5. (a) Define functionality of polymers. What are liner, branched, and cross-linked polymers? How does functionality play a role in formation of these polymers? (2+2+3=7)

(b) Write down the major components of portland cement. Name one cement factory located in Assam. (2+1=3)

(c) Describe the pre-hydrogenation step of hydrogenation of fats or oils. (5)

6. (a) Write in brief the production of sugar from sugarcane. What are its major engineering problems? (6+4=10)

(b) Write down the production of HDPE by using Ziegler-Natta catalyst. (5)

7. Write short notes on (any three) (3 × 5 = 15)

(a) Bulk and solution polymerization technique.

(b) Kraft process for pulp production.

(c) Major engineering problems in urea production.

(d) Resol and novalac.

(e) Solvent extraction method.

Total No. of printed pages = 3

CHE 181303

Roll No. of candidate | | | | | | | | | | |

2021

B.Tech. 3rd Semester End-Term Examination

CHEMICAL PROCESS INDUSTRIES
(New Regulation & New syllabus)

(For New Regulation (w.e.f 2017-18) and

New syllabus (w.e.f 2018-19)

Full Marks – 70 Time – Three hours

The figures in the margin indicate full marks for the questions.

Answer question No. 1 and any *four* from the rest.

1. Fill in the blanks : (10 × 1 = 10)

(i) Temperature of calcinations zone in cement manufacturing is ———— °C.

(ii) After setting of cement,———— starts

(iii) Input bulk requirement for Solvay process are salt, coal and _____.

(iv) The stabilizer used in bleaching of pulp is ————

(v) The principles raw materials used for production of triple superphosphate are phosphate rock and ————.

(vi) The major component in fertilizer used for development of starches of potatoes, sugar of vegetables and fruits is ————.

[Turn over

(vii) White Portland cement owes to absence of ——— compounds.

(viii) The two types of fermentation process are ——— and ———.

(ix) Ammonia oxidation process is used for _____ process.

(x) For many years since its discovery in 1853 the _____ method was for caustic soda production.

2. (a) Write two differences between : (5 × 2 = 10)

(i) LDPE and HDPE.

(ii) Diaphragm process and membrane process.

(iii) Sulphitation process and carbonation process.

(iv) Nylon 6 and Nylon 6,6.

(v) Dry process and wet process.

(b) Classify polymers under (5)

(i) Source.

(ii) Mode of formation

(iii) Thermal response

(iv) Main chemical linkage

(v) Physical properties.

3. (a) Write down the equations for (5 × 2 = 10)

(i) Saponification process

(ii) Fat splitting process

(iii) Fermentation process

(iv) Nickel formation in hydrogenation process

(v) Urea production process.

(b) What are the major components in the fertilizer industry? Write down their function in plant growth. (2+3=5)

4. (a) Write down the manufacturing process of Sulphuric acid with a proper flow diagram. (10)

(b) What are the merits of the fermentation process over the chemical synthesis process? (5)

5. (a) Define functionality of polymers. What are liner, branched, and cross-linked polymers? How does functionality play a role in formation of these polymers? (2+2+3=7)

(b) Write down the major components of portland cement. Name one cement factory located in Assam. (2+1=3)

(c) Describe the pre-hydrogenation step of hydrogenation of fats or oils. (5)

6. (a) Write in brief the production of sugar from sugarcane. What are its major engineering problems? (6+4=10)

(b) Write down the production of HDPE by using Ziegler-Natta catalyst. (5)

7. Write short notes on (any three) (3 × 5 = 15)

(a) Bulk and solution polymerization technique.

(b) Kraft process for pulp production.

(c) Major engineering problems in urea production.

(d) Resol and novalac.

(e) Solvent extraction method.

Total No. of printed pages = 3

CHE 181305

Roll No. of candidate | | | | | | | | | | |

2021

B.Tech. 3rd Semester End-Term Examination

CheE

ENERGY ENGINEERING

(New Regulation w.e.f. 2017-18)

(New Syllabus w.e.f. 2018-19)

Full Marks – 70 Time – Three hours

The figures in the margin indicate full marks for the questions.

Answer question No. 1 and any *four* from the rest.

1. Answer any *ten* : (10 × 1 = 10)

(i) What is energy crisis?

(ii) What do you mean by secondary sources of energy?

(iii) What is coal petrography?

(iv) The test related to the caking properties of coal is ————

(v) Name two methods for S- determination in solid fuel.

(vi) What is the use of air jacket and water jacket in Bomb calorimeter?

(vii) The dielectric properties of coal increase/decreases with its rank.

(viii) Give the expression for characterization factor

(ix) ———— have the best antiknock property.

(x) What is a cyclone separator?

(xi) High ———— point is required for clean combustion.

(xii) Mention two tests for bitumen.

(xiii) What is solar constant?

(xiv) Wind energy is measured with the help of ————

(xv) What do you mean by head in a hydro electric power plant?

[Turn over

2. (a) What is the difference between upstream and downstream companies? Give examples of each. (2)

(b) What do you mean by 'degree of metamorphism?' (2)

(c) Which stage of coal is also sometimes referred to as brown coal and why? (1 + 2 = 3)

(d) How is coal classified on the basis of plant debris? (3)

(e) How do you determine sulphur content in coal? Demonstrate it with proper calculation. (5)

3. (a) How does porosity and surface area influence the behavior of coal in context to its carbon content? Illustrate the variation of porosity with carbon with the help of a plot diagram. (4 + 2 = 6)

(b) Explain the formation of petroleum in brief. (6)

(c) Give the significance of flash point and fire point. (3)

4. (a) Define the smoke point and char value. What will be their values for good quality kerosene? (2 + 2 = 4)

(b) Illustrate the manufacture of Producer gas with proper sketch. (6)

(c) What are the advantages of catalytic cracking over thermal phase cracking? (3)

(d) What do you mean by shale oil? (2)

5. (a) Mention three prime requirements for gasoline. (3)

(b) What is the purpose of using power alcohols in gasoline engines? (2)

(c) A coal sample gave the following proximate analysis.

M = 1.6%, A = 15.7%, VM = 27.8% and FC = 54.9%. Calculate its ash on a dry basis and VM on daf and dmmf basis. (5)

(d) Calculate the excess air when Orsat analysis of a flue gas is 10% CO_2, 8% O_2,0.4% CO, 0.6% H_2 and rest N_2. (5)

6. (a) Give advantages of tidal energy. (2)

(b) Write the three types of geothermal resources. (3)

(c) What are the important points to be taken into account while doing any combustion calculation? (3)

(d) What are the disadvantages of solar energy? (2)

(e) Write shortly on the technologies of solar energy utilization. (5)

7. Write short notes on any *three* : (3 × 5 = 15)

(a) 2-stage distillation unit

(b) Applications of hydro energy

(c) Low temperature carbonization

(d) Fischer Tropsch Process

(e) Liquefied Petroleum Gas.

Total No. of printed pages = 2

CHE 181304

Roll No. of candidate | | | | | | | | | | |

2021

B.Tech. 3rd Semester End-Term Examination

CheE

MATERIAL SCIENCE OF CORROSION ENGINEERING

(New Regulation)

(w.e.f. 2017-2018)

(New Syllabus)

(w.e.f. 2018-2019)

Full Marks – 70 Time – Three hours

The figures in the margin indicate full marks for the questions.

Answer question No. 1 and any *four* from the rest.

1. (a) Answer briefly: (2 + 2 = 4)

   (i) What do you mean by Space Lattice?

   (ii) What is a phase diagram? Why it is importance?

   (b) Fill in the blanks. (4)

   (i) Bronze is an alloy of ———— and ————

   (ii) Nitriding is a ———— process.

   (iii) In a eutectic equilibrium reactions a liquid phase is transformed to ————.

   (iv) Surface atom posseses ————energy than that of internal atom.

   (c) Suggest suitable materials for the following. (1 × 2 = 2)

   (i) Aeroplane body

   (ii) Unbreakable container.

2. (a) What do you mean by atomic packing factor? How does it influence the properties of materials? (5)

(b) What is Bravais space lattice? Explain with examples. (2+8=10)

3. (a) What is dry corrosion? How does it differ from web corrosion? (1+2=3)

(b) Explain the mechanism of wet corrosion. (8)

(c) How does EMF and galvanic series help in prevention of corrosion? (4)

4. (a) Draw Iron-Carbon phase diagram. Explain the various points and lines on this diagram. (3+7=10)

(b) Mention the different types of crystal imperfection. Explain any one of them very briefly. (2+3=5)

5. (a) What is the purpose of heat treatment? Briefly describe the case hardening process of heat treatment of material. (2+5=7)

(b) What are the processes involved for the heat treatment of a non-Ferrous metals describe briefly? (8)

6. (a) What are the differential ways of protecting metal from corrosion? Explain any one of them. (2+5=7)

(b) What are the different Nickel alloys? Give their composition and application. (2+6=8)

7. (a) Give the essentials difference between destructive and non destructive testing of material. (3)

(b) Draw the following planes in a cubic unit cell. (3)

(i) (110)

(ii) (100)

(c) What is thermosetting plastics? Give two examples. (3)

(d) Compare induction hardening with flame hardening. (3)

(e) Mention few factors that influences the rate of corrosion. (3)

8. Write short notes on any *three*: (3 × 5 = 15)

(a) Refractory

(b) Creep

(c) Stress corrosion cracking

(d) Miller indices

(e) Criteria for selection of material

(f) Classification of engineering materials.

Total No. of printed pages = 4

CSE 181304

Roll No. of candidate | | | | | | | | | | |

2021

B.Tech. 3rd Semester End-Term Examination

DATA STRUCTURE AND ALGORITHMS

(New Regulation (w.e.f. 2017-18))

(New Syllabus (w.e.f. 2018-19))

Full Marks – 70 Time – Three hours

The figures in the margin indicate full marks for the questions.

Answer question No. 1 and any *four* from the rest.

1. Answer the following questions : (10 × 1 = 10)

(i) Elements in an array are accessed

(a) Randomly

(b) Sequentially

(c) Exponentially

(d) Logarithmically

(ii) While evaluating a prefix expression, the string is read from?

(a) Left to right

(b) Right to left

(c) Center to right

(d) Center to left to right

(iii) When an operand is read during Postfix conversion, which of the following is done?

(a) It is placed on to the output

(b) It is placed in operator stack

(c) It is ignored

(d) Operator stack is emptied

(iv) What is the time complexity of an infix to postfix conversion algorithm?

(a) O (N log N)

(b) O (N)

(c) O (N^2)

(d) O (M log N)

(v) How many children does a binary tree have?

(a) 2

(b) Any number of children

(c) 0 or 1 or 2

(d) 0 or 1

(vi) B-tree of order n is a order-n multiway tree in which each non-root node contains

(a) At most $(n-1)/2$ keys

(b) Exact $(n-1)/2$ keys

(c) At least $2n$ keys

(d) At least $(n-1)/2$ keys

(vii) Which of the following is false?

(a) A B+ -tree grows downwards

(b) A B+ -tree is balanced

(c) In a B+ -tree, the sibling pointers allow sequential searching

(d) B+ -tree is shallower than B-tree

(viii) Hashing is the problem of finding an appropriate mapping of keys into addresses.

(a) True

(b) False

(ix) Descending priority queue can be implemented using

(a) Max heap

(b) Min heap

(c) Min-max heap

(d) Trie

(x) The postfix form of the expression (A+B) * (C * D – E) * F / G is?

(a) AB + CD * E – FG /* *

(b) AB + CD * E – F* *G/

(c) AB + CD * E – * F * G /

(d) AB + CDE * – * F * G /

2. (a) Define the term Data Structure. Explain the categorization of Data Structures in detail with example. (1+3=4)

(b) Write down the algorithm for infix to postfix conversion. Convert the following expression into equivalent postfix expression: (3+5=8)

9 * 6 – (4/2+ (10% 5 * 2 + (8 % 3)) / 7) * 4)

(c) Explain Threaded Binary Tree with proper diagram. (3)

3. (a) Explain algorithm complexity. Explain different asymptotic notations. (5)

(b) Write a program to perform the insert and delete operation in a circular queue. (5)

(c) Construct a BST from the following: (5)

23, 18, 34, 56, 97, 58, 43, 66, 54, 32, 19, 49, 88, 76, 98

4. (a) Describe the different methods of Graph representations with suitable examples. (5)

(b) Explain the algorithm to perform the following operations in a doubly linked list: (10)

(i) Insert element at the beginning.

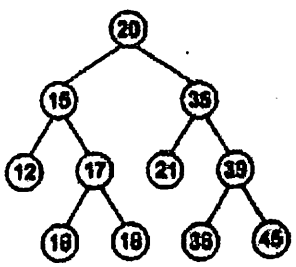
(ii) Delete element after a specific element.

5. (a) Explain Binary Searching technique with proper example. Analyse the time complexity for different best, worst and average case. (5)

(b) Consider the following key values and construct a B Tree of order 3: (10)

7 2 10 8 11 9 22 13 19 20 32 6 40 3

6. (a) Traverse the following tree using pre-order, in-order and post-order traversal method: (5)



(b) Sort the following sequence in descending order using Heap sort: (10)

43 32 10 3 56 78 55 48 23 64 5 38 84 22 15

7. (a) Define collision in Hashing. Explain different collision resolution techniques. (5)

(b) Explain BFS algorithm with proper example. (5)

(c) Define AVL tree. Construct an AVL tree from the following values (perform rotation if required):

50 41 68 32 44 41 (5)

Total No. of printed pages = 3

CSE 181303

Roll No. of candidate | | | | | | | | | | |

2021

B.Tech. 3rd Semester End-Term Examination

CSE

DIGITAL SYSTEMS

(New Regulation)

(w.e.f. 2017–2018)

(New Syllabus)

(w.e.f. 2018–2019)

Full Marks – 70 Time – Three hours

The figures in the margin indicate full marks for the questions.

Answer question No. 1 and any *four* from the rest.

1. Answer the following (MCQ/Fill in the blanks) (10 × 1 = 10)

   (i) In a 2 input NAND gate if one of the input is permanently connected to Logic 0, the output will be ————————

   (ii) An AND gate becomes ———————— gate when used with negative logic

   (iii) Bubbled OR gate is equal to ———————— gate.

   (iv) On Karnaugh map grouping of 0's produces ————————

   (a) SOP expression

   (b) POS expression

   (c) Non simplified expression

   (d) Not allowed

   (v) A 6 bit DAC has a step size of 50 mV What will be the full scale output voltage?

   (a) 5V

   (b) 3.15V

   (c) 3.2 mV

   (d) 50 mV

[Turn over

(vi) Which of the following is an Analog to digital converter

(a) Successive Approximation

(b) Flash type

(c) Weighted resistor/converter

(d) Both (a) and (b)

(vii) Define Fan-out?

(viii) State De-Morgan's theorem.

(ix) Which logic family is the fastest of all the logic families?

(x) What is MOD of a counter?

2. (a) Do the following conversions (4)

(i) $(89.325)_{10}$ to binary

(ii) $(543.621)_8$ to hexadecimal

(iii) Binary $(110010100)_2$ to Gray

(iv) $(FAC.4B)_{16}$ to Binary

(b) Do the following arithmetic (2×4=8)

(i) Given the two binary numbers X = 1010100 and Y = 1100101. Find X-Y using 2's complement.

(ii) Add the numbers in BCD: 171 + 188

(c) For $(292)_{10}$ $(1204)_b$, determine the base b. (3)

3. (a) Using Boolean algebra simplify the following expression. (4)

$$F = A\left[B + \overline{C}\overline{(AB + A\overline{C})}\right]$$

(b) Convert Y = ABC +AC +AB to standard SOP. Also find its corresponding POS. (6)

(c) Simplify using K-map: $Y = \Sigma m(1,3,7,8,12,13) + d(0,2,9,11,14,15)$ (5)

4. (a) State the difference between combinational circuit and sequential circuit. (2)

(b) Design a full subtractor circuit. (5)

(c) Design 16:1 MUX using 4:1 MUX. (4)

(d) Implement the following function using 3 to 8 line decoder. (4)

(i) $F(A,B,C) = \Sigma m(0,2,5,6,7)$

(ii) $F(X,Y,Z) = \prod M(0,1,4,5)$

5. (a) State the differences between latches and flip flops. (3)

(b) What is Race around condition? With a neat diagram explain the working of Master Slave JK flip flop? (2+5)

(c) Describe the operation of 4 bit bidirectional shift register. (5)

6. (a) What do you mean by synchronous and asynchronous counters? (2)

(b) Design and implement MOD-6 asynchronous counter using T flip flop. (5)

(c) Design a synchronous counter that goes through the states 0,3,5,6,0.....(8)

7. Write short notes on any *three* (3 × 5 = 15)

(a) R-2R Ladder D/A converter

(b) CMOS NAND

(c) ROMS and applications

(d) PAL and PLA

(e) 4 bit even and odd parity generator.

Total No. of printed pages = 3

CSE 181305

Roll No. of candidate | | | | | | | | | | |

2021

B.Tech. 3rd Semester End-Term Examination

Computer Science and Engineering

BASICS OF SIGNALS AND SYSTEMS

(New Regulation w.e.f. 2017-18)

(New Syllabus w.e.f. 2018-19)

Full Marks – 70 Time – Three hours

The figures in the margin indicate full marks for the questions.

Answer question No. 1 and any *four* from the rest.

1. Write short answer: (10 × 1 = 10)

(i) Define signal.

(ii) Write the mathematical expression for unit ramp signal.

(iii) Define causal and non causal signal.

