0 = 2, u_1 = 1$.

[10]

- 10.a) Suppose that G is a non directed graph with 12 edges. Suppose that G has 6 vertices of degree 3 and the rest have degree less than 3. Determine the minimum number of vertices G can have.

- b) Find the minimal spanning tree using Krushal's algorithm.

[5+5]



Code No: 133BE

R16

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD

B.Tech II Year I Semester Examinations, May/June - 2019

MECHANICS OF SOLIDS

(Common to ME, MCT, AE, MIE, MSNT)

Time: 3 Hours

Max. Marks: 75

Note: This question paper contains two parts A and B.

Part A is compulsory which carries 25 marks. Answer all questions in Part A.

Part B consists of 5 Units. Answer any one full question from each unit.

Each question carries 10 marks and may have a, b, c as sub questions.

PART- A

[25 Marks]

- 1.a) Define Poisson's ratio. What is its maximum value? [2]
- b) Differentiate among the strain energy, resilience and toughness. [3]
- c) Explain the sign convention for drawing Bending moment diagrams. [2]
- d) Define the point of contra flexure and discuss its significance. [3]
- e) Draw the shear stress distribution for the cross section of a symmetrical I- section. [2]
- f) State the bending equation. Give the meaning of each term and a set of consistent units for the terms. [3]
- g) What is a biaxial stress? What is its maximum principal stress? [2]
- h) State maximum shear stress theory. Draw the safe boundary region for a given yield strength of a material. [3]
- i) What are the assumptions made in the analysing thin cylindrical shells? [2]
- j) A shaft is transmitting a torque of 400 Nm at a frequency of 3 Hz/s. What is the power transmitted? [3]

PART- B

[50 Marks]

- 2.a) A 3 mm thick aluminum sheet is cut with a 40 mm diameter round punch. If the punch exerts a force of 6 kN, what is the shear stress in the sheet?
- b) A circular rod of steel 12 mm diameter is testing in a tensile testing machine and it is found that when the tension is 16 kN the total extension on a 200 mm length is 0.14 mm. Find the value of Young's Modulus. [5+5]

OR

- 3.a) A steel tie rod 50 mm in diameter and 2 m long is subjected to a pull of 120 kN. To what length the rod should be bored centrally so that the total extension will increase by 10 percent under the same pull, the bore being 20 mm diameter? Take Young's modulus as 200 GPa.
- b) A steel circular bar of radius 20 mm and 2 m long is subjected to a suddenly applied tensile force of 75 kN, determine the strain energy stored. If the same load is applied gradually, what is the change in the stored energy? [5+5]

- 4.a) A cantilever beam AB of span 6 m is subjected to a uniformly varying load of 8 kN/m intensity at the fixed end A and zero at the free end B. Draw the shear force and bending moment diagrams.
- b) The bending moment diagram for a beam is as shown in figure 1. Find the shear force and loading diagram. [5+5]

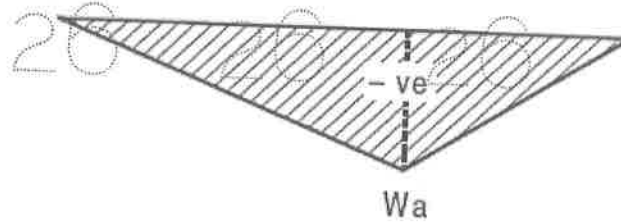


Figure 1

OR

5. A beam AB 5 m long is simply supported at A and B. It is loaded with point loads of 20 kN, 30 kN and 40 kN at distances of 1 m, 3 m and 4 m respectively from the support A, and a uniformly distributed load at the rate of 20 kN/m over the length of 2 m, the beginning of the uniformly distributed load being at the of 2 m from A. Draw the shear force and bending moment diagrams. [10]
- 6.a) A 100 mm wide and 10 mm thick steel plate is bent into a circular arc of 10 m radius. Determine the maximum value of stress produced. The modulus of elasticity is 200 GPa.
- b) Compare the weight of two beams of the same material and equal strength. One beam is of solid circular cross section while other beam is of hollow circular section, the internal diameter being 0.75 times the external diameter. [5+5]

OR

7. A I-section has flanges of size 200 × 12 mm and its overall depth is 360 mm. Thickness of web is also 12 mm. It is used as a simply supported beam over a span of 4 m to carry a load of 60 kN/m over its entire span. Determine the bending and shear stress at various critical points of the section. Draw the variation of bending and shearing stresses. [10]

8. A shaft as shown in Figure 2 is subjected to a bending load of 3 kN, pure torque of 1000 Nm and an axial pulling force of 15 kN. Determine (a) Maximum principal stress at points A and B, (b) Minimum principal stress at points A and B, (c) Maximum shear stress at points A and B, (d) Von Mises Equivalent stress at both the points. [3+3+2+2]

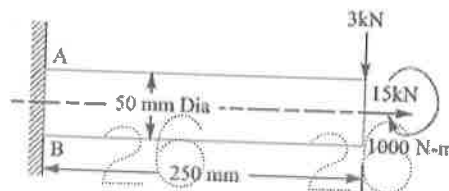


Figure 2

OR

9. A plane stress condition exists at a point on the surface of a loaded structure such as shown in Figure 3. Determine the stresses acting on an element that is oriented at a clockwise angle of 15° with respect to the original element, the principal stresses, the maximum shear stress and the angle of inclination for the principal stresses. Draw the Mohr's circle and indicate the points on it. [10]

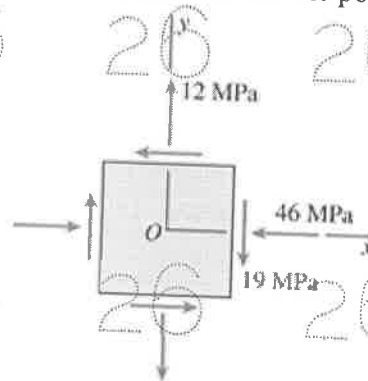


Figure 3

10. A hollow steel shaft has outer diameter of 150 mm and inner diameter of 100 mm. The steel has shear modulus of elasticity 75 GPa. For an applied torque of 16 kN m, determine the following quantities:
 (a) Shear stress at the outer surface and inner surface of the shaft. Represent them graphically.
 (b) Rate of twist (degrees per unit of length).
 (c) What diameter d is required for a solid shaft to resist the same torque with the same maximum stress?
 (d) What is the ratio of the weight of the hollow tube to the weight of the solid shaft? [3+2+3+2]
- OR**
11. A thin cylinder 75 mm internal diameter, 250 mm long with walls 2.5 mm thick is subjected to an internal pressure of 7 MPa. Determine the change in internal diameter and the change in length. If, in addition to the internal pressure, the cylinder is subjected to a torque of 200 N m, find the magnitude and nature of the principal stresses set up in the cylinder. Young's Modulus = 200 GPa. Poisson's $\nu = 0.3$. [10]