(iv) What is the condition for stability of a LTI systems?

(v) What is the area of an unit impulse function?

(vi) Write down the relation between unit step signal and unit impulse function.

(vii) What is meant by Region of Convergence (ROC) in z-transform?

(viii) Define static and dynamic system.

(ix) At $x = 0$, $\sin c(x) =$ ————————.

(x) The sum of two periodic signals $x1(t)$ and $x2(t)$ with periods $T1$ and $T2$ is said to be periodic if the ratio of the periods is ————————.

[Turn over

2. (a) Define periodic signal, non periodic signal, deterministic signal and random signal. (5)

(b) Identify the periodic signals and compute periodicity (fundamental period) if periodic

(i) $x(t) = 2\cos\frac{2\pi t}{3} + 3\cos\frac{2\pi t}{7}$

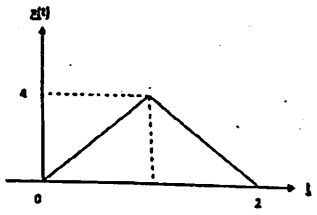
(ii) $x(t) = 3\cos\left(5t + \frac{\pi}{6}\right)$

(iii) $x[n] = e^{j5\pi n}$. (6)

(c) Find the convolution of the following signal

$x1(t) = u(t)$ and $x2(t) = u(t)$. (4)

3. (a) Sketch and label the even and odd component of the signal shown in fig: (6)



(b) Define energy and power signal. (4)

(c) Find the power and energy of the signal $x(t) = e^{\alpha t}u(t)$. (5)

4. (a) Explain with example the following operation on a signal: (3)

(i) Time delaying

(ii) Time folding

(iii) Time scaling

(b) Sketch the signals- (4)

(i) $u(-2t + 4)$

(ii) $y[n] = x[2n]$ for $x[n] = \{1,2,3,4,5\}$.

(c) Determine the following system described by $y(t) = x(t^2)$ is non causal and time variant. (6)

(d) Find the system $y(t) = 4t + x(t)$ is linear or not. (2)

5. (a) Describe the causality and stability properties of LTI system. (8)

(b) Determine the response of the LTI system whose input $x[n]$ and impulse response $h[n]$ are given by $x[n] = \{1,2,3,4\}$ $h[n] = \{1,2,2,1\}$. (7)

6. (a) Define Laplace transform State the condition for existence of Laplace transform. Find the Laplace transform of the signal $x(t) = e^{-3t}u(t)$ and plot ROC. (8)

(b) The impulse response of an LTI system is $h(t) = 2e^{-3t}u(t)$. Find the response of the system for the input $x(t) = 2e^{-5t}u(t)$ using Fourier Transform. (5)

(c) Define Z-transform. What is meant by region of convergence (ROC) in Z-transform. (2)

7. (a) Find Fourier series coefficient of $x(t) = 4 + 2\cos\frac{2\pi}{3}t + 4\sin\frac{5\pi}{3}t$ and sketch the magnitude and phase spectra. (7)

(b) Establish the relation between Fourier transform and Laplace transform from their basic definition. (3)

(c) State Sampling theorem. Show that the sampling frequency must be at least twice the maximum frequency of the signal for the proper reconstruction of the signal. (5)

Total No. of printed pages = 6

MA 181301B

Roll No. of candidate | | | | | | | | | | |

2021

B.Tech. 3rd Semester End-Term Examination

ECE, ETE, CSE

MATHEMATICS III – B

(New Regulation)

(w.e.f. 2017–2018)

(New Syllabus)

(w.e.f. 2018–2019)

Full Marks – 70 Time – Three hours

The figures in the margin indicate full marks for the questions.

(Answer question No. 1 and any *four* from the rest.)

1. Choose the correct answer: (10 × 1 = 10)

(i) An integer is chosen from 2 to 15. What is the probability that it is prime?

(a) $\frac{4}{7}$

(b) $\frac{3}{7}$

(c) $\frac{2}{7}$

(d) $\frac{1}{7}$

(ii) Let A and B be two events such that $P(B)=1$, then $P(A/B)=$ _____

(a) $P(A)$

(b) $P(B)$

(c) $P(A\cap B)$

(d) $P(A\cup B)$

(iii) For a random variable X which of the following is false?

(a) $0\le F_X(x)\le 1$

(b) $F_X(\infty)=1$

(c) $P(a<X\le b)=F_X(b)-F_X(a)$

(d) $F_X(x)=P(X\ge x)$

(iv) If X is a continuous random variable with probability density function $f_X(x)=\begin{cases} Kx^2 & for\ 0<x<3 \\ 0 & otherwise \end{cases}$. Then the value of K is _____

(a) $\frac{2}{9}$

(b) $\frac{1}{9}$

(c) $\frac{4}{9}$

(d) $\frac{5}{9}$

(v) If X is a continuous random variable with probability density function $f_X(x)=\begin{cases} \frac{1}{2}x & for\ 0<x<2 \\ 0 & otherwise \end{cases}$. Then $E(X)$ is _____

(a) 1

(b) 0

(c) 2

(d) 3

(vi) The frequency curve which is symmetrical about its mean is known as

(a) Platykurtic

(b) Mesokurtic

(c) Leptokurtic

(d) None of these

(vii) Which of the vector is a probability vectors?

(a) $\left(\frac{1}{4}, \frac{3}{2}, -\frac{1}{4}, \frac{1}{2}\right)$

(b) $\left(\frac{5}{2}, 0, \frac{8}{3}, \frac{1}{6}, \frac{1}{6}\right)$

(c) $\left(\frac{1}{12}, \frac{1}{2}, \frac{1}{6}, 0, \frac{1}{4}\right)$

(d) $\left(\frac{3}{13}, \frac{2}{13}, -\frac{1}{6}, 0, \frac{1}{5}\right)$

(viii) The joint probability mass function of two random variables X any Y is

$P_{X,Y}(x, y) = \begin{cases} \frac{1}{21}(x+y) \text{ for } x = 1,2 \text{ and } y = 1, 2, 3 \\ 0 \qquad\qquad\qquad\qquad \text{otherwise} \end{cases}$. The $P_X(1) =$ _____

(a) $\frac{3}{8}$

(b) $\frac{3}{7}$

(c) $\frac{5}{6}$

(d) $\frac{1}{4}$

(ix) 2% of the items produced by a firm are defective. If a box contains 100 items, then the variance is _____

(a) 2

(b) 3

(c) 1

(d) 4

(x) If θ be the angle between the lines of regression of the variables X and Y, then the lines of regression are perpendicular to each other if ——————

(a) $tan\,\theta = \frac{\pi}{2}$

(b) $sin\,\theta = \frac{\pi}{2}$

(c) $tan\,\theta = \infty$

(d) $sin\,\theta = 0$

2. Answer the following:

(a) A bag contains 6 white, 3 red and 9 black balls. Three balls are drawn one by one with replacement. What is the probability that at least one is white? (5)

(b) State and prove Baye's Theorem. (1+4=5)

(c) The probability density function of a random variable X is $f_X(x) = \frac{1}{2}e^{-|x|}$ for $-\infty < x < \infty$. Find the cumulative distribution function of X. (5)

3. Answer the following :

(a) The probability mass function of a random variable X is

$$p_X(x) = \begin{cases} \frac{1}{K^x} \text{ for } x = 1, 2, \ldots \\ 0, \quad otherwise \end{cases}$$, where K is a constant.

Find moment generating function of X. Hence evaluate mean of X. (3+2=5)

(b) How many tosses of a fair coin are needed so that the probability of getting at least one head is 87.5%? (5)

(c) Using the least square method fit a straight line to the four points (–1.0,1.000), (–0.1,1.099), (0.2,0.808), (1.0,1.000). (5)

4. Answer the following :

(a) In a normal distribution, 7% of the items are under 35 and 89% of the items are under 63. What is the mean and standard deviation of the distribution? (5)

(b) The first four moments of a distribution about the value 4 of the variable are –1.5, 17, –30 and 108. Calculate measure of skewness and measure of kurtosis, and comment upon the nature of the frequency distribution. (5)

(c) If the random variables Y, X_1 and X_2 are defined as $Y = aX_1 + bX_2$, where a and b are constants, find variance of Y. (5)

5. Answer the following :

(a) The joint probability mass function of two random variables X and Y is

$$P_{X,Y}(x,y) = \begin{cases} \frac{1}{42}(2x+y), & \text{for } x = 0, 1, 2 \text{ and } y = 0, 1, 2, 3 \\ 0, & \text{otherwise} \end{cases}$$

Find $p_y(y/2)$. Hence, find $P(Y = 1/X = 2)$. (3+2=5)

(b) Find the unique fixed probability vector t of $P = \begin{bmatrix} 0 & \frac{3}{4} & \frac{1}{4} \\ \frac{1}{2} & \frac{1}{2} & 0 \\ 0 & 1 & 0 \end{bmatrix}$ (5)

(c) Show that the Poisson distribution is the limiting form of the Binomial distribution. (5)

6. Answer the following :

(a) The joint probability density function of X and Y is

$$f_{X,Y}(x,y) = \begin{cases} 4xye^{-(x^2+y^2)}, & \text{for } 0 \le x < \infty \text{ and } 0 \le y < \infty. \\ 0, & \text{otherwise} \end{cases}$$

Show that X and Y are independent. (5)

(b) The marks secured by recruits in the selection test (X) and in the proficiency test (Y) are given below:

Sl.No.	1	2	3	4	5	6	7	8	9
X	10	15	12	17	13	16	24	14	22
Y	30	42	45	46	33	34	40	35	39

Calculate the rank correlation coefficient. (5)

(c) Let two dice be thrown at random. Let X be the discrete random variable that assigns to each point (a, b) the maximum of its numbers. Find the cumulative distribution function of X. (5)

7. Answer the following :

(a) The theory predicts the proportion of beans in four groups G_1, G_2, G_3 and G_4 should be in the ratio 9:3:3:1. In an experiment with 1600 beans the numbers in the four groups were 882, 313, 287 and 118. Does the experimental result support the theory? (5)

(b) Find the regression line of Y on X if $n = 5$, $\Sigma x = \Sigma y = 15$, $\Sigma x^2 = \Sigma y^2 = 49$ and $\Sigma xy = 44$. (5)

(c) Consider a two-state Markov chain with the transition probability matrix $P = \begin{bmatrix} 1-a & a \\ b & 1-b \end{bmatrix}$ for $0 < a < 1$ and $0 < b < 1$. Find the n-step transition probability matrix P^n. (5)

Total No. of printed pages = 6

EI 181303

Roll No. of candidate | | | | | | | | | | |

2021

B.Tech. 3rd Semester End-Term Examination

ANALOG ELECTRONICS

(New Regulation w.e.f. 2017–2018) &

(New Syllabus w.e.f. 2018–2019)

Full Marks – 70 Time – Three hours

The figures in the margin indicate full marks for the questions.

Answer question No. 1 and any *four* from the rest.

1. (A) Answer True or False : (5 × 1 = 5)

(i) Schottky Diode is also called Esaki Diode.

(ii) Voltage Tripler contains 3 Diode-Resistance combinations.

(iii) Energy Gap between CB and VB in Ge is 1.5 eV.

(iv) A Capacitor in a Filter Circuit is always connected in PARALLEL.

(v) In a Schmitt Trigger $|V_{B1}| = |V_{B2}|$.

(B) Choose the correct answer : (5 × 1 = 5)

(i) Shockley's Equation

(a) Shows Linear Characteristics

(b) Forms a basis for calculating resistance of a diode

(c) Indicates Negative Resistance

(d) All of the above

(ii) A Tunnel Diode can be used

(a) In an Oscillator Circuit.

(b) In a High Frequency Rectifier Circuit

(c) In the Break-Down Region.

(d) None of the above

(iii) The numerical value 0.3 is associated with

(a) The Cut-in Voltage of Ge diode

(b) Barrier Potential of Ge diode

(c) Energy Barrier in an open circuited Ge diode

(d) All of the above

(iv) A Zener Diode can be used as

(a) An Oscillator when reverse biased

(b) A Voltage Regulating Element when forward biased

(c) A Voltage Regulating Element when reverse biased

(d) A Voltage Regulating Element when biased in the Break-Down Region

(v) The following property of a P-N junction is used in a Varactor Diode

(a) A special type of P-N junction exhibits Negative Resistance under a certain bias condition

(b) When a junction is formed between a highly doped N-type semiconductors with a low conductivity metal, a barrier of electrons is formed at the junction boundary of the metal

(c) A depletion region is formed at the junction, which represents a capacitance whose value varies with an applied reverse bias

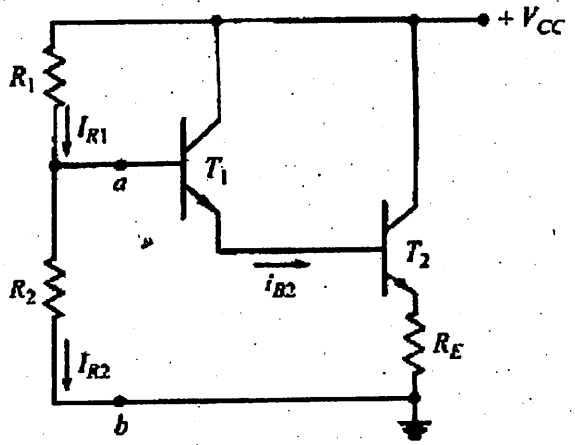
(d) The resistance of a Si P-N junction tends to infinity at reverse bias

2. (a) The Si Darlington transistor pair of Figure has negligible leakage current, and Let V_{cc} = 12V; R_E = 500Ω, and $R_1 = R_2$ = 1 MΩ. Find (5)

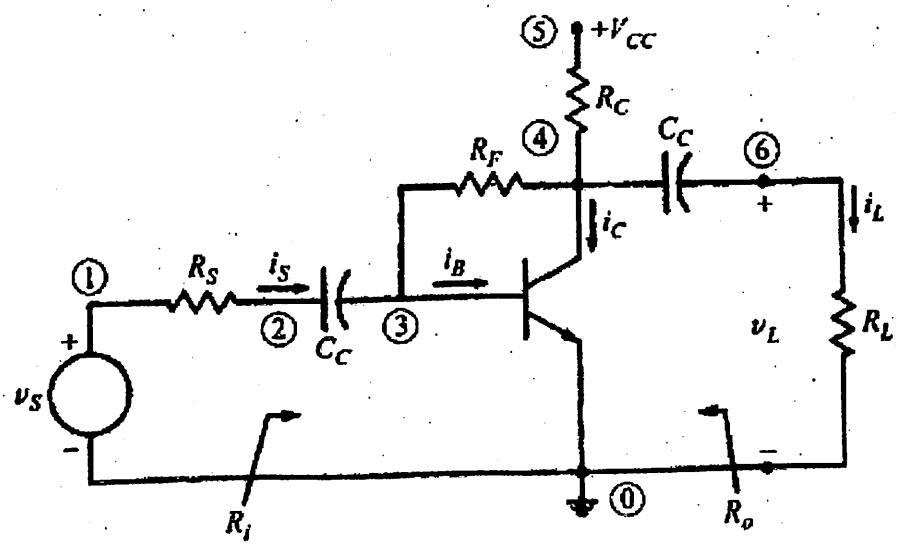
(i) I_{EQ2}

(ii) V_{CEQ2}

(iii) I_{CQ1}



(b) Find the value of the emitter resistor R_E that, when added to the Si transistor circuit of Figure, would bias for operation about V_{CEQ} = 5V. Let I_{CEO} = 0; β = 80; R_F = 220 kΩ; R_C = 2 kΩ and V_{cc} = 12 V. (5)



(c) Analyse the development of the different biasing conditions of transistor from the stability point of view with the help of stability factor. (5)

3. (a) With proper analysis, and diagrams derive transfer characteristics of JFET. (5)

(b) What are the difference between D-MOSFET and E-MOSFET? With proper diagrams and graphs analyse self-bias configuration (DC and AC) of JFET. (5)

(c) Establish Gain and phase relationship of a collector feedback configuration using r_e model. (5)

4. (a) With Diagram, explain different feedback connections in brief and their relationship in terms of gain, input and output impedance. (5)

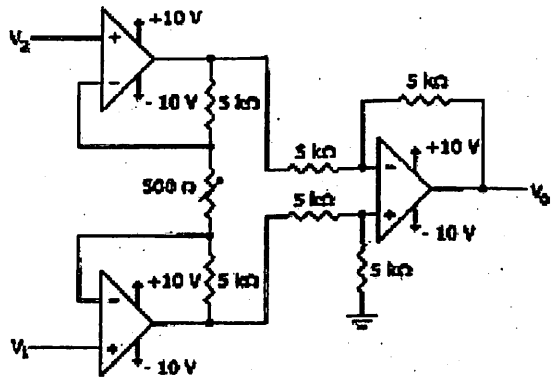
(b) Draw the circuit diagram of phase shift oscillators and different tuned oscillators using BJT and / or FET, write their frequency expressions. (5)

(c) What are the Classes of power amplifiers? Define them. With circuit diagram, derive the expression of maximum efficiency of a Class A amplifier. (5)

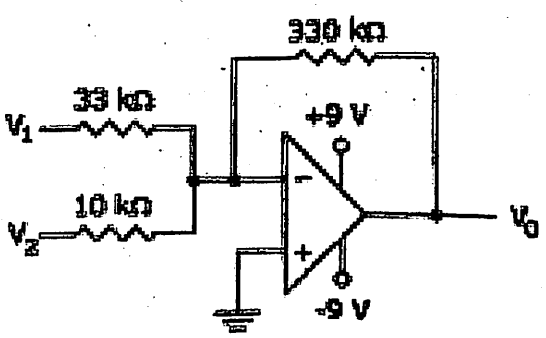
5. (a) With circuit diagram explain the operation of Schmitt trigger circuit. (3)

(b) Define CMRR. What are differential gain and common mode gain? (3)

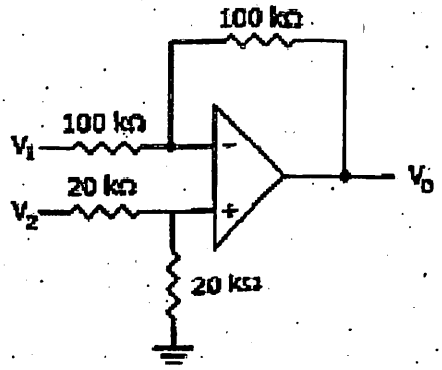
(c) Calculate the output voltage for this circuit when V_1 = 2.5 V and V_2 = 2.25V. (3)



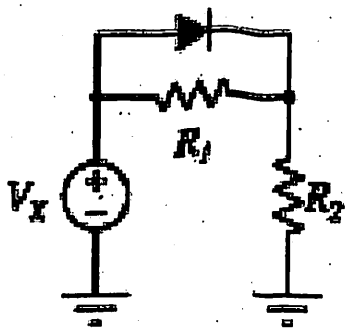
(d) Calculate the output voltage if V_1 = –0.2 V and V_2 = – 0 V. (3)



(e) Determine the output voltage when $V_1 = -V_2 = 1$ V. (3)

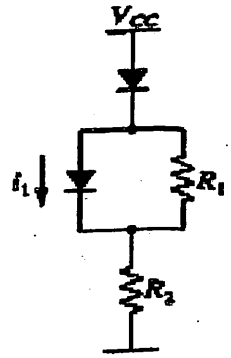


6. (a) In the circuit below, the diode has a cut-in voltage of 0.7 volts. (3)



V_x is 7 volts, R_1 and R_2 are 0.1 and 2.1 kilo-ohms respectively. What is the current through R_2? Give your answer in milli-amperes.

(b) In the circuit below, Ri and Ri are 4.4 and 1.1 kilo-ohms respectively. The voltage VCC is 4.9 volts. The diodes follow the standard diode equation, with saturation current of 16×10^{-12} milli-amperes, and the thermal voltage of 25 milli-volts.



What is the current i_1 ? Give your answer in milli-amperes. (3)

(c) Explain the working of the 555 timer IC. (5)

(d) Write short note on any one of the following : (4)

(i) Zener diode

(ii) LED

Total No. of printed pages = 4

EI 181304

Roll No. of candidate | | | | | | | | | | |

2021

B.Tech. 3rd Semester End-Term Examination

ELECTRICAL MACHINE – I

(New Regulation w.e.f 2017 – 2018)

(New Syllabus w.e.f 2018 – 2019)

Full Marks – 70 Time – Three hours

The figures in the margin indicate full marks for the questions.

First question is mandatory and from other Answer any *four*

1. Give the Answer for Multiple choice questions : (10 × 1 = 10)

   (i) For which DC motor regenerative breaking is not possible:

   (a) Shunt motor

   (b) Separately-excited motor

   (c) Series motor

   (d) None of the above

   (ii) Speed reversal of DC series motor is only possible:

   (a) When current direction of armature winding gets reversed

   (b) When current direction of field winding gets reversed

   (c) When current direction of both the field and armature winding get reversed simultaneously

   (d) When current direction of either of field winding or armature winding get reversed

   (iii) Eddy current loss will depends on

   (a) Frequency

   (b) Flux density

   (c) Thickness

   (d) All of the above

[Turn over

(iv) Swinburne's Test is a ————————.

(a) Direct method of testing of DC machine

(b) Indirect method of testing of DC machine

(c) Both direct and indirect method of testing of DC machine

(d) None of the above

(v) What is the condition for the parallel operation of two DC shunt generators?

(a) Polarity should be same

(b) Terminal voltage should be same

(c) Both of the polarity and terminal voltage should be same

(d) None of the above

(vi) The open-circuit characteristics of DC generator is also known as

(a) Internal characteristic

(b) External characteristic

(c) Magnetization characteristic

(d) None of the above

(vii) Which of the statement is true for Lap-winding of the DC machine?

(a) The number of parallel paths is equal to two

(b) Equalizer connections are not required

(c) The number of parallel paths is equal to number of poles

(d) None of the above

(viii) Zero voltage regulation of the transformer is possible for ————————.

(a) Resistive load (b) Inductive load

(c) Capacitive load (d) None of the above

(ix) What is the condition for maximum efficiency of the single-phase transformer?

(a) Variable copper loss should be less than core loss

(b) Variable copper loss should be more than core loss

(c) Variable copper loss should be equal to core loss

(d) None of the above

(x) V-V connection of 3-phase transformer also known as

(a) Stat-Star connection (b) Delta-Delta connection

(c) Open-Delta connection (d) None of the above

2. (a) What are the types of DC machine? Draw equivalent circuit diagram and explain each type as a DC generator. (7)

(b) A DC generator has an armature EMF of 100 V when the useful flux per pole is 20 mWb and the speed is 800 rpm. Calculate the generated EMF (i) with the same flux and a speed of 1000 rpm, (ii) with a flux per pole of 24 mWb and a speed of 900 rpm. (8)

3. (a) Draw and explain the different characteristics of separately excited DC generator. (7)

(b) Explain the process of commutation in the dc machine and describe the methods to improve it. (8)

4. (a) What are the drawbacks of 3-point starter? Describe a four-point starter with a neat sketch. (7)

(b) A DC shunt machine, connected to 250 V supply, has an armature resistance (including brushes) of 0.12 ohm and the resistance of the field circuit is 100 ohms. Find the ratio of speed as a generator to the speed as a motor, the line current in each case being 80 A. (8)

5. (a) Draw a torque-speed characteristic of DC series motor and explain why this motor should never run unloaded condition. (7)

(b) With the suitable diagram, explain the ward-Leonard system of speed control of DC shunt motor. (8)

6. (a) Derive the EMF equation of single-transformer and list any three properties (or assumptions) for ideal transformer. (7)

(b) A single-phase transformer has 400 primary and 1,000 secondary turns. The net cross-sectional area of the core is 60 cm^2. If the primary winding be connected to a 50 Hz supply at 500V, calculate the peak value of the flux density in the core. (8)

7. (a) A transformer is rated at 100 kVA. At full load its copper loss is 1000 W and its iron is 900 W. Calculate the maximum efficiency at 0.85 power factor. (8)

(b) Derive the condition for maximum efficiency of a single-phase transformer. (7)

8. (a) A 25kVA, 2000/200 V, 2-winding transformer is to be used as a step-up autotransformer with constant source voltage of 2000 V. With the suitable circuit diagram, calculate the KVA rating of this step-up autotransformer at unity power factor. (8)

(b) Draw and explain the Scott connection of transformers and mark the terminals and turn ratio. What are the applications of Scott connection? (7)

Total No. of printed pages = 6

EI 181303

Roll No. of candidate | | | | | | | | | | |

2021

B.Tech. 3rd Semester End-Term Examination

ANALOG ELECTRONICS

(New Regulation w.e.f. 2017–2018) &

(New Syllabus w.e.f. 2018–2019)

Full Marks – 70 Time – Three hours

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(v) In a Schmitt Trigger $|V_{B1}| = |V_{B2}|$.

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(c) Indicates Negative Resistance

(d) All of the above

(ii) A Tunnel Diode can be used

(a) In an Oscillator Circuit.

(b) In a High Frequency Rectifier Circuit

(c) In the Break-Down Region.

(d) None of the above

(iii) The numerical value 0.3 is associated with

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(b) Barrier Potential of Ge diode

(c) Energy Barrier in an open circuited Ge diode

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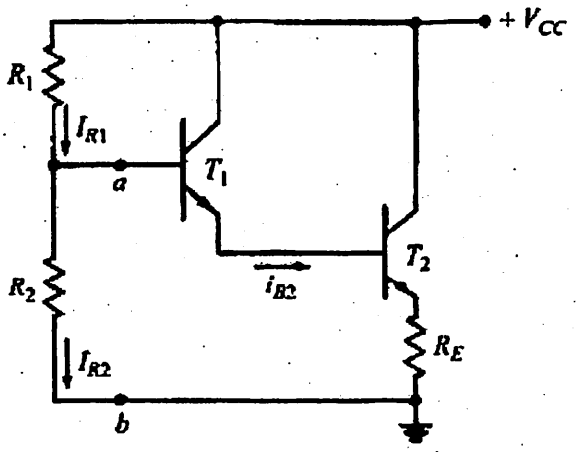
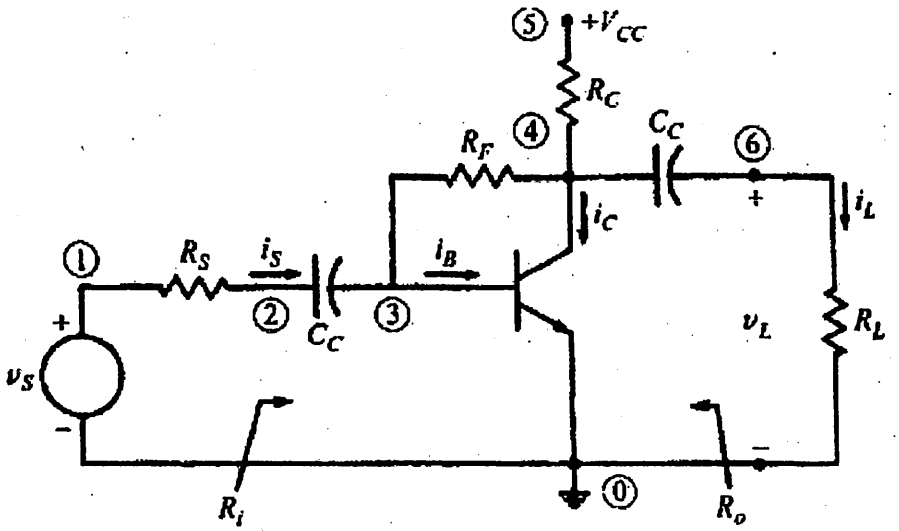
(ii) V_{CEQ2}

(iii) I_{CQ1}



(b) Find the value of the emitter resistor R_E that, when added to the Si transistor circuit of Figure, would bias for operation about V_{CEQ} = 5V. Let I_{CEO} = 0; $\beta = 80$; $R_F = 220\,k\Omega$; $R_C = 2\,k\Omega$ and V_{cc} = 12 V. (5)



(c) Analyse the development of the different biasing conditions of transistor from the stability point of view with the help of stability factor. (5)

3. (a) With proper analysis, and diagrams derive transfer characteristics of JFET. (5)

(b) What are the difference between D-MOSFET and E-MOSFET? With proper diagrams and graphs analyse self-bias configuration (DC and AC) of JFET. (5)

(c) Establish Gain and phase relationship of a collector feedback configuration using r_e model. (5)

4. (a) With Diagram, explain different feedback connections in brief and their relationship in terms of gain, input and output impedance. (5)

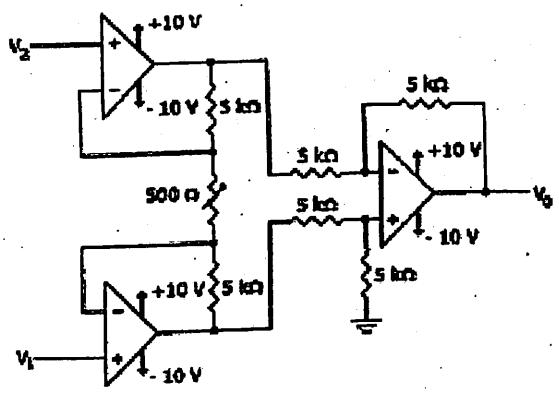
(b) Draw the circuit diagram of phase shift oscillators and different tuned oscillators using BJT and / or FET, write their frequency expressions. (5)

(c) What are the Classes of power amplifiers? Define them. With circuit diagram, derive the expression of maximum efficiency of a Class A amplifier. (5)

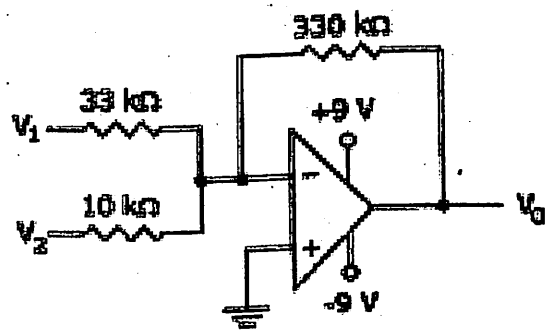
5. (a) With circuit diagram explain the operation of Schmitt trigger circuit. (3)

(b) Define CMRR. What are differential gain and common mode gain? (3)

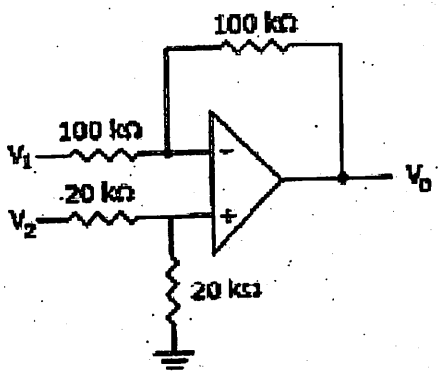
(c) Calculate the output voltage for this circuit when V_1 = 2.5 V and V_2 = 2.25V. (3)



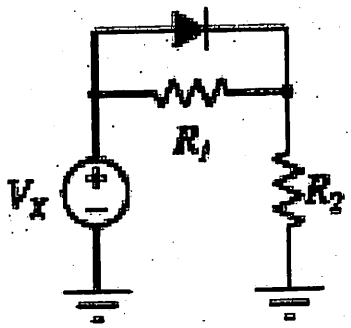
(d) Calculate the output voltage if V_1 = –0.2 V and V_2 = – 0 V. (3)



(e) Determine the output voltage when $V_1 = -V_2 = 1$ V. (3)

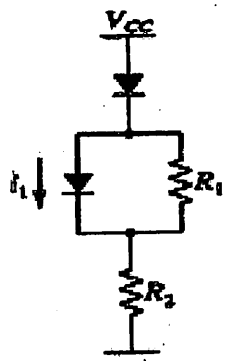


6. (a) In the circuit below, the diode has a cut-in voltage of 0.7 volts. (3)



V_x is 7 volts, R_1 and R_2 are 0.1 and 2.1 kilo-ohms respectively. What is the current through R_2? Give your answer in milli-amperes.

(b) In the circuit below, Ri and Ri are 4.4 and 1.1 kilo-ohms respectively. The voltage VCC is 4.9 volts. The diodes follow the standard diode equation, with saturation current of 16×10^{-12} milli-amperes, and the thermal voltage of 25 milli-volts.



What is the current i_1 ? Give your answer in milli-amperes. (3)

(c) Explain the working of the 555 timer IC. (5)

(d) Write short note on any one of the following : (4)

(i) Zener diode

(ii) LED

Total No. of printed pages = 2

EI 181305

Roll No. of candidate | | | | | | | | | | |

2021

B.Tech. 3rd Semester End-Term Examination

EE, IE, EEE

DIGITAL ELECTRONICS

(New Regulation w.e.f. 2017-18)

(New Syllabus w.e.f. 2018-19)

Full Marks – 70 Time – Three hours

The figures in the margin indicate full marks for the questions.

Answer question No. 1 and any *four* from the rest.