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Code No: 123AC

R15

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD

B.Tech II Year I Semester Examinations, May/June - 2019

MECHANICS OF SOLIDS

(Common to ME, MCT, AE, AME, MSNT)

Time: 3 Hours

Max. Marks: 75

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PART- A

[25 Marks]

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PART- B

[50 Marks]

- 2.a) A 3 mm thick aluminum sheet is cut with a 40 mm diameter round punch. If the punch exerts a force of 6 kN, what is the shear stress in the sheet?
 - b) A circular rod of steel 12 mm diameter is testing in a tensile testing machine and it is found that when the tension is 16 kN the total extension on a 200 mm length is 0.14 mm. Find the value of Young's Modulus. [5+5]
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- 3.a) A steel tie rod 50 mm in diameter and 2 m long is subjected to a pull of 120 kN. To what length the rod should be bored centrally so that the total extension will increase by 10 percent under the same pull, the bore being 20 mm diameter? Take Young's modulus as 200 GPa.
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- b) The bending moment diagram for a beam is as shown in figure 1. Find the shear force and loading diagram. [5+5]

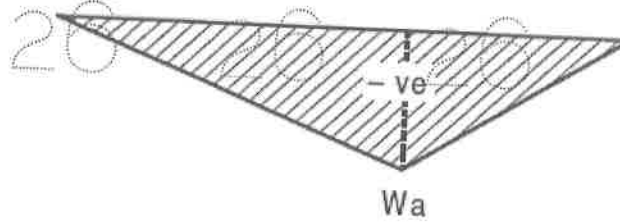


Figure 1
OR

5. A beam AB 5 m long is simply supported at A and B. It is loaded with point loads of 20 kN, 30 kN and 40 kN at distances of 1 m, 3 m and 4 m respectively from the support A, and a uniformly distributed load at the rate of 20 kN/m over the length of 2 m, the beginning of the uniformly distributed load being at the of 2 m from A. Draw the shear force and bending moment diagrams. [10]
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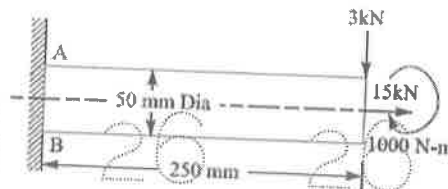


Figure 2
OR

9. A plane stress condition exists at a point on the surface of a loaded structure such as shown in Figure 3. Determine the stresses acting on an element that is oriented at a clockwise angle of 15° with respect to the original element, the principal stresses, the maximum shear stress and the angle of inclination for the principal stresses. Draw the Mohr's circle and indicate the points on it. [10]

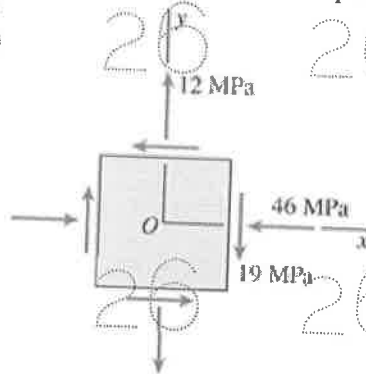


Figure: 3

10. A hollow steel shaft has outer diameter of 150 mm and inner diameter of 100 mm. The steel has shear modulus of elasticity 75 GPa. For an applied torque of 16 kN m, determine the following quantities:
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 (b) Rate of twist (degrees per unit of length).
 (c) What diameter d is required for a solid shaft to resist the same torque with the same maximum stress?
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- OR
11. A thin cylinder 75 mm internal diameter, 250 mm long with walls 2.5 mm thick is subjected to an internal pressure of 7 MPa. Determine the change in internal diameter and the change in length. If, in addition to the internal pressure, the cylinder is subjected to a torque of 200 N m, find the magnitude and nature of the principal stresses set up in the cylinder. Young's Modulus = 200 GPa. Poisson's $\nu = 0.3$. [10]

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Code No: 123BW

R15

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD
B.Tech II Year I Semester Examinations, May/June - 2019

ELECTRICAL CIRCUITS

(Common to EEE, ECE)

Time: 3 Hours

Max. Marks: 75

Note: This question paper contains two parts A and B.

Part A is compulsory which carries 25 marks. Answer all questions in Part A.

Part B consists of 5 Units. Answer any one full question from each unit.

Each question carries 10 marks and may have a, b, c as sub questions.

PART - A

- 1.a) Define node, a junction and a branch. (25 Marks) [2]
b) Summarize the classifications of Circuit elements. [3]
c) Define the term RMS value and write RMS value of a sinusoidal alternating Quantity. [2]
d) Define form factor and peak factor. [3]
e) Define mutual inductance and self-inductance. [2]
f) Find the resonant frequency in the ideal parallel LC circuit with $L = 40\text{mH}$ and $C = 0.01\text{ mf}$. [3]
g) Define loop, tree and cutset. [2]
h) Define Duality of networks. [3]
i) State Compensation theorem. [2]
j) State Reciprocity theorem with an example. [3]

PART-B

- 2.a) Differentiate between independent and dependent sources and draw their circuit representation. (50 Marks)
b) Obtain the relationship between star to delta conversion. [5+5]
OR
3.a) Determine the current through each resistor in the circuit shown in figure 1.

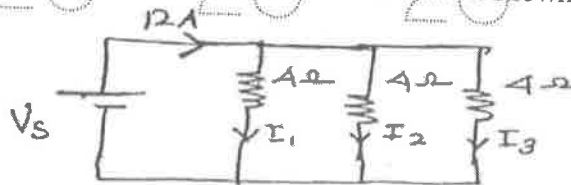


Figure: 1

- b) Find the current I supplied by the battery of the Figure 2 through delta/star transformation. [5+5]

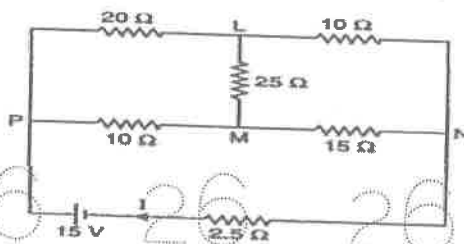


Figure: 2

- 4.a) Derive R.M.S value and Average value for the voltage waveform shown in figure 3.