1. Answer the following questions :

(i) Find Decimal equivalent of binary no $(1100.1011)_2$ (1)

(ii) Find binary equivalent of decimal no $(10.625)_{10}$ (1)

(iii) Find Octal equivalent of decimal no $(249)_{10}$ (1)

(iv) Find Octal equivalent of binary no $(10110011)_2$ (1)

(v) Find Hexadecimal equivalent of binary no $(11011100.101010)_2$ (1)

(vi) Fill up the blanks by the next two Hexadecimal numbers FE, FF, _____, _____. (1)

(vii) Find the GRAY CODE for binary $(11011)_2$. (1)

(viii) Find the binary equivalent of GRAY COOE $(1110101)_{GRAY\ code}$. (1)

(ix) Subtract $(1101)_2$ from $(1011)_2$ by 2's complement method. (2)

[Turn over

2. (a) Simplify the following expressions and get the minimized forms by using Boolean algebraic theorems. (3+3=6)

(i) $AB+(AC)'+AB'C(AB+C)$

(ii) $A(A'+C)(A'B+C')$

(b) Derive the standard SOP and standard POS expressions for the following function $f(A, B, C)=A+BC$. (5)

(c) Represent the following logical expression in a K-map and obtain the minimized expression from it $f(A, B, C, D)=\Sigma m(2,3,4,5,9,10,13)$. (4)

3. (a) Obtain the minimized SOP expression for the following function by Quine McClusky's method: $f(A,B,C,D)=\Sigma m(0,1,2,3,5,7,8,9,11,14)$. (8)

(b) Starting from the Truth Table and with the help of k-map develop the logic expressions of a 2-bit digital comparator circuit. (3+4=7)

4. (a) What is a multiplexer? Implement the following Boolean function by using 16:1 multiplexer. $f(A,B,CD)=\Sigma m(0,3,5,6,9,10,12,15)$. (2+6=8)

(b) What is race around condition of a J-K flip flop? How it can be eliminated? (5+2=7)

5. (a) What are half adder and full adder? (4)

(b) What are half subtractor and full subtractor? (4)

(c) Use four full adders and other gate elements to develop a 4-bit binary adder/subtractor circuit. Give a brief description of the circuit. (2+5=7)

6. (a) What is a register? Explain in details how a shift register works in SISO mode? (2+6=8)

(b) Design and draw the circuit of a modulus-16 Synchronous Up-counter. (7)

7. Write briefly about any *three* of the following: (3 × 5 = 15)

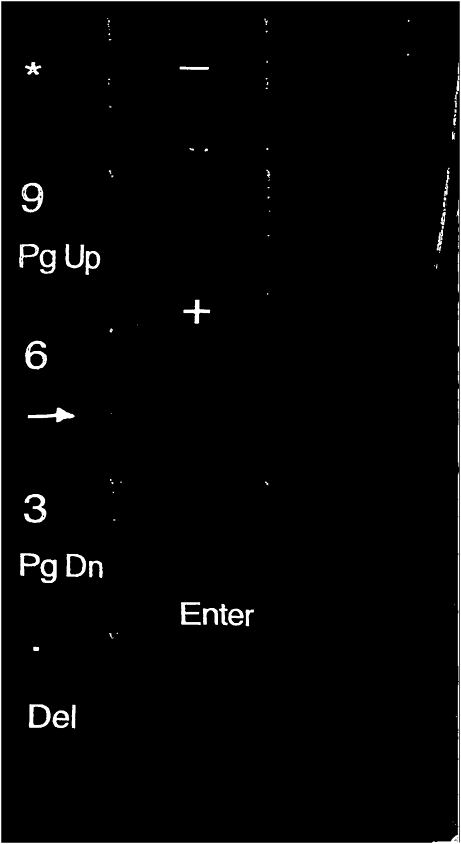
(a) ROM organization

(b) Even parity generator and odd parity generator.

(c) Decade counter

(d) 7-segment decoder

(e) DAC.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ME 181304

Roll No. of candidate | | | | | | | | | | |

2021

B.Tech. 3rd Semester End-Term Examination

ME, IPE

THEORY OF MACHINES

(New Regulation)

(W.e.f. 2017-18)

(New Syllabus)

(W.e.f. 2018-19)

Full Marks – 70 Time – Three hours

The figures in the margin indicate full marks for the questions.

Answer question No. 1 and any *four* from the rest.

1. Answer the following (MCQ/ Fill in the blanks) : (10 × 1 = 10)

(i) The motion between a pair which takes place in _____ is known as incompletely constrained motion.

(a) One direction only (b) Two directions only

(c) More than one direction (d) None of these

(ii) If the opposite links of a four bar linkage are equal, the links will always form a

(a) Parallelogram (b) Triangle

(c) Rectangle (d) Pentagon

(iii) Cam size depends upon_____

(a) Prime circle (b) Pitch circle

(c) Base circle (d) Outer circle

(iv) The frictional torque transmitted in a conical pivot bearing, considering uniform wear, is _____

(a) (2/3) $\mu W R \operatorname{cosec}\alpha$ (b) (1/2) $\mu W R \operatorname{cosec}\alpha$

(c) (3/4) $\mu W R \operatorname{cosec}\alpha$ (d) (1/8) $\mu W R \operatorname{cosec}\alpha$

(v) In a four stroke I.C. engine, the turning moment during the compression stroke is_____

(a) Positive throughout

(b) Negative throughout

(c) Positive during major portion of the stroke

(d) Negative during major portion of the stroke

(vi) For two governors A and B, the lift of sleeve of governor A is more than that of governor B, for a given fractional change in speed. It indicates that_____

(a) Governor B is more sensitive than governor A

(b) Governor A is more sensitive than governor B

(c) Both governors A and B are equally sensitive

(d) None of the above

(vii) Idler tension pulley must be located_____

(a) Next to driving pulley on loose side of belt

(b) Next to driven pulley on loose side of belt

(c) Next to driving pulley on tight side of belt

(d) Next to driven pulley on tight side of belt

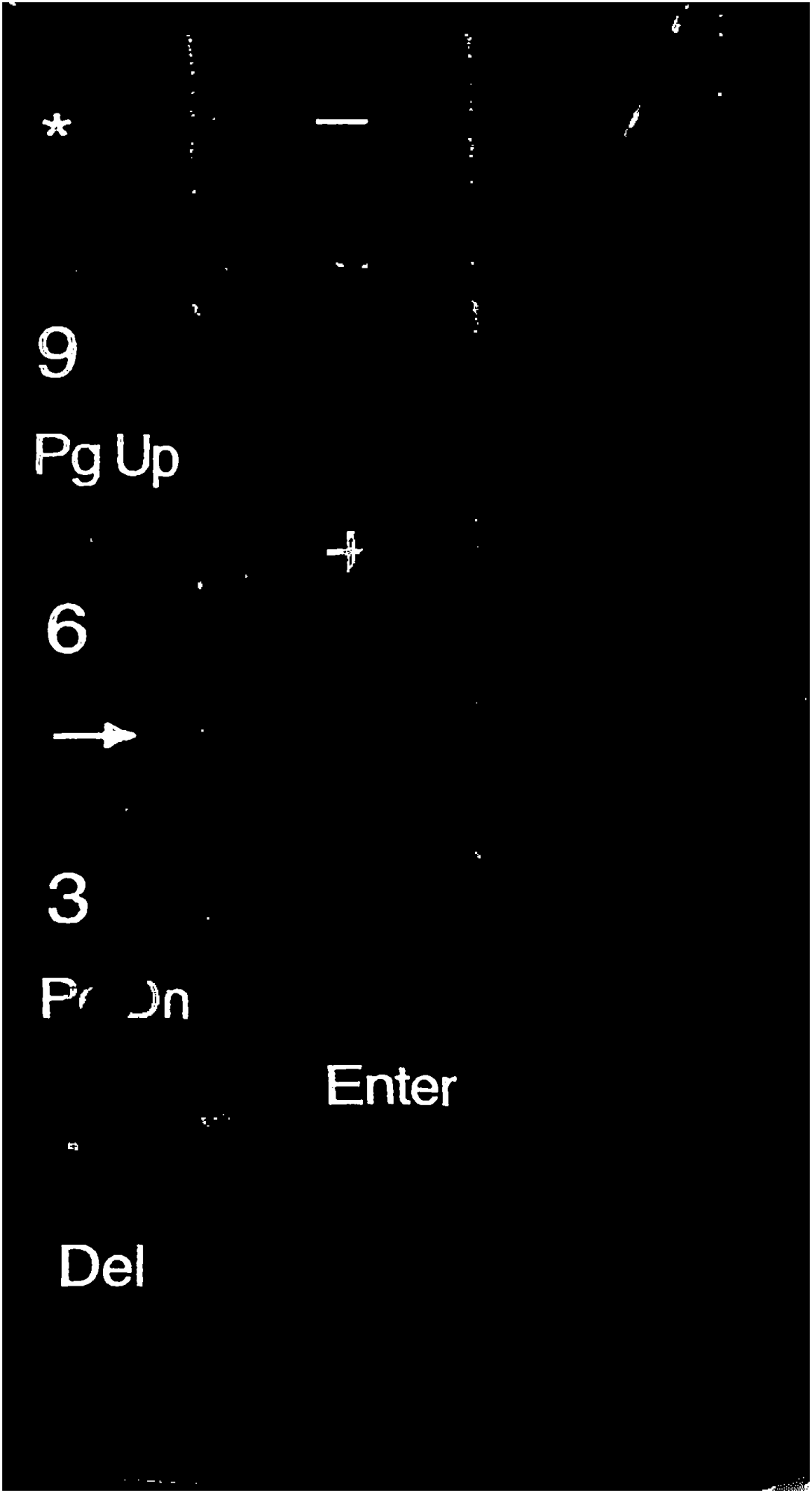
(viii) When the belt is stationary, it is subjected to some tension, known as initial tension. The value of this tension is equal to the_____

(a) Tension in the tight side of the belt

(b) Tension in the slack side of the belt

(c) Sum of the tensions in the tight side and slack side of the belt

(d) Average tension of the tight side and slack side of the belt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(ix) In which type of gear trains, shaft axes which are mounted by gear wheels have relative motion between them?

(a) Compounded gear train

(b) Simple gear train

(c) Epicyclic gear train

(d) Reverted gear train

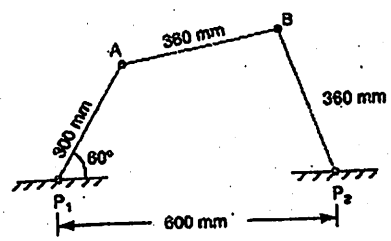
(x) When brakes are applied to all the four wheels of a moving car, the distance travelled by the car before it is brought to rest, will be_____

(a) Maximum (b) Minimum

(c) Equal (d) None of the mentioned

2. (a) What are the different types of constrained motion?

(b) The dimensions and configuration of the four bar mechanism, shown in Fig, are as follows: P_1A = 300 mm; P_2B = 360 mm; AB = 360 mm, and P_1P_2 = 600 mm. The angle $AP_1P_2 = 60°$. The crank P_1A has an angular velocity of 10 rad/s and an angular acceleration of 30 rad/s^2 both clockwise. Determine the angular velocities and angular accelerations of P_2B, and AB and the velocity and acceleration of the joint B. (5 + 10= 15)



3. (a) The arms of a Porter governor are 300 mm long. The upper arms are pivoted on the axis of rotation and the lower arms are attached to the sleeve at a distance of 35 mm from the axis of rotation. The load on the sleeve is 54 kg and the mass of each ball is 7 kg.Determine the equilibrium speed when the radius of the balls is 225 mm. What will be the range of speed for this position, if the frictional resistances to the motion of the sleeve are equivalent to a force of 30 N?

(b) In a spring loaded Hartnell type governor, the extreme radii of rotation of the balls are 80 mm and 120 mm. The ball arm and the sleeve arm of the bell crank lever are equal in length. The mass of each ball is 2 kg. If the speeds at the two extreme positions are 400 and 420 rpm, find:

(i) the initial compression of the central spring, and

(ii) the spring constant. (8+7= 15)

4. (a) What is a cam? Discuss the different types of Followers according to the surface in contact.

(b) A cam is to be designed for a knife edge follower with the following data:

(i) Cam lift = 40 mm during 90° of cam rotation with simple harmonic motion

(ii) Dwell for the next 30°

(iii) During the next 60° of cam rotation, the follower returns to its original position with simple harmonic motion.

(iv) Dwell during the remaining 180°.

Draw the profile of the cam when

(1) the line of stroke of the follower passes through the axis of the cam shaft, and

(2) the line of stroke is offset 20 mm from the axis of the cam shaft.

The radius of the base circle of the cam is 40 mm. Determine the maximum velocity and acceleration of the follower during its ascent and descent, if the cam rotates at 240 r.p.m. (5+10=15)

5. (a) Derive the relation for Energy stored in a Flywheel.

(b) The turning moment diagram for a multi-cylinder engine has been drawn to a scale of 1 mm to 500 N-m torque and 1 mm to 6° of crank displacement. The intercepted areas between output torque curve and mean resistance line taken in order from one end, in sq. mm are

– 30, + 410, – 280, + 320, – 330, + 250, – 360, + 280, – 260 sq. mm, when the engine is running at 800 r.p.m. The engine has a stroke of 300 mm and the fluctuation of speed is not to exceed ± 2% of the mean speed. Determine a suitable diameter and cross-section of the flywheel rim for a limiting value of the safe centrifugal stress of 7 MPa. The material density may be assumed as 7200 kg/m^3.The width of the rim is to be 5 times the thickness.

(5+10=15)

6. (a) Derive the relation for the ratio of Driving Tensions For Flat Belt Drive.

(b) An open flat belt drive connects two parallel shafts 1.2 m apart. The driving and the driven shafts rotate at 350 r.p.m. and 140 r.p.m. respectively and the driven pulley is 400 mm in diameter. The belt is 5 mm thick and 80 mm wide. The coefficient of friction between the belt and pulley is 0.3 and the maximum permissible tension in the belting is 1.4 MN/m^2. Determine:

(i) Diameter of the driving pulley,

(ii) Maximum power that may be transmitted by the belting, and

(iii) Required initial belt tension. (5+10=15)

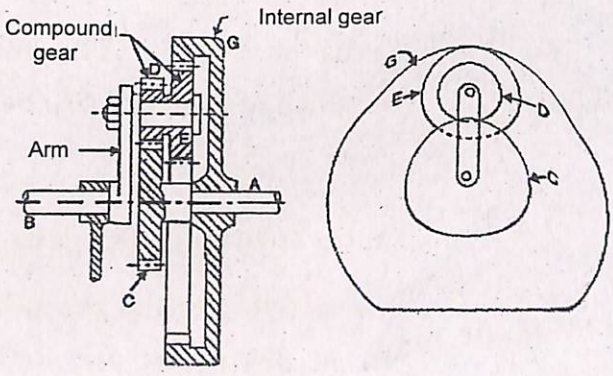
7. (a) A band brake acts on the 3/4th of circumference of a drum of 450 mm diameter which is keyed to the shaft. The band brake provides a braking torque of 225 N-m. One end of the band is attached to a fulcrum pin of the lever and the other end to a pin 100 mm from the fulcrum. If the operating force is applied at 500 mm from the fulcrum and the coefficient of friction is *0.25,* find the operating force when the drum rotates in the

(i) anticlockwise direction, and

(ii) clockwise direction.

(b) Two shafts A and B are co-axial. A gear C (50 teeth) is rigidly mounted on shaft A. A compound gear D-E gears with C and an internal gear G. D has 20 teeth and gears with C and E has 35 teeth and gears with an internal gear G. The gear G is fixed and is concentric with the shaft axis. The compound gear D-E is mounted on a pin which projects from an arm keyed to the shaft B. Find the number of teeth on internal gear G assuming that all gears have the same module. If the shaft A rotates at 110 r.p.m., find the speed of shaft B.

(7+8=15)



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ME 181305

Roll No. of candidate | | | | | | | | | | |

2021

B.Tech. 3rd Semester End-Term Examination

ME, IPE

MACHINE AND ASSEMBLY DRAWING

(New Regulation w.e.f. 2017–18)

(New Syllabus w.e.f. 2018-19)

Full Marks – 70 Time – Three hours

The figures in the margin indicate full marks for the questions.

Answer question No. 5 and any *two* from the rest.

1. (a) Sketch the following thread profiles for a pitch 30 mm and give their applications (*any two*) : (2 × 2.5 = 5)

   (i) BSW Thread

   (ii) Buttress thread

   (iii) Acme Thread

   (iv) Square Thread

   (b) Using first angle projection, draw the following views of a 50% threaded hexagonal headed bolt of 40 mm diameter and 100 mm long with a hexagonal nut and washer assembly. (8+7=15)

   (i) Elevation

   (ii) Left side view

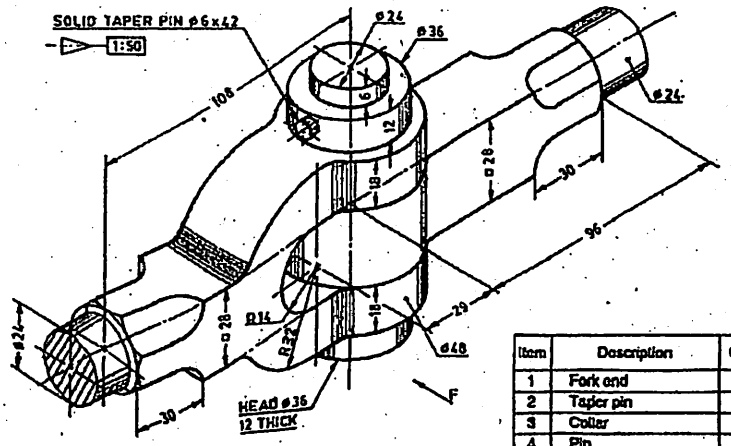
2. (a) Sketch neatly anyone of the following types of keys, fitted in position on a 50 mm diameter shaft showing two views showing completed dimensions.

   (i) Tapper sunk key with Gib head

   (ii) Feather sunk Key. (5)

[Turn over

(b) From the accompanying figure (Figure 1), draw the sectional front view of the Knuckle Joint. (15)



ITEM LIST

Item	Description	Qty.	Material
1	Fork end	1	M. S.
2	Taper pin	1	M. S.
3	Collar	1	M. S.
4	Pin	1	M. S.
5	Eye end	1	M. S.