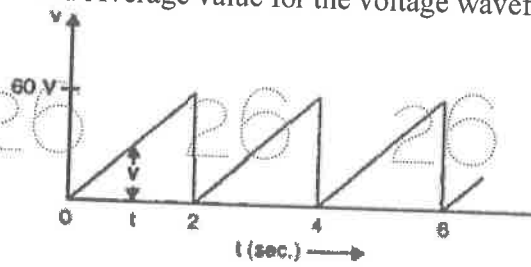


Figure: 3

- b) The impedances of a parallel circuit are $Z_1 = (4+j6)\Omega$ and $Z_2 = (8-j6)\Omega$. If the applied voltage is 120V, find
 i) current and power factor of each branch
 ii) overall current and power factor of the circuit
 iii) Power Consumed by each impedance. Draw phasor diagram. [5+5]
- OR
- 5.a) Explain the concept of complex power. What is the physical interpretation of real power and reactive power and derive their expressions for sinusoidal excitation.
 b) Determine RMS value, Average value, Form Factor and Peak Factor of output current waveform of a half wave rectifier. [5+5]
- 6.a) For a series RL circuit, obtain the locus diagram of current as inductance is changed from 0 to ∞ when the applied voltage is constant.
 b) A RLC series circuit consists of $R=50\Omega$, $L=0.16H$ and $C=4\mu F$. Calculate resonant frequency, quality factor, band width and half power frequencies. [5+5]
- OR
- 7.a) Explain the terms self-inductance, mutual inductance and coefficient of coupling as applied to a magnetic circuit. With usual notation, establish the relationship between mutual inductance, self inductance and coefficient of coupling.
 b) State and explain Faraday's law of electromagnetic induction. Distinguish between self and mutual induced voltages. [5+5]
- 8.a) Draw a suitable tree and dual network for the following network. Use general loop analysis to find i_o in the circuit shown in Figure 4.

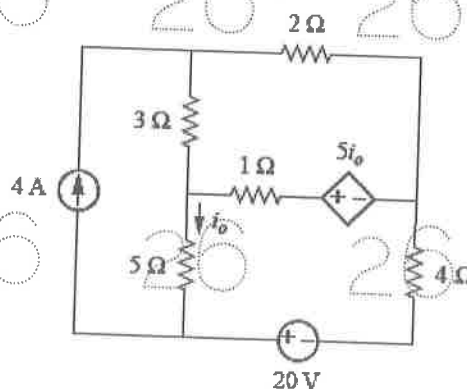


Figure: 4

- b) For the given network graph shown in figure 5, write down the basic Tieset matrix, taking the tree consisting of edges 2,4 and 5. [5+5]

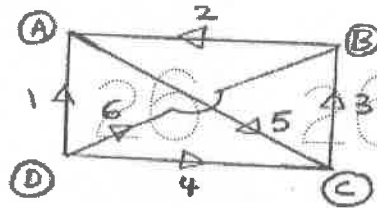


Figure: 5

- 9.a) Draw the dual of the network shown in figure 6.

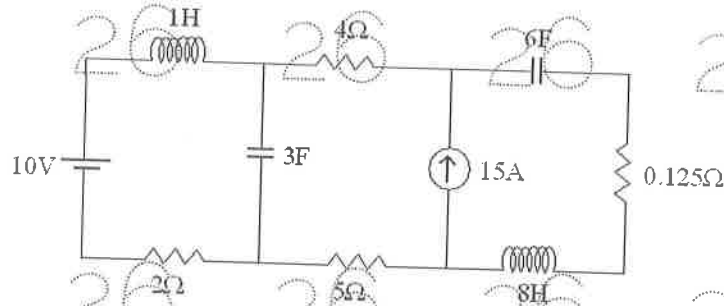


Figure: 6

- b) Construct the incidence matrix for the graph shown in figure 7. [5+5]

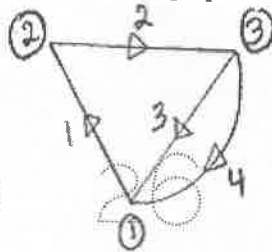


Figure: 7

- 10.a) State and explain reciprocity theorem with an example.
b) Use the Thevenin equivalent of the network shown in Figure 8 to find the value of R which will receive maximum power. Find also this power. [5+5]

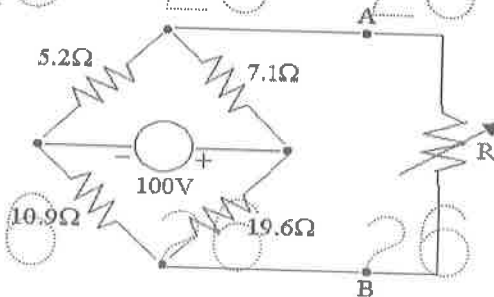


Figure: 8
OR

11.a) A load of $(20-jx_2)$ is supplied from a source of 10V rms and internal impedance of $(10+j20)\Omega$. Find the value of x_2 for maximum power transfer and also find the maximum power.

b) Using the superposition theorem, determine the voltage drop and current across the resistor $3.3\text{ k}\Omega$ in the circuit shown in figure 9. [5+5]

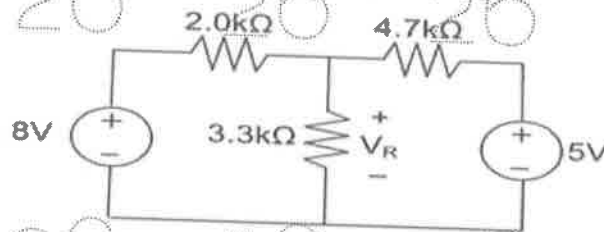


Figure: 9

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Code No: 123BN

R15

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD
B.Tech II Year I Semester Examinations, May/June - 2019

MATHEMATICAL FOUNDATIONS OF COMPUTER SCIENCE
(Common to CSE, IT)

Time: 3 Hours

Max. Marks: 75

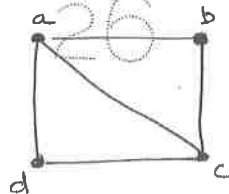
Note: This question paper contains two parts A and B.

Part A is compulsory which carries 25 marks. Answer all questions in Part A.

Part B consists of 5 Units. Answer any one full question from each unit. Each question carries 10 marks and may have a, b, c as sub questions.

PART - A

- 1.a) Write converse and inverse for the statement "If Sun rises in the east then $3 \times 7 = 98$ ". (25 Marks) [2]
- b) Express $(P \rightarrow Q) \wedge (P \leftrightarrow R)$ in terms of \wedge, \vee, \sim only. [2]
- c) Define LUB and GLB of a lattice and give examples for each. [3]
- d) Explain equivalence relation. Give suitable examples for a relation which is not equivalence relation. [2]
- e) In how many ways can 6 boys and 5 girls sit in a row? [3]
- f) Calculate the number of binary numbers with 9 one's and 5 zero's. [2]
- g) Write the characteristic equation for the following recurrence relation $a_n - 4a_{n-4} = 0, n \geq 4$ and solve it. [3]
- h) Find the generating function for the sequence $A = \{a_r\}$ where [2]
- $$a_r = \begin{cases} 2, & \text{if } 0 \leq r \leq 3 \\ 4, & \text{if } 4 \leq r \leq 5 \\ 0, & \text{if } r \geq 6 \end{cases}$$
- i) Give a general formula for Chromatic number of Cycle graph C_n . [3]
- j) Find the Euler Path in the following graph 1. [2]



Graph: 1

PART-B

- 2.a) Obtain principal conjunctive normal form (PCNF) for the formula $(\sim p \rightarrow r) \wedge (q \leftrightarrow p)$. (50 Marks) [5+5]
- b) Show that the following is inconsistent $P \rightarrow Q, R \rightarrow S, P \vee R, \sim (Q \vee S)$. [5+5]
- OR
- 3.a) Using indirect proof, derive $P \rightarrow \sim S$ from $P \rightarrow Q \vee R, Q \rightarrow \sim P, S \rightarrow \sim R, P$. [5+5]
- b) Show that $R \rightarrow (S \rightarrow Q), \sim P \vee R$ and $S \Rightarrow P \rightarrow Q$. [5+5]
- 4.a) Explain properties of binary relations with examples. [5+5]
- b) Draw the Hasse diagram for the partial ordering $\{(A, B): A \leq B\}$ on the power set $e(S)$ where $S = \{a, b, c\}$ and \leq is subset relation. [5+5]
- OR
- 5.a) Draw the Hasse diagram for the divisibility on the set $\{1, 2, 3, 6, 12, 24, 36, 48, 96\}$. [5+5]
- b) Define equivalence relation. Show that the relation *equal* on set of integers is equivalence relation. [5+5]

- 26 26 26 26 26 26 26 26
- 6.a) Write the 3-combinations and 3-permutations of $\{3.a, 2.b, 1.c, 3.d\}$.
 b) In how many ways can a committee of 5 teachers and 4 students be selected from 9 teachers and 15 students such that teacher A refuses if student B is in the committee. [5+5]

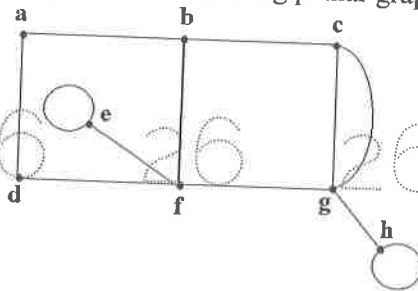
OR

- 7.a) Find the number of non negative integral solution for the equation $X_1+X_2+X_3+X_4=50$, where $X_1 \geq 2, X_2 \geq 4, X_3 \geq -3, X_4 \geq 7$.
 b) Expand the multinomial $(X_1+X_2+X_3+X_4)^4$. [5+5]
- 8.a) Find the solution for the Fibonacci series $a_n=a_{n-1}+a_{n-2}, n \geq 2$ and $a_0=1, a_1=1$.
 b) Using substitution method, find the solution for $a_n=a_{n-1}+1/n(n-1)$ where $a_0=2$. [5+5]

OR

- 9.a) Solve the recurrence relation $a_n - 7a_{n-1} + 16a_{n-2} - 12a_{n-3} = 0$ for $n \geq 3$ with the initial conditions $a_0=1, a_1=4$, and $a_2=8$.
 b) Find the solution for $a_n - 3a_{n-1} - 4a_{n-2} = 0$ for $n \geq 2$ and, $a_0=a_1=1$. [5+5]

- 10.a) Find the degree of each region in the following planar graph 2.

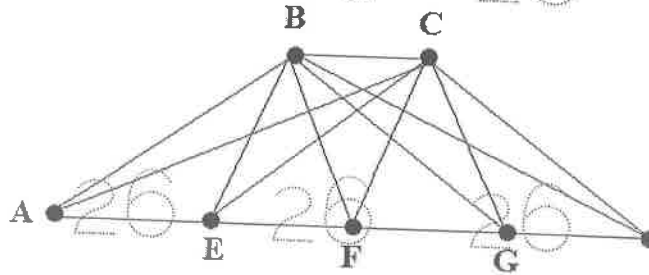


Graph: 2

- b) Show that the complete bi-partite graph $K_{3,3}$ is not planar graph. [5+5]

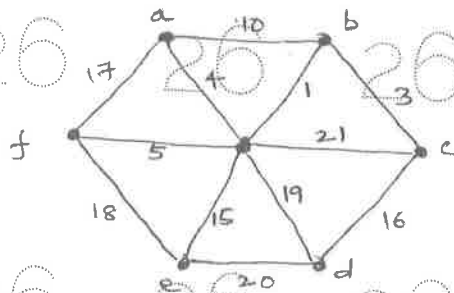
OR

- 1.a) Find the dual of the following graph 3.



Graph: 3

- b) Define spanning tree. Apply Prim's algorithm to find minimum spanning tree on the following weighted graph 4. [5+5]



Graph: 4

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Code No: 113BW

R13

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD

B.Tech II Year I Semester Examinations, May/June - 2019

ELECTRICAL CIRCUITS

(Common to EEE, ECE, ETM)

Time: 3 Hours

Max. Marks: 75

Note: This question paper contains two parts A and B.

Part A is compulsory which carries 25 marks. Answer all questions in Part A.

Part B consists of 5 Units. Answer any one full question from each unit.

Each question carries 10 marks and may have a, b, c as sub questions.