Figure – 1

3. (a) Draw the sectional front view and the top view of a double riveted double strap butt joint (chain type) for 12 mm thick plates, show its margin, pitch and width of overlap. (8+7=15)

(b) Draw the symbols for the following welds (5)

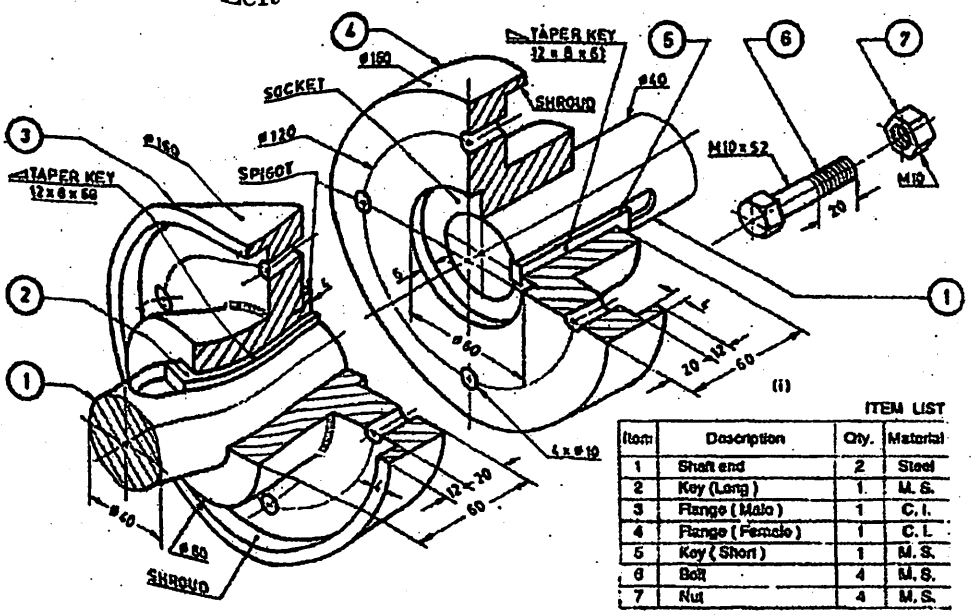
(i) Fillet weld (ii) Spot weld

(iii) Seam weld (iv) Square butt weld

4. From the accompanying figure (Figure 2), draw the following views of the Flanged Coupling (Protected type). (15+5=20)

(a) Half Sectional Elevation

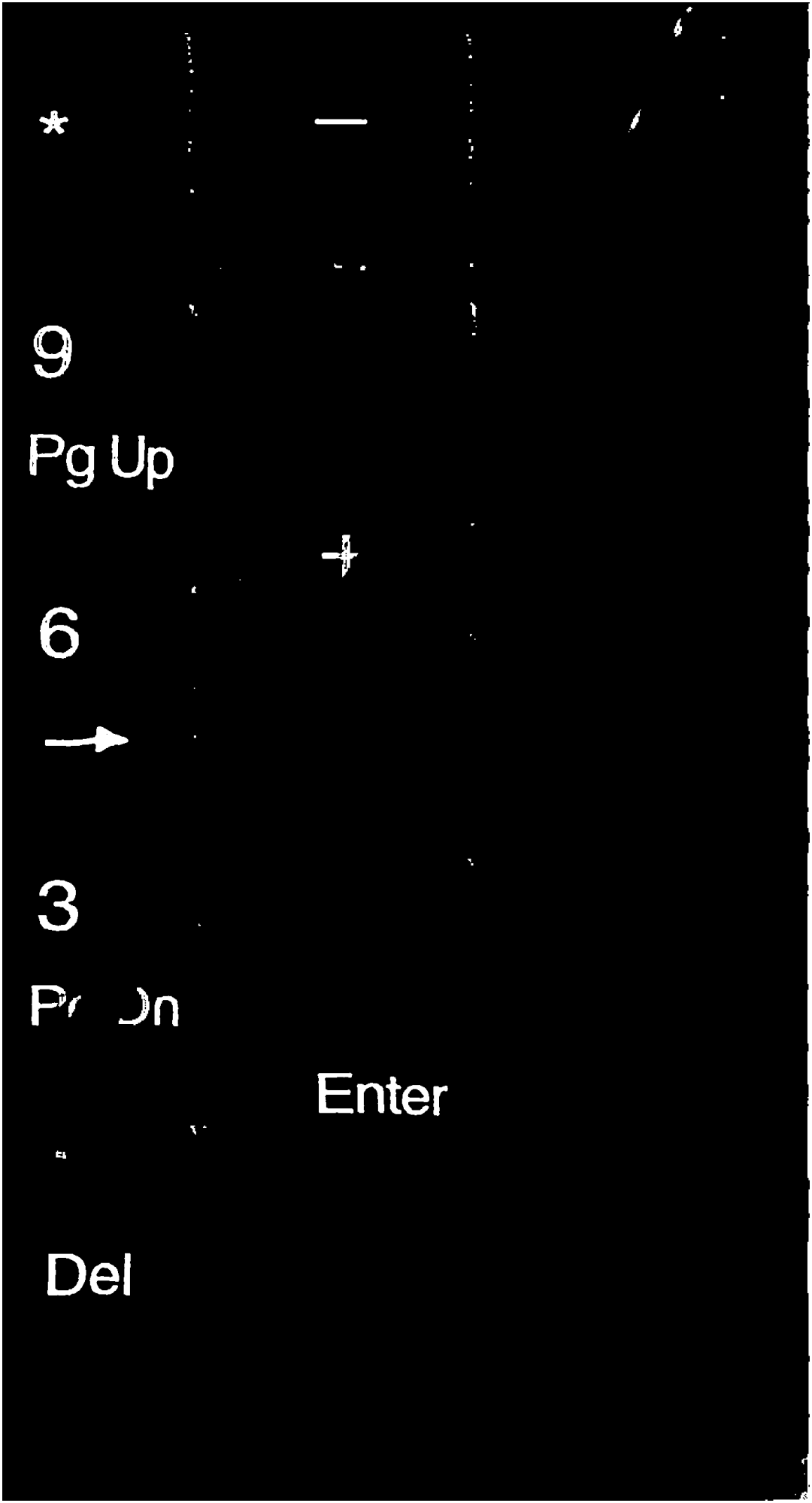
(b) Side View from Left



ITEM LIST

Item	Description	Qty.	Material
1	Shaft end	2	Steel
2	Key (Long)	1	M. S.
3	Flange (Male)	1	C. I.
4	Flange (Female)	1	C. I.
5	Key (Short)	1	M. S.
6	Bolt	4	M. S.
7	Nut	4	M. S.

Figure – 2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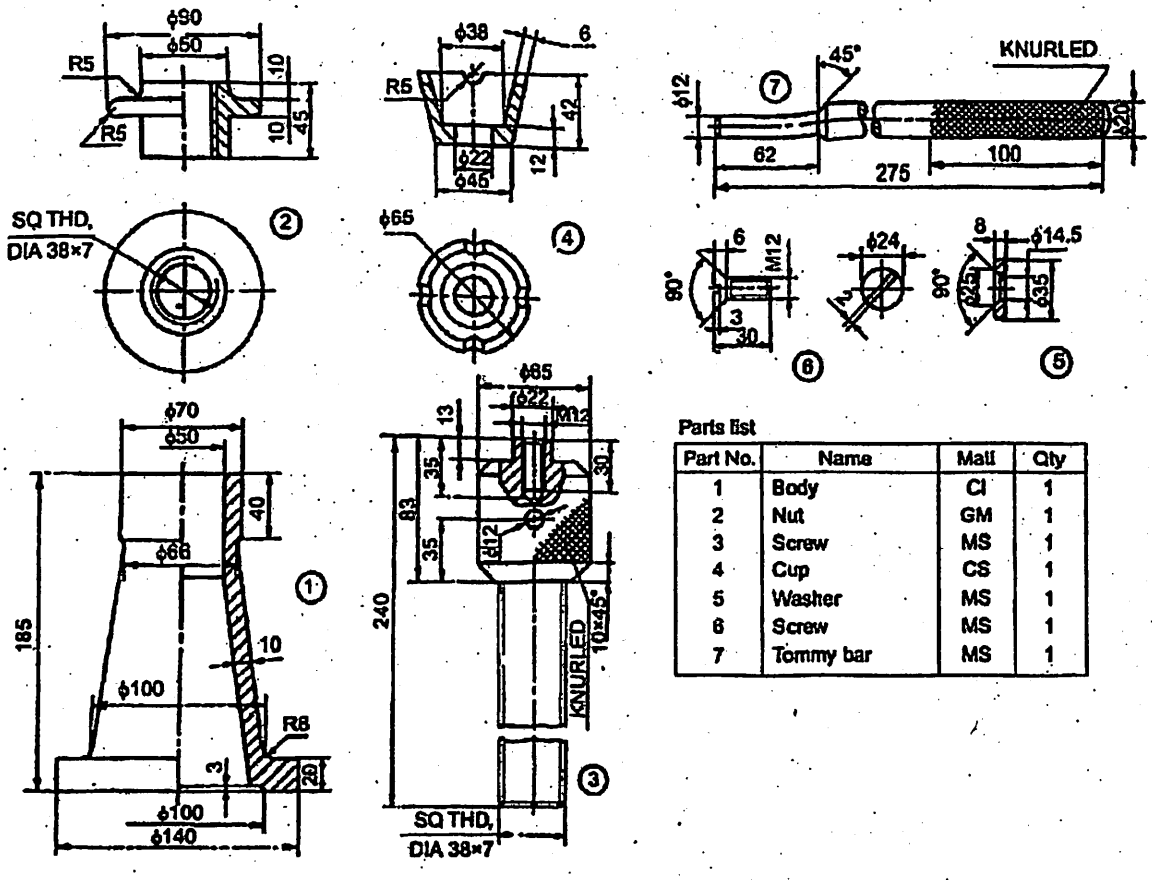
5. Figure 3 shows the details of a Screw Jack. Assemble all the parts and draw the following views using first angle projection. (20+10=30)

(a) Half sectional front view

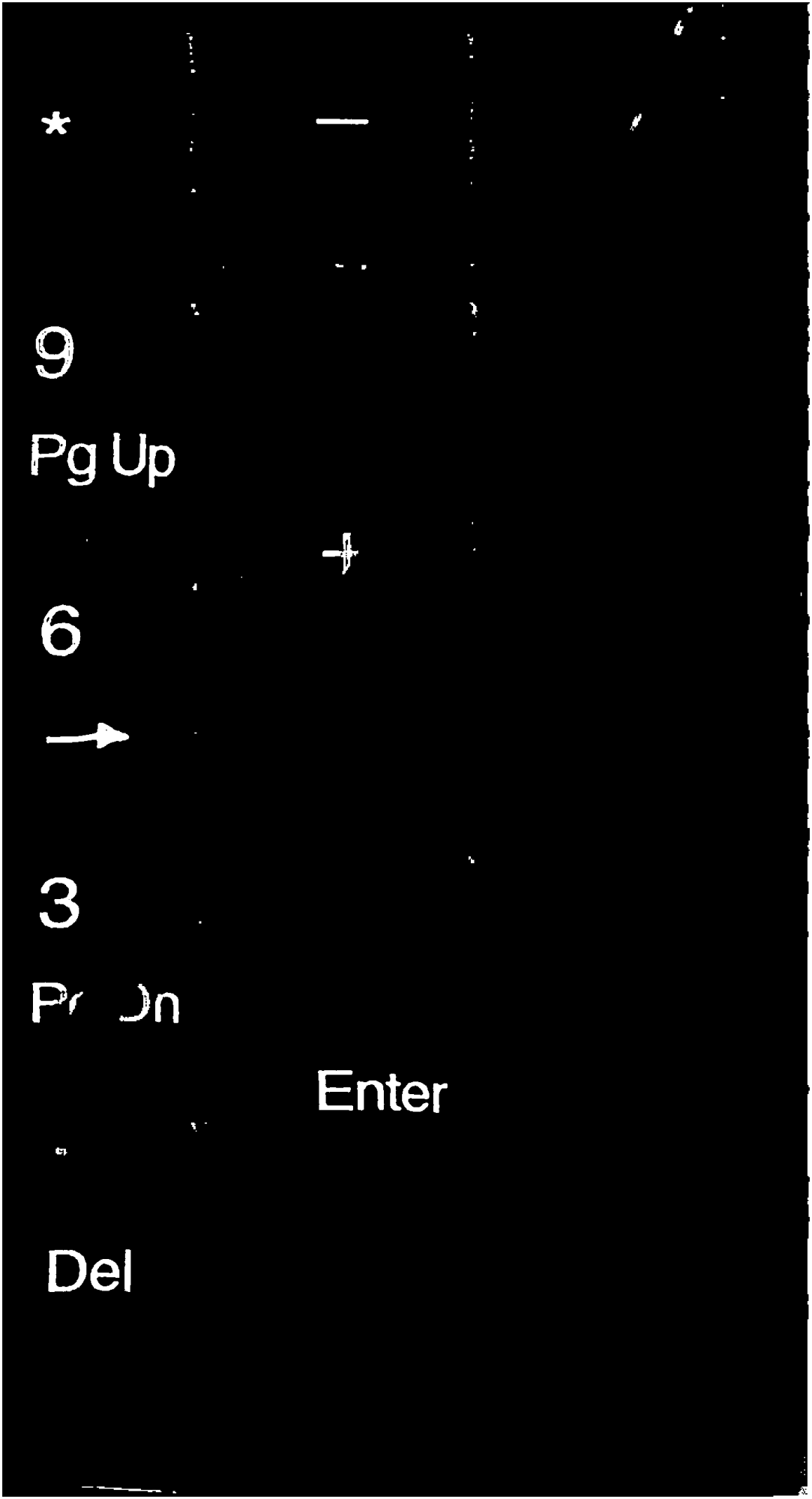
(b) Top view



Parts list

Part No.	Name	Matl	Qty
1	Body	CI	1
2	Nut	GM	1
3	Screw	MS	1
4	Cup	CS	1
5	Washer	MS	1
6	Screw	MS	1
7	Tommy bar	MS	1

Figure – 3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ME 181303

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2021

B.Tech. 3rd Semester End-Term Examination

ME, IPE

BASIC THERMODYNAMICS

(New Regulation)

(w.e.f. 2017-18)

(New Syllabus)

(w.e.f. 2018-19)

Full Marks – 70 Time – Three hours

The figures in the margin indicate full marks for the questions.

Answer question No. 1 and any *four* from the rest.

1. Answer the following questions : (10 × 1 = 10)

(i) An open system is one in which ————————

(a) Mass does not cross boundaries of the system, through energy may do so

(b) Neither mass nor energy crosses the boundaries of the system

(c) Both energy and mass cross the boundaries of the system

(d) Mass crosses the boundary but not the energy

(ii) For free expansion process, work done is ————————.

(a) Positive (b) Negative

(c) Zero (d) Maximum

(iii) For an isothermal process, the internal energy of a process ————————.

(a) Increase (b) Decrease

(c) Remain constant (d) May increase or decrease

(iv) Kelvin-Planck statement deals with ————————.

(a) Conservation of heat (b) Conservation of work

(c) Conversion of heat into work (d) Conversion of work into heat

[Turn over

(v) The entropy chosen at the triple point of water is _____,

(a) Zero (b) Less than zero

(c) More than zero (d) None of the above

(vi) Which condition is correct according to the entropy principle?

(a) The entropy of an isolated system can never decrease

(b) The entropy of a system remains constant only when the process is reversible

(c) The entropy of a system increases when the process is irreversible

(d) All of the above

(vii) The relation between compression ratio and the efficiency of the Otto cycle is _____.

(a) Efficiency decreases with an increase in compression ratio

(b) Efficiency increases with an increase in compression ratio

(c) Efficiency does not affect by the change in compression ratio

(d) None of the above

(viii) For the same maximum pressure and Temperature _____.

(a) Otto cycle is more efficient than the Diesel cycle

(b) Diesel cycle is more efficient than the Otto cycle

(c) Dual cycle is more efficient than Otto and Diesel cycles

(d) Dual cycle is less efficient than Otto and Diesel cycles

(ix) Rankine cycle efficiency of a good Steam Power Plant may be in the range of

(a) 15 to 20% (b) 35 to 45%

(c) 70 to 80% (d) 90 to 95%

(x) In the flue gas analysis by Orsat's apparatus, CO_2 is absorbed by

(a) Potassium hydroxide (b) Dilute potassium carbonate

(c) Cuprous chloride (d) Alkaline pyrogallic solution

2. (a) What do you mean by point function and path function? (2+2+2+4+5 = 15)

(b) State the difference between extensive and intensive properties.

(c) Differentiate between absolute and gauge pressure.

(d) Show that the internal energy of a system is a point function.

(e) A gas undergoes a reversible non-flow process according to the relationship $P = -(3V + 15)$, where V is the volume in m^3 and P is the pressure in bar. Find the work done when the volume changes from 3 to 6 m^3.

3. (a) Explain the perpetual motion machine of the first kind. (3+7+5 = 15)

(b) In a gas turbine air enters at the rate of 6 kg/s with a velocity of 50 m/s, enthalpy of 900 kJ/kg, and leaves the turbine with the velocity of 150 m/s, enthalpy 400 kJ /kg. The loss of heat from the gas to the surrounding is 25 kJ/kg. Assume the value of gas constant R = 0.285 kJ/kg, C_p = 1.005 kJ /kg K and inlet condition is 100 kPa and 25°C. Calculate the power output of the turbine and the diameter of the inlet pipe.

(c) A steel block of mass 8 kg at 1000K is dropped in 80 kg of oil at 300K. Find the entropy change of the steel, oil, and universe. The specific heat of steel and oil is 0.5 kJ /kg and 3.5 kJ /kg, respectively.

4. (a) State the difference between a refrigerator and a heat pump. (3+5+7 = 15)

(b) A reversed heat engine absorbs 250 kJ of heat from the low-temperature region and has a mechanical work input of 100 kJ. What should be the heat transfer to the high-temperature region? Also, find the COP of the reversed heat engine when working as a refrigerator and heat pump.

(c) Three real heat engines have the same thermal efficiency and are connected in series. The first engine absorbs 2400 kJ of heat from a thermal reservoir at 1250 K and the third engine rejects its wastes of 300 kJ to a sink at 150°C. Determine the work output from each engine.