PART - A

- 1.a) Define node, a junction and a branch. (25 Marks)
- b) Summarize the classifications of Circuit elements. [2]
- c) Define the term RMS value and write RMS value of a sinusoidal alternating Quantity. [3]
- d) Define form factor and peak factor. [2]
- e) Define mutual inductance and self-inductance. [3]
- f) Find the resonant frequency in the ideal parallel LC circuit with $L = 40\text{mH}$ and $C = 0.01\text{ mf}$. [2]
- g) Define loop, tree and cutset. [3]
- h) Define Duality of networks. [2]
- i) State Compensation theorem. [3]
- j) State Reciprocity theorem with an example. [2]

PART-B

- 2.a) Differentiate between independent and dependent sources and draw their circuit representation. (50 Marks)
- b) Obtain the relationship between star to delta conversion. [5+5]

OR

- 3.a) Determine the current through each resistor in the circuit shown in figure 1.

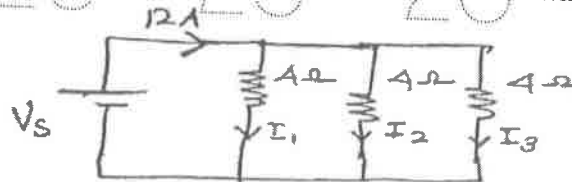


Figure: 1

- b) Find the current I supplied by the battery of the Figure 2 through delta/star transformation. [5+5]

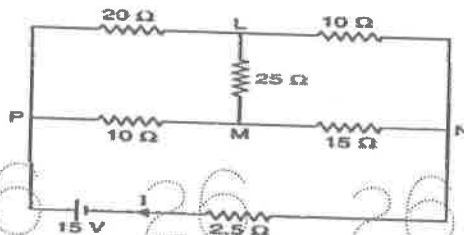


Figure: 2

- 4.a) Derive R.M.S value and Average value for the voltage waveform shown in figure 3.

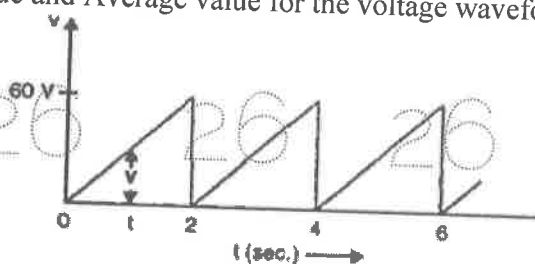


Figure: 3

- b) The impedances of a parallel circuit are $Z_1 = (4+j6)\Omega$ and $Z_2 = (8-j6)\Omega$. If the applied voltage is 120V, find
 i) current and power factor of each branch
 ii) overall current and power factor of the circuit
 iii) Power Consumed by each impedance. Draw phasor diagram.

[5+5]

OR

- 5.a) Explain the concept of complex power. What is the physical interpretation of real power and reactive power and derive their expressions for sinusoidal excitation.
 b) Determine RMS value, Average value, Form Factor and Peak Factor of output current waveform of a half wave rectifier.
 6.a) For a series RL circuit, obtain the locus diagram of current as inductance is changed from 0 to ∞ when the applied voltage is constant.
 b) A RLC series circuit consists of $R=50\Omega$, $L=0.16H$ and $C=4\mu F$. Calculate resonant frequency, quality factor, band width and half power frequencies.

[5+5]

OR

- 7.a) Explain the terms self inductance, mutual inductance and coefficient of coupling as applied to a magnetic circuit. With usual notation, establish the relationship between mutual inductance, self inductance and coefficient of coupling.
 b) State and explain Faraday's law of electromagnetic induction. Distinguish between self and mutual induced voltages.

[5+5]

- 8.a) Draw a suitable tree and dual network for the following network. Use general loop analysis to find i_o in the circuit shown in Figure 4.

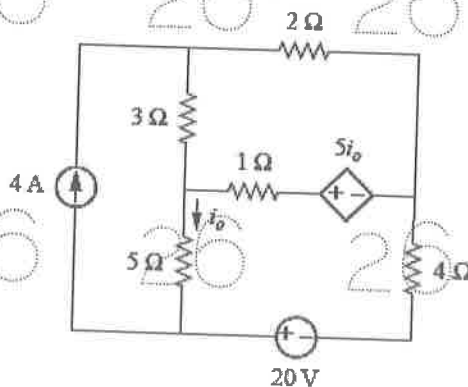


Figure: 4

- b) For the given network graph shown in figure 5, write down the basic Tieset matrix, taking the tree consisting of edges 2,4 and 5. [5+5]

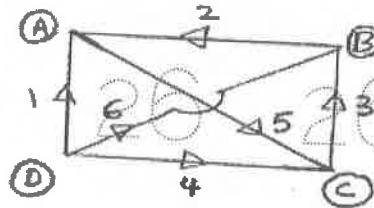


Figure: 5

- 9.a) Draw the dual of the network shown in figure 6.

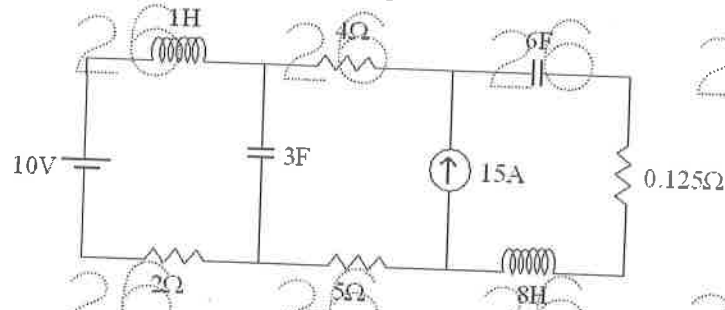


Figure: 6

- b) Construct the incidence matrix for the graph shown in figure 7. [5+5]

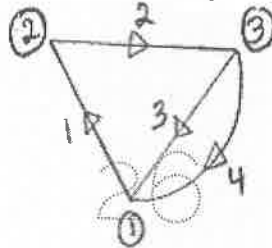


Figure: 7

- 10.a) State and explain reciprocity theorem with an example.
b) Use the Thevenin equivalent of the network shown in Figure 8 to find the value of R which will receive maximum power. Find also this power. [5+5]

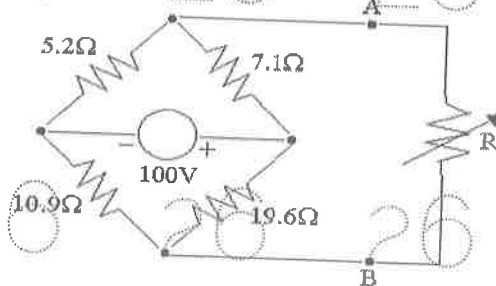


Figure: 8
OR

11.a) A load of $(20-jx_2)$ is supplied from a source of 10V rms and internal impedance of $(10+j20)\Omega$. Find the value of x_2 for maximum power transfer and also find the maximum power.

b) Using the superposition theorem, determine the voltage drop and current across the resistor $3.3\text{ k}\Omega$ in the circuit shown in figure 9. [5+5]

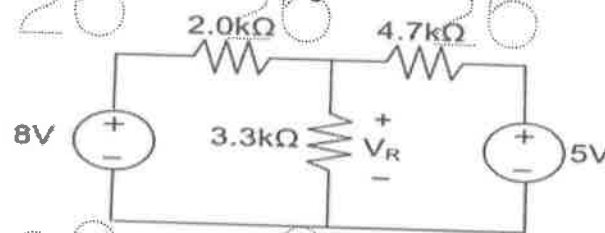


Figure: 9

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Code No: 113AC

R13

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD

B.Tech II Year I Semester Examinations, May/June - 2019

MECHANICS OF SOLIDS

(Common to ME, MCT, MMT, AE, AME)

Time: 3 Hours

Max. Marks: 75

Note: This question paper contains two parts A and B.
Part A is compulsory which carries 25 marks. Answer all questions in Part A.
Part B consists of 5 Units. Answer any one full question from each unit.
Each question carries 10 marks and may have a, b, c as sub questions.

PART- A

[25 Marks]

- 1.a) Define Poisson's ratio. What is its maximum value? [2]
- b) Differentiate among the strain energy, resilience and toughness. [3]
- c) Explain the sign convention for drawing Bending moment diagrams. [2]
- d) Define the point of contra flexure and discuss its significance. [3]
- e) Draw the shear stress distribution for the cross section of a symmetrical I- section. [2]
- f) State the bending equation. Give the meaning of each term and a set of consistent units for the terms. [3]
- g) What is a biaxial stress? What is its maximum principal stress? [2]
- h) State maximum shear stress theory. Draw the safe boundary region for a given yield strength of a material. [3]
- i) What are the assumptions made in the analysing thin cylindrical shells? [2]
- j) A shaft is transmitting a torque of 400 Nm at a frequency of 3 Hz/s. What is the power transmitted? [3]

PART- B

[50 Marks]

- 2.a) A 3 mm thick aluminum sheet is cut with a 40 mm diameter round punch. If the punch exerts a force of 6 kN, what is the shear stress in the sheet?
- b) A circular rod of steel 12 mm diameter is testing in a tensile testing machine and it is found that when the tension is 16 kN the total extension on a 200 mm length is 0.14 mm. Find the value of Young's Modulus. [5+5]

OR

- 3.a) A steel tie rod 50 mm in diameter and 2 m long is subjected to a pull of 120 kN. To what length the rod should be bored centrally so that the total extension will increase by 10 percent under the same pull, the bore being 20 mm diameter? Take Young's modulus as 200 GPa.
- b) A steel circular bar of radius 20 mm and 2 m long is subjected to a suddenly applied tensile force of 75 kN, determine the strain energy stored. If the same load is applied gradually, what is the change in the stored energy? [5+5]

- 4.a) A cantilever beam AB of span 6 m is subjected to a uniformly varying load of 8 kN/m intensity at the fixed end A and zero at the free end B. Draw the shear force and bending moment diagrams.
- b) The bending moment diagram for a beam is as shown in figure 1. Find the shear force and loading diagram. [5+5]

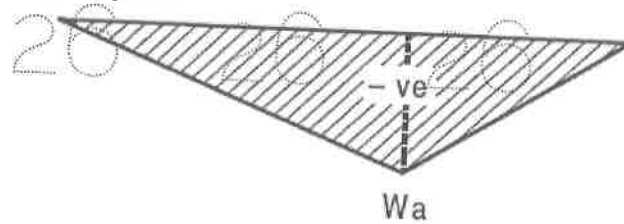


Figure 1

OR

5. A beam AB 5 m long is simply supported at A and B. It is loaded with point loads of 20 kN, 30 kN and 40 kN at distances of 1 m, 3 m and 4 m respectively from the support A, and a uniformly distributed load at the rate of 20 kN/m over the length of 2 m, the beginning of the uniformly distributed load being at the of 2 m from A. Draw the shear force and bending moment diagrams. [10]

- 6.a) A 100 mm wide and 10 mm thick steel plate is bent into a circular arc of 10 m radius. Determine the maximum value of stress produced. The modulus of elasticity is 200 GPa.

- b) Compare the weight of two beams of the same material and equal strength. One beam is of solid circular cross section while other beam is of hollow circular section, the internal diameter being 0.75 times the external diameter. [5+5]

OR

7. A I-section has flanges of size 200 × 12 mm and its overall depth is 360 mm. Thickness of web is also 12 mm. It is used as a simply supported beam over a span of 4 m to carry a load of 60 kN/m over its entire span. Determine the bending and shear stress at various critical points of the section. Draw the variation of bending and shearing stresses. [10]

8. A shaft as shown in Figure 2 is subjected to a bending load of 3 kN, pure torque of 1000 Nm and an axial pulling force of 15 kN. Determine (a) Maximum principal stress at points A and B, (b) Minimum principal stress at points A and B, (c) Maximum shear stress at points A and B, (d) Von-Mises Equivalent stress at both the points. [3+3+2+2]

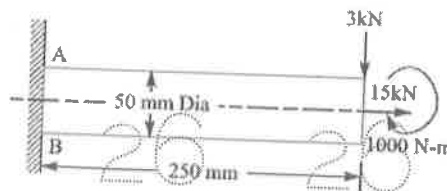


Figure 2

OR

9. A plane stress condition exists at a point on the surface of a loaded structure such as shown in Figure 3. Determine the stresses acting on an element that is oriented at a clockwise angle of 15° with respect to the original element, the principal stresses, the maximum shear stress and the angle of inclination for the principal stresses. Draw the Mohr's circle and indicate the points on it. [10]