5. (a) Define the compression ratio. How does it affect the air standard efficiency of an Otto cycle? (3+3+9 = 15)

(b) With a neat sketch compare the Otto, Diesel, and Duel cycle for the same compression ratio and heat rejection.

(c) An air standard engine working on Otto cycle is supplied with air at a 0.1 MPa, 35°C. The compression ratio of the engine is 8. The heat transferred to air at constant volume is 2100 kJ/kg.

Determine -

(i) Maximum pressure and temperature of the cycle

(ii) Efficiency of the cycle

(iii) Mean effective pressure

For air C_p = 1.005 kJ/kg, C_v = 0.718 kJ/kg, and R = 0.278 kJ kg.

6. (a) Define the following terms (6+9 = 15)

(i) Sensible heat

(ii) Latent heat

(iii) Critical point

(iv) Degree of superheat

(b) Steam at 20 bar and 360°C is expanded in a steam turbine to 0.08 bar. It is then entering a condenser, where it condensed to saturated liquid water. The pump feeds back the water to the boiler. Assuming ideal processes draw the T-S diagram of the cycle and determine the network done and cycle efficiency.

7. (a) Define the calorific value of a fuel. Differentiate between the lower and higher calorific value of a fuel. (4+3+8 = 15)

(b) What do you mean by stoichiometric air-fuel ratio? Explain briefly.

(c) The following is the composition of a sample of coal

Carbon = 85 %; Hydrogen = 7%; Sulphur = 3%; Oxygen = 2% and remaining are incombustible matter. Write down the necessary chemical reactions and determine

(i) Stoichiometric air-fuel ratio

(ii) Mixture strength for the air-fuel mixture of 11.5:1.

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MCA 182301

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2021

M.C.A. 3rd Semester Final Examination

OPERATING SYSTEM

(New Regulation w.e.f. 2017-18)

(New Syllabus w.e.f. 2018-19)

Full Marks –70 Time – Three hours

The figures in the margin indicate full marks for the questions.

Answer question No. 1 and any *four* from the rest.

1. Choice the appropriate answer : (10 × 1 = 10)

(i) In a time sharing operating system when time slot given to a process is completed, process next phase is

(a) Blocked State

(b) Ready State

(c) Suspend State

(d) Terminal State

(ii) In a multiprogramming environment

(a) Processor executes more than one process at a time

(b) Programs developed by more than one person

(c) More than one process reside in memory

(d) A single user executes multiple programs.

(iii) Condition when a process executing in critical section no other process allowed to execute is called

(a) Mutual Exclusion

(b) Critical Section

(c) Synchronous exclusion

(d) Asynchronous Exclusion

[Turn over

(iv) Which one of following is a synchronization tool

(a) Thread

(b) Pipe

(c) Semaphore

(d) Socket

(v) In a FIFO page replacement policy algorithm

(a) Oldest page is choosen

(b) Newest page is choosen

(c) Random Page is choosen

(d) None of the mentioned

(vi) A program in execution is called

(a) Paging

(b) A process

(c) Virtual Memory

(d) None of mentioned

(vii) Compaction algorithm is used for overcoming problem of

(a) Internal Fragmentation

(b) External Fragmentation

(c) Page faults

(d) Swapping

(viii) Direct Memory Access (DMA)

(a) Relieve CPU for other works

(b) Engage CPU continuously for data transfer

(c) Used for process allocation

(d) None of mentioned

(ix) Device driver program is

(a) Device dependent

(b) Device independent

(c) Partially device dependent

(d) None of mentioned

(x) Multithreading models are defined as

(a) Many to one

(b) One to many

(c) Many to many

(d) All of mentioned

2. (a) Explain how operating system can be viewed as an extended machine and resource manager. (6)

(b) State the differences of sequential and concurrent processing. Using an example at your own show how concurrent processing is more efficient than sequential processing. (9)

3. (a) What is PCB? How it keeps track of different informations. (5)

(b) Give distinct features of three different types of schedulers. (5)

(c) Explain working of Round Robin or SRTN scheduling algorithm. (5)

4. (a) How contigious and non contigious memory allocation differ? What are the problems of internal and external fragmentation? (4)

(b) State the features of Dynamic memory allocation with reference to compaction, protection and sharing. (9)

(c) What is the swapping technique used in memory management? (2)

5. (a) Explain the process of DMA transfer. (5)

(b) What are the different functions performed by four layers of input / output Software. (10)

6. (a) State the basic idea behind disk space management in operating systems. (5)

(b) Explain how I-node structure is implemented for file storage. (5)

(c) What is Protection Domain? How it is implemented with Protection Matrix? (5)

7. Write short notes (any *three*) : (3 × 5)

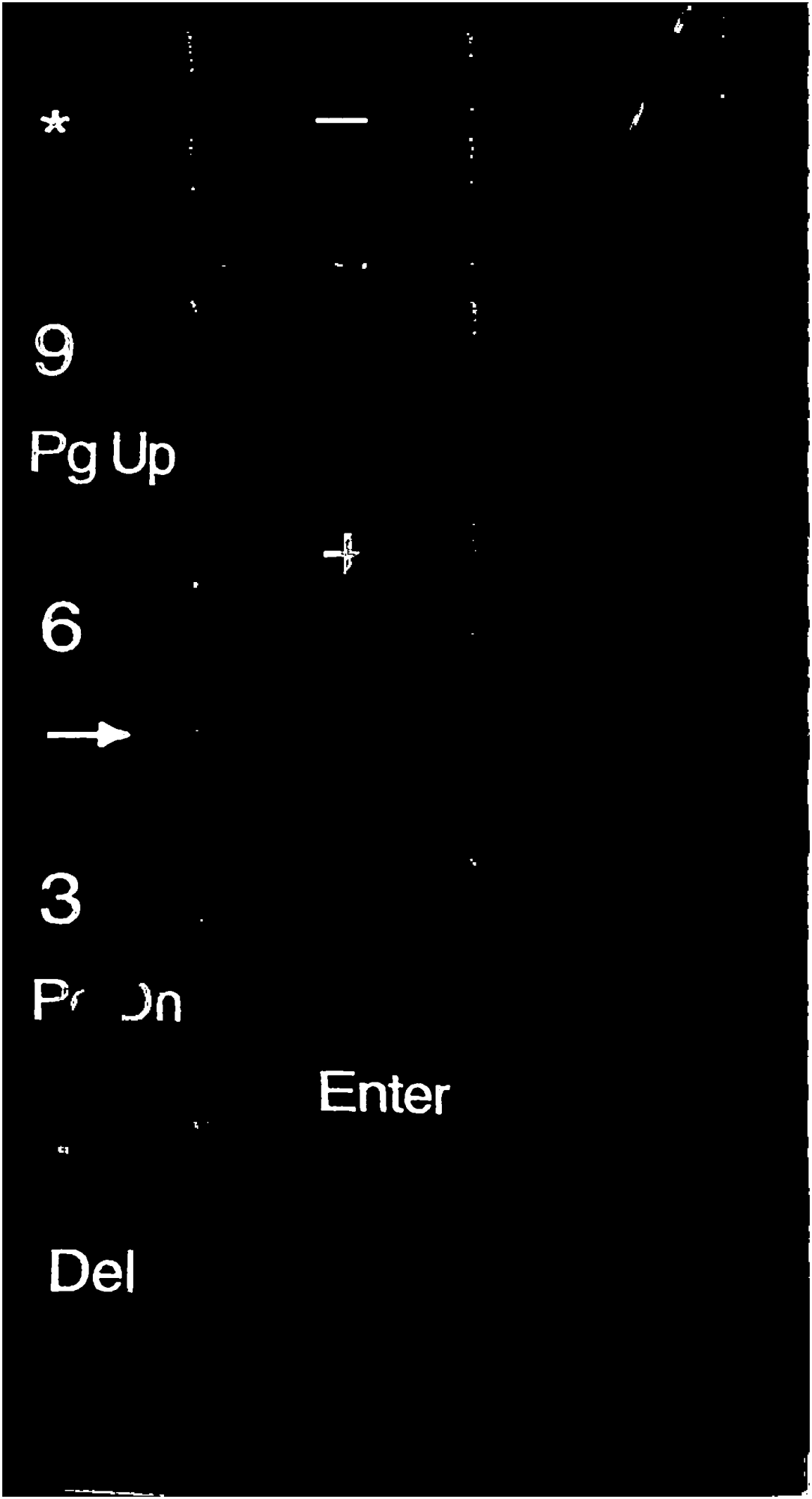
(a) LRU/FIFO page replacement policy

(b) Bankers algorithm for multiple resource

(c) Paging

(d) Batch operating systems

(e) Multithreading.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MCA 182302

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2021

M.C.A. 3rd Semester End-Term Examination

DESIGN AND ANALYSIS OF ALGORITHMS

New regulation (W.e.f. 2017-18) & New Syllabus (W.e.f. 2018-19)

Full Marks – 70 Time – Three hours

The figures in the margin indicate full marks for the questions.

Answer question No. 1 and any *four* from the rest.

1. Choose the appropriate answer: (10 × 1 = 10)

(i) O-notation provides an asymptotic

(a) upper bound (b) lower bound

(c) light bound (d) none of these

(ii) In which sorting technique at every step each element is placed in its proper position?

(a) Bubble sort (b) Merge sort

(c) Heap sort (d) Quick sort

(iii) Optimal substructure property is exploited by

(a) Dynamic programming (b) Greedy method

(c) Both (a) and (b) (d) None of these

(iv) Steps of Divide and Conquer approach

(a) Divide, Conquer and Combine

(b) Combine, Conquer and Divide

(c) Combine, Divide and Conquer

(d) Divide, Combine and Conquer

[Turn over

(v) Which of the given options provides the increasing order of asymptotic complexity of functions f_1, f_2, f_3 and f_4?

$f_1(n)=2^n$
$f_2(n)=n^{(3/2)}$
$f_3(n)=n\lg n$
$f_4(n)=n^{\lg n}$

(a) f_3, f_2, f_1, f_4 (b) f_2, f_3, f_1, f_4

(c) f_2, f_3, f_4, f_1 (d) f_3, f_2, f_4, f_1

(vi) The complexity of searching an element from a set of n elements using Binary search algorithm is

(a) $O(n\log n)$ (b) $O(\log n)$

(c) $O(n^2)$ (d) $O(n)$

(vii) For analyzing an algorithm which is better complexity time?

(a) $O(\lg n)$ (b) $O(n)$

(c) $O(2^n)$ (d) $O(\lg\lg n)$

(viii) Which case of Master's theorem is applicable in the recurrence relation $T(n)=0.5*T(n/2)+1/n$?

(a) Case 3

(b) Case 1

(c) Master's theorem is not applicable

(d) Case 2

(ix) Division Pattern of Problems in Divide and Conquer approach

(a) Iterative (b) Recursive

(c) Parallel (d) Random

(x) The running time of quick sort depends on the selection of.

(a) Selection of pivot elements

(b) Number of input

(c) Number of passes

(d) Arrangements of the elements

2. (a) He the asymptotic notations used in Analysis of algorithm.

(b) What is an algorithm? Write the characteristics of Algorithm. (1 + 5 = 6)

(c) What are the basic asymptotic efficiency classes? (3)

3. (a) Write the Insertion Sort algorithm and Analyze the time complexity for the best case and the worst case. (3 + 5 = 8)

(b) Merge sort and write the advantages of merge-sort. (5 + 2 = 7)

4. (a) Write sequence of operations in Quick sort for the array A=<2,8,7,1,3,5,6,4>. (5)

(b) What is a R-B tree? Explain with an appropriate example. (3 + 3 = 6)

(c) Write Insert and delete operation for the RB tree in Q.No.4b. (4)

5. (a) Explain Traveling Salesman Problem with suitable diagrams. (6)

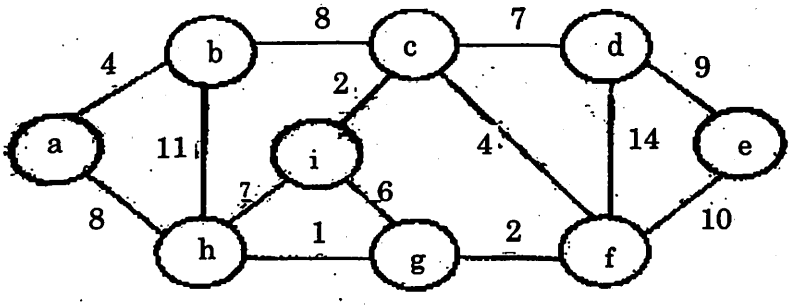
(b) Explain the Ford Fulkerson Algorithm using a suitable example. (6)

(c) Define maximum Bi-partie matching. (3)

6. (a) Differentiate between Greedy method and Dynamic programming. (6)

(b) Write the Floyd and War shall algorithm and explain with an example. (6)

(c) Apply Kruskal/s Algorithm to find minimum spanning tree on the following graph: (3)



7. Write short notes on (any *three*) : 3 × 5 = 15

(a) Recursion tree

(b) AVL and B Tree

(c) Problem classes

(d) Topological sort

(e) OS Tree.

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MCA 182304

Roll No. of candidate | | | | | | | | | | |

2021

M.C.A. 3rd Semester (End Term) Examination

OBJECT ORIENTED PROGRAMMING AND DESIGN

(New Regulation W.e.f. 2017-18 and New Syllabus W.e.f. 2018-19)

Full Marks – 70 Time – Three hours

The figures in the margin indicate full marks for the questions.

Answer question No. 1 and any *four* from the rest.

1. Answer the following : (10 × 1 = 10)

   (i) List different relationships shared among objects of an application.

   (ii) When and why constructor is used in a class?

   (iii) State the purpose of generalization.

   (iv) How framework and contract help in OO application development?

   (v) How encapsulation and data hiding is done in OOP?

   (vi) Why are activities and events used in State Diagram?

   (vii) If a programming language provides a constructor for a class, what will be its signature?

   (viii) How multiple constructors are implemented?

   (ix) Can polymorphism be implemented without inheritance? Justify your answer.

   (x) How Use Case is determined in a Use Case diagram.

2. (a) Give the sequence and activity diagram for login operation. (5)

   (b) Why domain analysis and application analysis are done in application development? Write their significance? (2 + 2 = 4)

   (c) Why non-portable codes should be kept separately? (3)

   (d) Why serializing and marshaling of objects are needed? (3)

[Turn over

3. (a) Illustrate the relationship between person, employee and organization using class diagram. Elaborate it with an object diagram for this class diagram. (2 + 3 = 5)

(b) How transient objects are represented in sequence model? Give example. (5)

(c) Why qualified associations are used? Explain. (5)

4. (a) Why association end names are important? Explain with example. (2 + 3 = 5)

(b) Give one-shot state diagrams for chess game with and without entry and exit points. (6)

(c) When include and extend relationships are used in Interactive modeling? (4)

5. (a) Discuss the three types of attributes used in OOP. (6)

(b) Discuss the relations among class model, state model and interaction model? (3)

(c) How to show passive objects in sequence diagrams? Give example. (4)

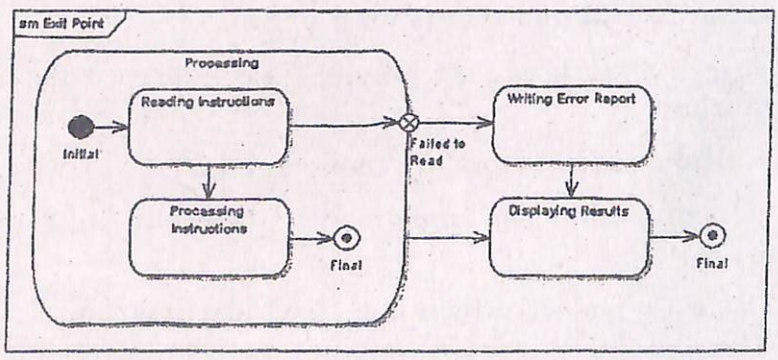
(d) Why are events used? Name few commonly used events in state modeling. (2)

6. (a) Write the differences between Waterfall and Iterative development. (6)

(b) How signals are shown in activity diagram? State with an example. (4)

(c) Why multiple inheritances are important? Write the delegation methods to avoid it. (2 + 3 = 5)

7. (a) Explain the system given below: (5)



(b) Why state diagram is important? (2)

(c) Write different ways to handle errors in applications. (5)

(d) When association class is used? How it can be shown in class diagram? (2 +1 = 3)

Total No. of printed pages = 4

MCA 182303

Roll No. of candidate | | | | | | | | | | |

2021

M.C.A. 3rd Semester End-Term Examination

DATABASE MANAGEMENT SYSTEM

(New Regulation (w.e.f. 2017-18))

(New Syllabus (w.e.f. 2018-19))

Full Marks – 70 Time – Three hours

The figures in the margin indicate full marks for the questions.

Answer question No. 1 and any *four* from the rest.

1. Choose the appropriate answer: (10 × 1 = 10)

(i) 'View' is ————————

(a) Logical table (b) Physical table

(c) Joint table (d) None of these

(ii) Which of the following is associated with : NEW and : OLD?

(a) Trigger (b) Stored Procedure

(c) Function (d) None of these

(iii) To remove specific row from table, which of the following maybe used?

(a) Delete (b) Drop

(c) Commit (d) None of these

(iv) To modify specific data in a table, which of the following is used?