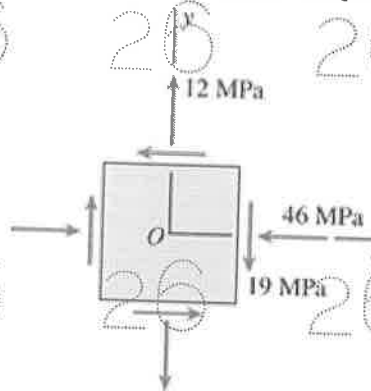


Figure 3

10. A hollow steel shaft has outer diameter of 150 mm and inner diameter of 100 mm. The steel has shear modulus of elasticity 75 GPa. For an applied torque of 16 kN m, determine the following quantities:
 (a) Shear stress at the outer surface and inner surface of the shaft. Represent them graphically.
 (b) Rate of twist (degrees per unit of length).
 (c) What diameter d is required for a solid shaft to resist the same torque with the same maximum stress?
 (d) What is the ratio of the weight of the hollow tube to the weight of the solid shaft? [3+2+3+2]

OR

11. A thin cylinder 75 mm internal diameter, 250 mm long with walls 2.5 mm thick is subjected to an internal pressure of 7 MPa. Determine the change in internal diameter and the change in length. If, in addition to the internal pressure, the cylinder is subjected to a torque of 200 N m, find the magnitude and nature of the principal stresses set up in the cylinder. Young's Modulus = 200 GPa. Poisson's $\nu = 0.3$. [10]

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Time: 3 Hours

Max. Marks: 75

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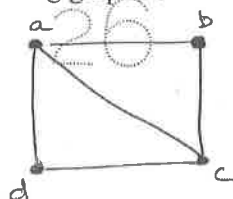
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PART - A

(25 Marks)

- 1.a) Write converse and inverse for the statement "If Sun rises in the east then $3 \times 7 = 98$ ". [2]
- b) Express $(P \rightarrow Q) \wedge (P \leftrightarrow R)$ in terms of \wedge, \vee, \sim only. [3]
- c) Define LUB and GLB of a lattice and give examples for each. [2]
- d) Explain equivalence relation. Give suitable examples for a relation which is not equivalence relation. [3]
- e) In how many ways can 6 boys and 5 girls sit in a row? [2]
- f) Calculate the number of binary numbers with 9 one's and 5 zero's. [3]
- g) Write the characteristic equation for the following recurrence relation $a_n - 4a_{n-4} = 0, n \geq 4$ and solve it. [2]
- h) Find the generating function for the sequence $A = \{a_r\}$ where
$$a_r = \begin{cases} 2, & \text{if } 0 \leq r \leq 3 \\ 4, & \text{if } 4 \leq r \leq 5 \\ 0, & \text{if } r \geq 6 \end{cases}$$
 [2]
- i) Give a general formula for Chromatic number of Cycle graph C_n . [3]
- j) Find the Euler Path in the following graph 1. [2]



Graph: 1

PART-B

(50 Marks)

- 2.a) Obtain principal conjunctive normal form (PCNF) for the formula $(\sim p \rightarrow r) \wedge (q \leftrightarrow p)$. [5+5]
 - b) Show that the following is inconsistent $P \rightarrow Q, R \rightarrow S, P \vee R, \sim (Q \vee S)$. [5+5]
- OR
- 3.a) Using indirect proof, derive $P \rightarrow \sim S$ from $P \rightarrow Q \vee R, Q \rightarrow \sim P, S \rightarrow \sim R, P$. [5+5]
 - b) Show that $R \rightarrow (S \rightarrow Q), \sim P \vee R$ and $S \Rightarrow P \rightarrow Q$. [5+5]
- 4.a) Explain properties of binary relations with examples.
 - b) Draw the Hasse diagram for the partial ordering $\{(A, B): A \leq B\}$ on the power set $e(S)$ where $S = \{a, b, c\}$ and \leq is subset relation. [5+5]
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- 5.a) Draw the Hasse diagram for the divisibility on the set $\{1, 2, 3, 6, 12, 24, 36, 48, 96\}$.
 - b) Define equivalence relation. Show that the relation *equal* on set of integers is equivalence relation. [5+5]

- 6.a) Write the 3-combinations and 3-permutations of $\{3.a, 2.b, 1.c, 3.d\}$.
 b) In how many ways can a committee of 5 teachers and 4 students be selected from 9 teachers and 15 students such that teacher A refuses if student B is in the committee.

[5+5]

OR

- 7.a) Find the number of non negative integral solution for the equation $X_1 + X_2 + X_3 + X_4 = 50$, where $X_1 \geq 2, X_2 \geq 4, X_3 \geq -3, X_4 \geq 7$
 b) Expand the multinomial $(X_1 + X_2 + X_3 + X_4)^4$.

[5+5]

- 8.a) Find the solution for the Fibonacci series $a_n = a_{n-1} + a_{n-2}, n \geq 2$ and $a_0 = 1, a_1 = 1$.
 b) Using substitution method, find the solution for $a_n = a_{n-1} + 1/n(n-1)$ where $a_0 = 2$.

[5+5]

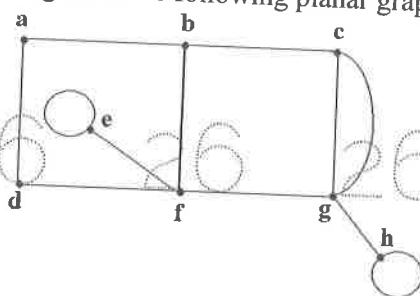
OR

- 9.a) Solve the recurrence relation $a_n - 7a_{n-1} + 16a_{n-2} - 12a_{n-3} = 0$ for $n \geq 3$ with the initial conditions $a_0 = 1, a_1 = 4$, and $a_2 = 8$.

- b) Find the solution for $a_n - 3a_{n-1} - 4a_{n-2} = 0$ for $n \geq 2$ and $a_0 = a_1 = 1$.

[5+5]

- 10.a) Find the degree of each region in the following planar graph 2.

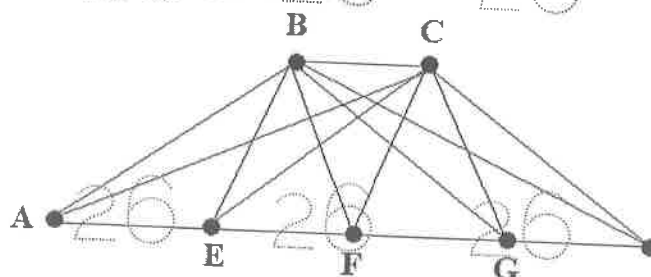


Graph: 2

- b) Show that the complete bi-partite graph $K_{3,3}$ is not planar graph.