(a) Modify (b) Change

(c) Alter (d) None of these

[Turn over

(v) PAN number has the format of 5 alphabets, followed by 4 numbers and 1 alphabet. The following PL/SQL function is created to check valid PAN numbers

```
create or replace function check_pan(pan_no varchar2)
    return number
    is
    x number(2);
    begin
        if (regexp _ LIKE (pan _ no '[A-Z] [A-Z] [A-Z] [A-Z] [A-Z]
        [0-9][0-9][0-9][0-9][A-Z]'))then
        x:=1;
        else
        x:=0;
        end if;
        return x;
        end;
        /
```

Output of the SQL statement-

Select check_pan('APMPB9629P'),check_pan('BPMQW121 B') from dual;

(a) 0 1 (b) 1 0

(c) syntax error in function (d) syntax error in SQL statement

(vi) Just after running the SQL statement:

create sequence mca_code_sequence start with 10 increment by 2;

If the very next SQL statement is: select mca_code_sequence.currval from dual; which of the following output is correct for the second statement

(a) 10 (b) error

(c) 12 (d) none of these

(vii) Output of the SQL statement:

select length(substr('Lachit Borphukan',7)) from dual;

(a) 9 (b) 10

(c) syntax error (d) None of these

(viii) ON DELETE CASCADE is associated with

(a) datatype (b) primary key-foreign key

(c) view (d) commit

(ix) Select abs(-56) from dual; returns-

(a) –56 (b) 56

(c) 5.6 (d) 9

(x) Which function returns the first letter of the string to uppercase?

(a) INITCAP (b) CAPINIT

(c) UPPER (d) UPFUN

2. (a) What is the importance of ER diagram in database design? Describe the relationships with example. (7)

(b) Draw an ER diagram for an 'Online Bus Ticket Booking System' to fulfill the following objectives (8)

(i) To store bus detail along with route of service in database.

(ii) To enable users to check for available seats and their position (window side, single/double etc.)

(iii) To store route wise and bus category wise fares.

(iv) To book seat and the payment information to be stored in database.

(v) To store passenger data.

(vi) To enable cancellation of booking.

3. (a) Describe ACID properties of Database in detail. (8)

(b) Describe Rollback, Commit, Savepoint, Union, Union all, Intersect and Minus with example. (7)

4. (a) Consider the following tables (9)

Book_Stock

B id (PK)	Book_name	Book_price	Available_Quantity
1	Let Us C	500	100
2	The old man and the Sea	400	80
3	Engineering Mathematics	450	70

Book_Sale

Sale id (PK)	B_id(FK)	Sale_quantity	Pay_amount	B_Language
1	1	3	?	?
2	3	10	?	?

Create a trigger on Book_Sale that automatically calculates Pay-amount by considering Book_price and Sale_quantity. 10% rebate is provided for all non-English books. Data for B_Language is to be inserted as either'Englsih' or 'Non-English' depending on the Language of Book_name. Implement logic so that Available_Quantity is automatically adjusted after each sale but never attain a negative value.

(b) Write SQL statement to display the Book_name and Book_price of the book with lowest Available_Quantity as on table Book_Stock of Q4(a). (2)

(c) Write SQL statement to find the total number of books available in database. (2)

(d) Write SQL statement to display name of the books that contain the word 'Man' in its name. (2)

5. (a) Describe the concept of Normalization. (6)

(b) What is 'package' in PL/SQL? How 'package specification' is different from 'package body'? Explain with syntax and example. (9)

6. (a) How instr() is different from substr()? Explain with example. Write about 'group by' in detail with example. (6)

(b) What is the difference between 'row level trigger' and 'statement level trigger'? Explain the use of 'instead of trigger' with example. (9)

7. Write short notes on any three the followings: (3 × 5=15)

(a) B+ tree index files

(b) Stored procedure

(c) Partitioned Hashing

(d) Cursor

Total No. of printed pages = 3

CE 181304

Roll No. of candidate | | | | | | | | | | |

2021

B.Tech. 3rd Semester End-Term Examination

CE

BUILDING CONSTRUCTION AND PLANNING

(New Regulation)

(w.e.f. 2017-18)

(New Syllabus)

(w.e.f. 2018-19)

Full Marks – 70 Time – Three hours

The figures in the margin indicate full marks for the questions.

Answer question No. 1 and any *four* from the rest.

1. Choose the correct answer: (10 × 1 = 10)

(i) The 9cm × 9cm side of a brick as seen in the wall face, is generally known as

(a) stretcher (b) face

(c) header (d) front

(ii) The concrete slump recommended for beams and slabs is

(a) 25 to 50 mm (b) 25 to 75 mm

(c) 30 to 125 mm (d) 50 to 100 mm

(iii) If height of the first storey of a building is 3.2 m and riser is 13cm, the number of treads required, is

(a) 12 (b) 18

(c) 24 (d) 30

(iv) A flooring which is made of thin laminated stone slabs of regular geometric shape laid on concrete bedding is called

(a) Flag stone flooring (b) tiled flooring

(c) granolothic flooring (d) stone block flooring

(v) The triangular portion between any two adjacent arches and the tangent to their crowns, is

(a) spandril (b) haunch

(c) soffit (d) rise

(vi) The form work including the props can be removed from beams, only after

(a) 3 days (b) 7 days

(c) 14 days (d) 21 days

(vii) For the construction of flyovers in sandy soils, the type of foundation provided, is

(a) strap footing (b) raft footing

(c) combined footing (d) pier footing

(viii) The minimum width of a stair in residential buildings, is

(a) 55 cm (b) 70 cm

(c) 85 cm (d) 100 cm

(ix) As per Indian Standards, the door designated as 10 DT 20 means

(a) a single shuttered door of 1 m × 2 m

(b) a double shuttered door of 1 m × 2 m

(c) a single shuttered door of 2m × 1 m

(d) a double shuttered door of 2 m × 1 m

(x) The highest line of sloping roof, where two opposite slopes meet is known as

(a) Rafter (b) Ridge

(c) Crown (d) Eave

2. (a) Explain various functional requirement of a building. (8)

(b) What are the causes of dampness? Describe one method of damp proofing in a building. (7)

3. (a) What is vertical and horizontal circulation? Explain with examples. What are the points to be considered for the location of stairs? (8)

(b) Explain any two types of bonds in bricks stating their merits and demerits. (7)

4. Write short notes on any three of the following: (3 × 5 = 15)

(a) Shoring

(b) Classification of stairs

(c) Defects in brick masonry

(d) Deep foundation

(e) Location of doors and windows

5. (a) Explain the zoning regulation in building planning. Why is Building Planning necessary? (7)

(b) Explain orientation and privacy consideration in building planning. (8)

6. (a) What are the factors affecting site selection. Draw a site plan of a residential building showing all the details. (8)

(b) Briefly explain the following terms (7)

(i) Building height limitation

(ii) Minimum sizes of different rooms as per the building bye-laws

7. Write short notes on any three of the following (3 × 5 = 15)

(a) Aspect

(b) LEED and GRIHA provisions

(c) Ventilation and air conditioning services

(d) Provision of water supply and drainage services in different buildings

(e) Electrical services

Total No. of printed pages =4

CE 181303

Roll No. of candidate | | | | | | | | | | |

2021

B.Tech. 3rd Semester End-Term Examination

CE

FLUID MECHANICS

(New Regulation w.e.f. 2017 – 18)

(New Syllabus w.e.f 2018 – 19)

Full Marks – 70 Time – Three hours

The figures in the margin indicate full marks for the questions.

Answer question No. 1 and any *four* from the rest.

1. Choose the correct answer: (10 × 1 = 10)

(i) If x, y, v and t denote the length along flow, depth of flow, velocity of flow and time of flow respectively, then in case of a steady flow

(a) $\frac{\partial y}{\partial x}=0, \frac{\partial v}{\partial x}\neq 0$ (b) $\frac{\partial y}{\partial x}=0, \frac{\partial v}{\partial x}=0$

(c) $\frac{\partial y}{\partial t}=0, \frac{\partial v}{\partial t}\neq 0$ (d) $\frac{\partial y}{\partial t}=0, \frac{\partial v}{\partial t}=0$

(ii) The difference between the total energy line and the H.G. line represents

(a) datum head (b) piezometric head

(c) velocity head (d) pressure head

(iii) The pressure variation along the radial direction for vortex flow along a horizontal plane is given as

(a) $\frac{\partial P}{\partial r}=-\rho\frac{V^2}{r}$ (b) $\frac{\partial P}{\partial r}=\rho\frac{V^2}{r}$

(c) $\frac{\partial P}{\partial r}=\rho\frac{V}{r}$ (d) none of the above

[Turn over

(iv) Dynamic viscosity (μ) has the dimensions as

(a) $M^{-1}L^{-1}T^{-1}$ (b) $M^{-1}L^{-1}T^{-2}$

(c) $ML^{-1}T^{-1}$ (d) $ML^{-1}T^{-2}$

(v) Atmospheric pressure in terms of water column is

(a) 13.6 m (b) 7.85 m

(c) 1.36 m (d) 10.3 m

(vi) For the Figure -(I) Ideal fluid represents line or curve corresponds to

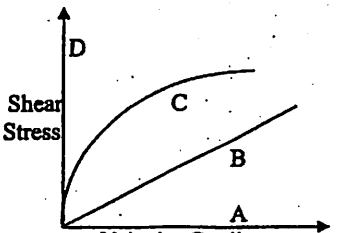


Figure – I

(a) A (b) B

(c) C (d) C

(vii) A block of wood 2 m long, 2 m wide and 1 m deep is floating horizontally in water. If density of wood is 800 kg/m^3, then the volume of water displaced will be

(a) 4 m^3 (b) 3.2 m^3

(c) 2 m^3 (d) 1.6 m^3

(viii) The difference in pressure, measured by a mercury-oil manometer for a 2.0cm difference of mercury level will be equivalent to 'x' cm of oil of specific gravity 0.8

(a) $x=27.2$ cm of oil (b) $x=25.2$ cm of oil

(c) $x=32$ cm of oil (d) $x=34$ cm of oil

(ix) Froude's number is defined as the ratio of square root of

(a) inertia force to viscous force

(b) inertia force to gravity for

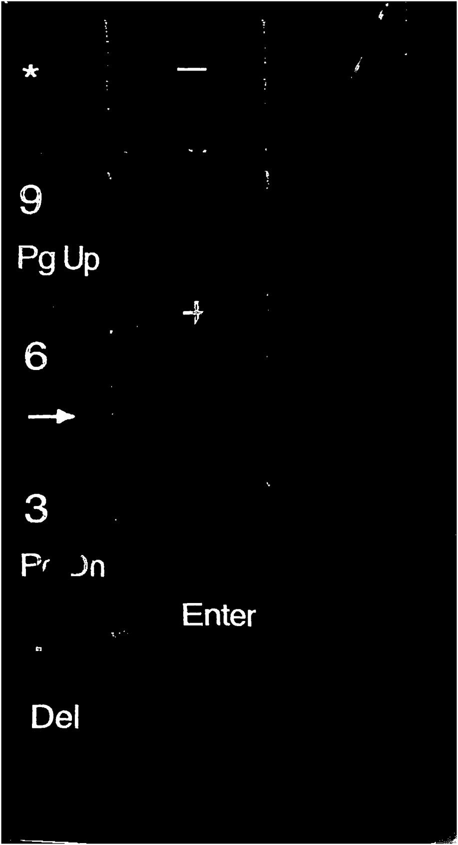
(c) inertia force to pressure force

(d) none of the above

(x) If V be the velocity of flow of a liquid in a pipe, the loss of energy at the entrance of a pipe from a large vessel is given by the formula

(a) $\frac{0.5V^2}{2g}$ (b) $\frac{0.375V^2}{2g}$

(c) $\frac{V^2}{2g}$ (d) $\frac{0.75V^2}{2g}$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2. (a) For the system shown in Figure-II determine the pressures differences at M and N. (7)

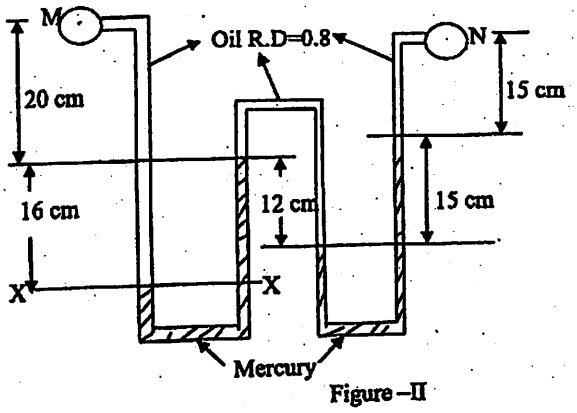


Figure –II

(b) Derive Euler's equation of motion. Hence derive Bernoulli's equation. (5+3=8)

3. (a) A rectangular gate $6m \times 2.5m$ is hinged at its base and inclined at 60° to the horizontal as shown in Figure – III. To keep the gate in a stable position, a counter weight of 65kN is attached at the upper and of the gate as shown in figure. Find the depth of water at which the gate begins to fall. Neglect the weight of the gate and friction at the hinge and pulley. (9)

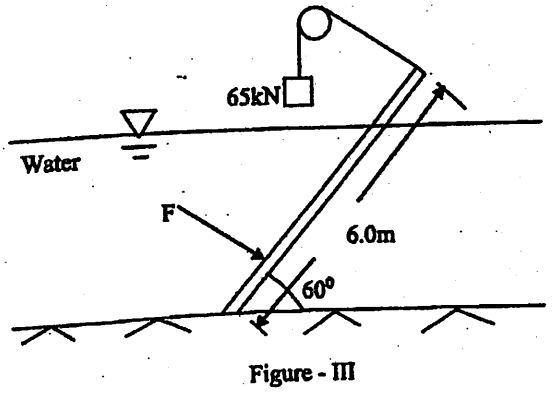
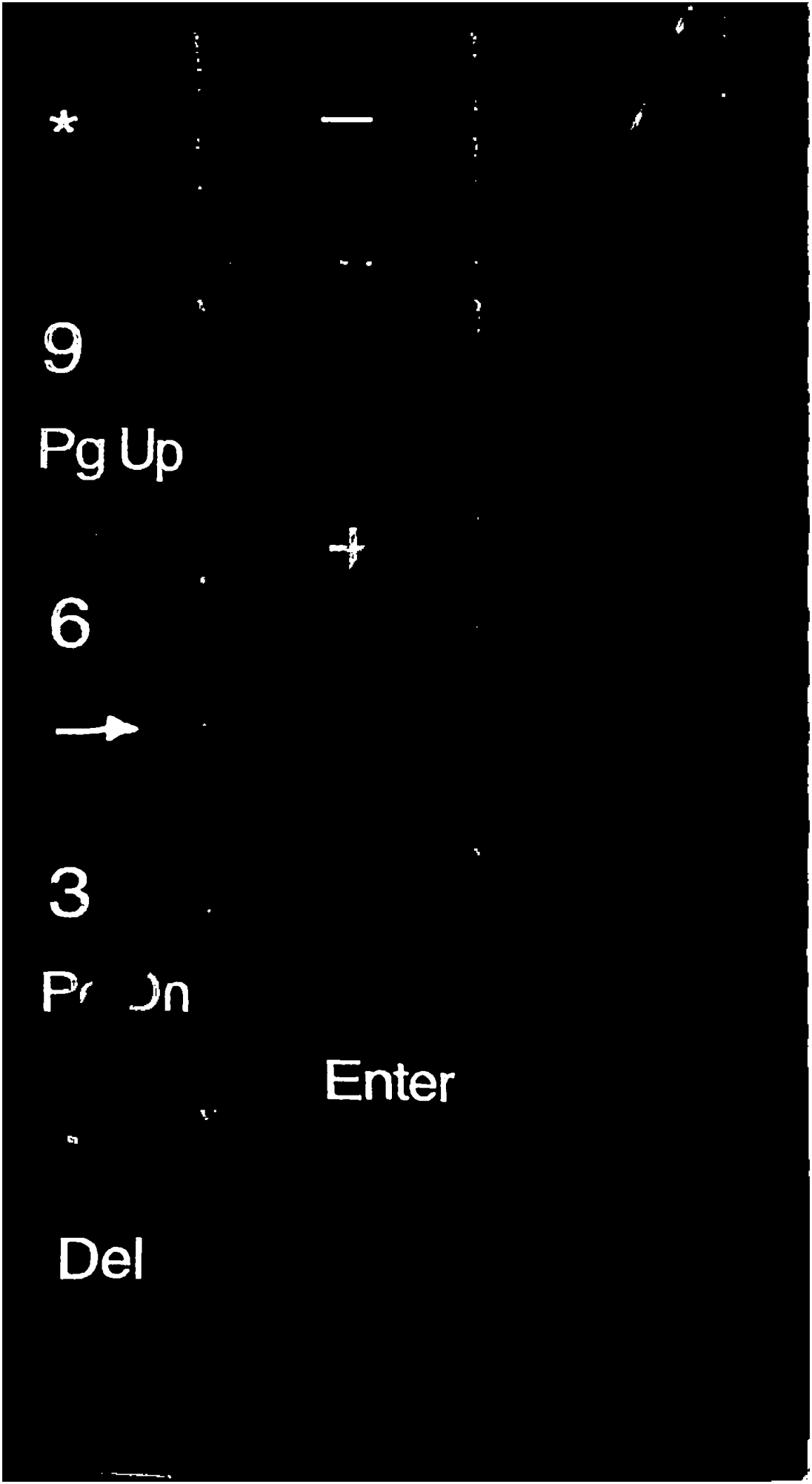


Figure - III

(b) The velocity potential for a 2-D flow is $\phi = x(2y-1)$, determine –

(i) the velocity at appoint P(4,5)

(ii) the expression for stream function (2+4 = 6)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4. (a) A tank has two identical orifices in one of its vertical sides. The upper orifice is 3 m below the water surface and lower one is 5 m below the water surface. If the coefficient of velocity for each orifice is 096, find the point of intersection of the two jets. (5)

(b) A horizontal pipe line 40 m long is connected to a water tank at one end and discharges freely into the atmosphere at the other end. For the first 25 m of its length from the tank, the pipe is a 50 mm diameter and its diameter is suddenly enlarged to 300 mm. The height of water level in the tank is 8 m above the centre of the pipe. Considering all losses, determine the rate of flow. Take friction factor, f = 0.04. (10)

5. (a) Derive an equation for the discharge through a triangular notch with an apex angle. (8)

(b) A 300mm × 150mm venturimeter is provided in a vertical pipe line carrying oil of specific gravity 0.9, the flow being upwards. The difference in elevation of the through section of the venturimeter is 300mm an area ratio of 6. The differential U-tube mercury manometer shows a gauge deflection of 250mm. Calculate the discharge of the oil. Take the coefficient of discharge of venturimeter is 0.98. (7)

6. (a) The power P required by the pump is a function of discharge Q, head H, acceleration due to gravity g, viscosity μ, mass density of fluid ρ, speed of rotation N and impeller diameter d. Show by dimensional analysis

$$\frac{P}{\rho N^3 D^5} = f\left[\frac{Q}{ND^3}, \frac{gH}{N^2D^2}, \frac{ND^2\rho}{\mu}\right] \quad (12)$$

(b) An open circular cylinder of 15 cm diameter and 100 cm long contains water up to a height of 70cm. Find the angular velocity at which the cylinder is to be rotated about its vertical axis, so that the axial depth becomes zero. (3)

7. (a) Define the following terms (any three)
Specific volume, Surface tension, Free vortex, Coefficient of contraction (3)

(b) Writs short notes on : (any three): $3 \times 4 = 12$

(i) Pitot tube

(ii) Conditions of equilibrium of a Floating body based on the position of metacentre

(iii) Flow through a Convergent- Divergent Mouthpiece

(iv) Reynold's Model law

Total No. of printed pages = 3

CE 181305

Roll No. of candidate | | | | | | | | | | |

2021

B.Tech. 3rd Semester Examination

CE

ENGINEERING SURVEYING – I

(New Regulation w.e.f. 2017-2018)

(New Syllabus w.e.f. 2018-2019)

Full Marks – 70 Time – Three hours

The figures in the margin indicate full marks
for the questions.