[5+5]

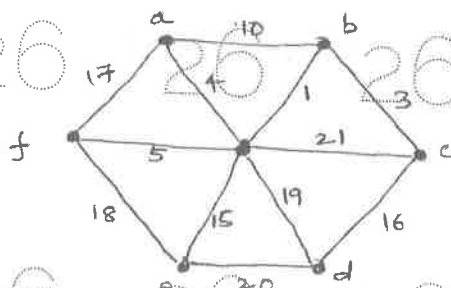
- 11.a) Find the dual of the following graph 3.



Graph: 3

- b) Define spanning tree. Apply Prim's algorithm to find minimum spanning tree on the following weighted graph 4.

[5+5]



Graph: 4

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Code No: 53022

R09

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD

B. Tech II Year I Semester Examinations, May/June - 2019

MATHEMATICAL FOUNDATIONS OF COMPUTER SCIENCE

(Common to CSE, IT)

Time: 3 hours

Max. Marks: 75

Answer any five questions
All questions carry equal marks

- 1.a) Construct the truth table for the compound proposition $(p \rightarrow q) \leftrightarrow (\sim p \rightarrow \sim q)$.
b) Define principle disjunctive normal form. Obtain principle disjunctive normal form for the compound proposition $p \rightarrow \{(p \rightarrow q) \wedge \sim(\sim q \vee \sim p)\}$. [7+8]
2. Disprove the statement using method of disproof "the sum of two odd integers is an odd integer". [15]
- 3.a) How to find the transitive closure of a relation R? Explain.
b) List and explain the Properties of Binary Relations. [7+8]
- 4.a) Let $(S, *)$ be a semi group, then prove that there exists a homomorphism $g : S \rightarrow S^S$ where $\langle S^S, \circ \rangle$ is a semi group of a function from S to S under the operation of the Composition.
b) Show that every finite semi group has an idempotent. [7+8]
- 5.a) Determine the number of positive integers x where $x \leq 9,999,999$ and the sum of the digits in x equals 31.
b) In how many ways can 6 men and 6 women be seated in a row?
i) if any person may sit next to any other
ii) If men and women must occupy alternate seats? [7+8]
- 6.a) Solve recurrence relation $2a_n = 7a_{n-2} - 3a_{n-1}$ for $n \geq 2$ with $a_0 = 2, a_1 = 5$.
b) Define generating function? Find the generating function for the sequences:
i) 1, 2, 3, -4
ii) 0, 1, -2, 3, -4 [7+8]
- 7.a) Find minimum spanning tree using Prim's and Kruskal's algorithms for your own example.
b) What are bipartite graphs? Show that bipartite graphs $K_{2,2}$ and $K_{2,3}$ are planar graphs. [7+8]

Code No: 53016

R09

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD
B. Tech II Year I Semester Examinations, May/June - 2019

MECHANICS OF SOLIDS
(Common to ME, AE, AME)

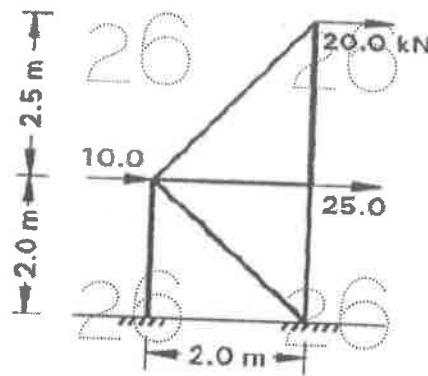
Time: 3 hours

Max. Marks: 75

Answer any five questions
All questions carry equal marks

- 1.a) What are different types stresses to be considered for understanding the elastic behavior of the solids? Explain their significance.
- b) A specimen of material having 12 mm dia. is tested under tension over a gauge length of 50 mm. At 20 kN load the extension was 0.035 mm. The maximum load taken by the specimen was 60 kN and the fracture occurred at 40 kN. Find the modulus of elasticity, ultimate strength, breaking strength and percentage elongation, if the final length of the specimen was 70 mm. [7+8]
- 2.a) A 10 m long simply supported beam carries a uniformly distributed load of 20 kN/m for 4 m starting from the left support and two point loads each of 40 kN at 6 m and 8 m from the left support. Draw shear force and bending moment diagrams and determine the position and magnitude of the maximum bending moment.
- b) Differentiate between fixed beam and overhanging beam based on their practical applications. [8+7]
- 3.a) Derive the bending equation from the first principle and deduce for the rectangular cross section beam.
- b) Two rectangular bars, one of brass and the other of steel each of 80 mm × 20 mm are placed together, to form a 2 m apart, the brass being on the top of steel. Determine the maximum central load which can be applied to the beam if the bars are (i) separated and can bend independently, and (ii) firmly secured to each other through out their length. Take $E_s = 2 \times 10^5 \text{ N/mm}^2$; $\sigma_{s\max} = 120 \text{ N/mm}^2$; $E_b = 0.8 \times 10^5 \text{ N/mm}^2$; $\sigma_{b\max} = 75 \text{ N/mm}^2$. [7+8]
- 4.a) Explain the variation of shear stress distribution in the circular shaft along with the simple sketch.
- b) A T-section beam with 100 mm × 15 mm flange and 150 mm × 15 mm web is subjected to shear force of 10 kN at a section. Draw the variation of shear stress across the depth of the beam and obtain value of maximum shear stress at a section. [7+8]

5. Estimate the forces generated in the truss structure along with the loading condition shown below. [15]



- 6.a) A horizontal cantilever of uniform section and length L carries two vertical point loads W_1 and W_2 . While W_1 acts upwards at free end, W_2 acts downwards at a distance ' L ' from the fixed end. Derive an expression for deflection at the free end.
- b) Differentiate between the double integration method and Maculay's method to estimate the slope and deflection of beams. [8+7]
- 7.a) List the assumptions of thin cylinder theory, and explain the limitations of the theory.
- b) A 6 m long thin cylindrical shell in 1m in diameter and 10mm thick. It is subjected to an internal pressure of 4 MPa. Calculate the stresses induced in the cylinder. Determine the change in diameter, change in length and change in volume of the shell. $E = 205 \text{ GPa}$ and Poisson's ratio $= 0.3$. [7+8]
8. A compound cylinder, formed by shrinking one tube on to another, is subjected to an internal pressure of 50 N/mm^2 . Before the fluid is admitted the internal and external diameter of the compound cylinder are 100 mm and 180 mm and the diameter at the junction is 150 mm. If, after shrinking on, the radial pressure at the common surface is 8 N/mm^2 , calculate the final stresses set up by the section. [15]

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