Answer question No. 1 and any *four* from the rest.

1. Answer the following questions : (10 × 1 = 10)

(i) The principle of surveying is

(a) To work from whole to part (b) To work from part to whole

(c) None of above (d) Both (a) and (b)

(ii) The errors which always be of same size and sign

(a) Mistakes (b) Compensating error

(c) Cumulative error (d) None of above

(iii) The most accurate method of measuring distances is

(a) Passometer (b) Odometer

(c) Perambulator (d) Chaining

(iv) The arrow is inserted into the ground after

(a) End of every chain length (b) End of survey line

(c) End of 10 distance (d) None of above

(v) The ranging of survey line is required when

(a) Length of survey line is less than one chain length

(b) Length of survey line is equal to one chain length

(c) Length of survey line is more than one chain length

(d) All of above

[Turn over

(vi) The bearing of whole circle baring varies between

(a) 0° and 90° (b) 0° and 180°

(c) 0° and 270° (d) 0° and 360°

(vii) Theodolite is used to

(a) Measure horizontal angle (b) Measure vertical angle

(c) Measure deflection angle (d) All of above

(viii) The point on which both back sight and fore sight readings are taken is called

(a) Station point (b) Staff point

(c) Change point (d) Bench mark

(ix) Contour interval is

(a) Horizontal distance between two contour line

(b) Vertical distance between any two contour line

(c) Vertical distance between two consecutive contour line

(d) All of above

(x) Simpson' rule is used

(a) Area between irregular boundary and survey line

(b) Area bounded by survey line

(c) Area bounded by irregular boundary

(d) All of above

2. (a) Discuss about various instruments required in chaining. (7)

(b) A 20m chain used for a survey was found to be 20.10 m at the beginning and 20.30 mat the end of the work. The area of the plan driven to a scale of 1 cm = 8 m was measured with the help of planimeter and was found to be 32.56 sq.cm. Find the true area of the field. (8)

3. (a) A 30 m steel tape was standardized on the flat and was found to be exactly 30 m under no pull at 66°F. It was used in catenary to measure a base of 5 bays. The temperature during the measurement was 92°F and the pull exerted during measurement was 10 kg. The area of cross-section of the tape was 0.08 sqm. The specific weight of the steel is 7.86 gm/cm^2. α =0.0000063 per°F and E= 2.109 × 10^6 kg/cm^2. Find True length of the line. (7)

(b) Explain the following terms of chain surveying (8)

(i) Base line

(ii) Tie line.

4. (a) The following fore and back bearings were observed in traversing with a compass in place where local attractions was suspected.

Line	FB	BB
AB	38°30'	219°15'
BC	100°45'	278°30'
CD	28°45'	207°15'
DE	325°15'	145°15'

Find the correct fore and back bearing and the true bearing of each of the line given that the magnetic declination was 10°W. (10)

(b) What are the four important characteristics of contour lines? (5)

5. (a) What is orientation of plane table surveying? (7)

(b) The following perpendicular offsets were taken from a chain line to a hedge:

Chainage , m	0	15	30	45	60	70	80	100	120	140
Offsets, m	7.60	8.5	10.7	12.8	10.6	9.5	8.3	7.9	6.4	6.4

Calculate the area between the survey line, the hedge and the end offsets by Simpson's rule. (8)

6. (a) Enlist and explain the function of each of the instruments required for plane table surveying. (7)

(b) Explain briefly the desired relationships between fundamental lines of theodolite. (8)

7. Write short notes on (any three): (3 × 5 =15)

(a) Setting out of perpendicular offset on a point on chain line

(b) Different types of bench mark

(c) Three point problem

(d) Double meridian distance

(e) dip of needle

(f) Refraction correction

(g) Computation of reservoir capacity.

Total No. of printed pages = 6

CE 181307

Roll No. of candidate | | | | | | | | | | |

2021

B.Tech. 3rd Semester End-Term Examination

CE

STRUCTURAL ANALYSIS – I

(New Regulation w.e.f. 2017–18)

(New Syllabus w.e.f. 2018–19)

Full Marks – 70 Time – Three hours

The figures in the margin indicate full marks for the questions.

Answer question No. 1 and any *four* from the rest.

1. Answer the following questions : (10 × 1 = 10)

(i) Moment of Inertia is a significant geometrical property for analysis of

(a) Truss for member forces

(b) Deflection and Slope in beam

(c) SF and BM of statically determinate beam

(d) Force in cable

(ii) Pin-jointed Truss members take

(a) Shear force and Bending Moment

(b) Axial force

(c) Torsion

(d) Only compression

(iii) Method of section is best suited when truss member in question is connected to

(a) Hinge support (b) Roller support

(c) Joints away from support (d) None of the above

[Turn over

(iv) Method of joint is best suited when the truss member in question is connected to

(a) Roller support

(b) Joints away form support

(c) Joints connecting more than two members

(d) Joints connecting more than three members

(v) Non-linear structure is one that where

(a) Stress-strain has a nonlinear relationship

(b) Geometry is non-linear

(c) None of the above

(d) Both (a) and (b)

(vi) Statical indeterminacy in the context of a truss is related to

(a) Redundant reactions

(b) Redundant members

(c) Both (a) and (b)

(d) Degrees of freedom

(vii) Kinematic Indeterminacy is defined on

(a) Degrees of freedom at nodes

(b) Degree of redundancy

(c) Degrees of freedom anywhere in the structure

(d) Degrees of freedom in any direction at a node

(viii) A point on an elastic line can have different

(a) Slopes

(b) Deflection

(c) Both (a) and (b)

(d) None of the above

(ix) An SFD or a BMD

(a) Cannot show more than one ordinate at a particular section

(b) Cannot differentiate between SF and BM at a section, just right to the section and just left to the section

(c) Can differentiate between BM at a section, just right to the section and just left to the section

(d) None of the above

(x) Macaulay Method is used to

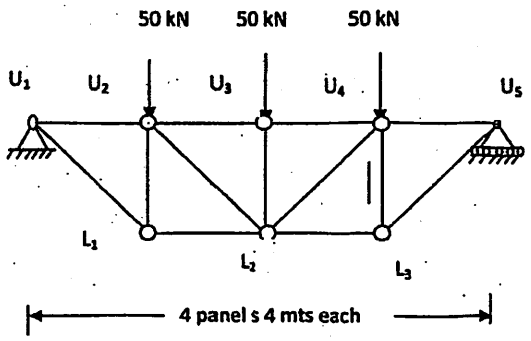
(a) Draw SFD and BMD of statically determinate beam

(b) Determine slope and deflection in asymmetrically loaded beam

(c) Draw conjugate beam

(d) None of the above

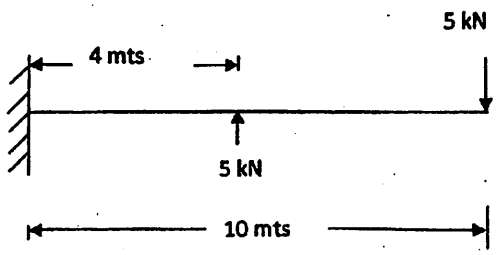
2. (a) Determine the forces in the truss by method of joints. Depth of the truss is 4 mts. (12)



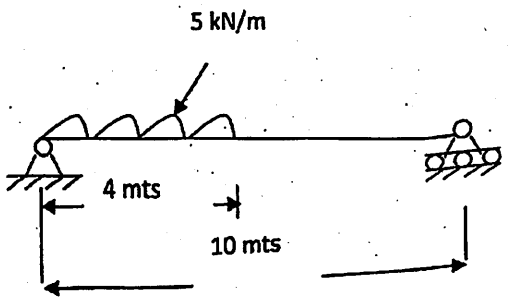
(b) Determine the force in member U_2U_3 using Method of section: (3)

3. Draw the Shear Force Diagram and Bending Moment Diagram for the beams shown below ((2½ ×2) × 3=15)

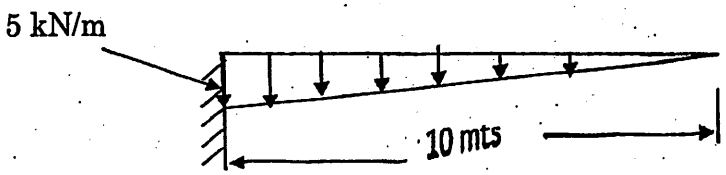
(a)



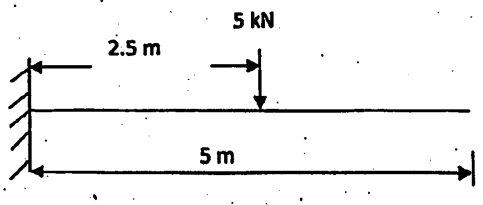
(b)



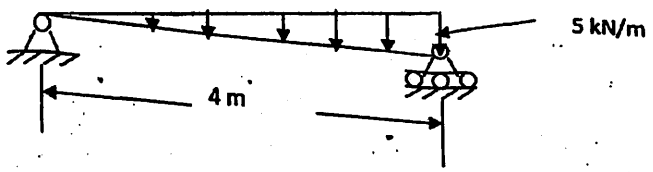
(c)



4. (a) Determined the slope and deflection at the free end of the cantilever beam using Moment-Area Method. EI value is constant for the beam. (2½ ×2)=5

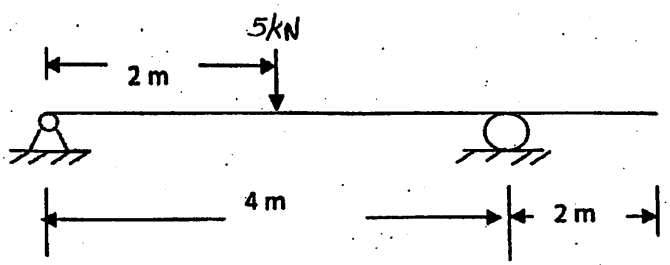


(b) Determine the equation of elastic line for the following beam. (5)



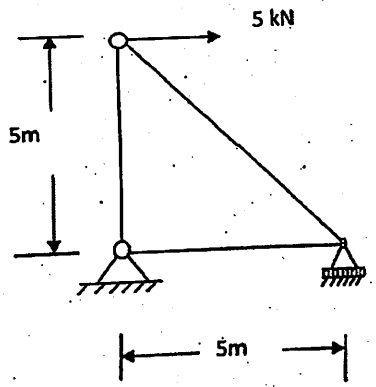
EI value is constant for the beam

(c)

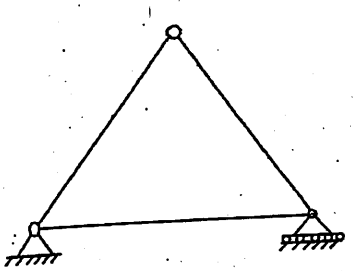


Determine the slope and deflection at the overhang end using conjugate beam method. EI value is constant for the beam. (2½ ×2)=5

5. (a) Determine the horizontal deflection at the top node using Castiligano's 2nd Theorem/Unit load method. AE value is constant in all the members. (5)

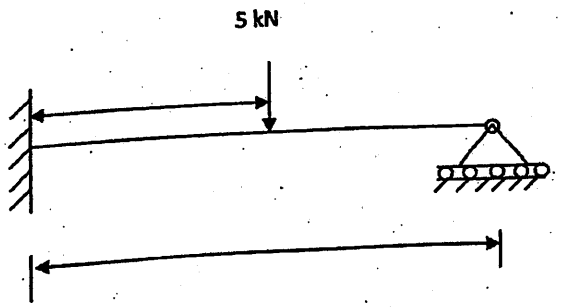


(b)



The left inclined member is too short by 2 mm. Determine the horizontal translation of top node using virtual work method. AE is constant for all the members. The members are of equal length. (5)

(c)



Using Castigliano's 2nd Theorem, determine the redundant reaction at roller support. The value of EI for the beam is constant. (5)

6. (a) A three-hinged parabolic arch of span 10 mts and central rise 3 mts has a point load at 2.5 mts from left support. Determine the horizontal thrust. Also determine normal thrust and radial shear at a section 2.5mts from right support. (2+3+3)

(b) A two-hinged parabolic arch of span 10 mts and central rise 3 mts has a udl of intensity 10 *kN/m* on its full span. Determine the horizontal thrust. The moment of inertia of the arch varies as secant of the moment of inertia at the crown. (7)

7. (a) A three-hinged stiffening girder has a span 100 mts. The central dip of the cable is 7 mts. The girder supports a point load of 50 kN at left quarter span. Draw the bending moment of the stiffening girder. (7)

(b) A two-hinged stiffening girder has a span 100 mts. The central dip of the cable is 7 mts. The girder supports a point load of 50 kN at left quarter span. Draw the bending moment of the stiffening girder. (8)

Total No. of printed pages = 4

CE 181302

Roll No. of candidate | | | | | | | | | | |

2021

B.Tech. 3rd Semester End-Term Examination
CE
SOLID MECHANICS
(New Regulation)
(w.e.f. 2017-18)
(New Syllabus)
(w.e.f. 2018-19)

Full Marks – 70 Time – Three hours

The figures in the margin indicate full marks for the questions.

Answer question No. 1 and any *four* from the rest.

1. Answer the following : (10 × 1 = 10)

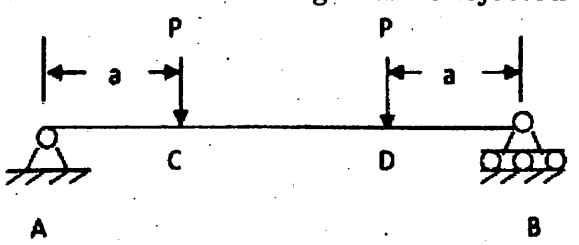
(i) A drive-shaft is primarily subjected to

(a) Bending (b) Shear
(c) Torsion (d) Compression

(ii) A beam under pure bending is subjected to

(a) Flexural tension and flexural compression
(b) Direct tension and direct compression
(c) Shear and bending
(d) Torsion and bending

(iii) Indicate the portion of the following beam subjected to pure bending



(a) AC (b) BD
(c) CD (d) Point C

[Turn over

(iv) Indicate the portion of the beam in Q.1 (iii) subjected to shear

(a) AC and BD

(b) CD

(c) All the portions

(d) None of the portions

(v) Shear Stress distribution across a beam section is

(a) Linear

(b) Parabolic

(c) Cubic

(d) Rectangular

(vi) The Shear stress across a beam section is minimum in

(a) Top fibre alone

(b) Bottom fibre alone

(c) Neutral Axis

(d) Both top and bottom fibre

(vii) Maximum bending stress across a beam section occurs in

(a) either top or bottom fibre or both

(b) only at top fibre

(c) only at bottom fibre

(d) at neutral axis

(viii) Neutral axis in a beam is called so because it has

(a) No shear stress

(b) No bending stress

(c) Maximum shear stress

(d) Maximum bending stress

(ix) The secant formula rationally includes

(a) Imperfections

(b) Strength of material

(c) Inherent aspect of instability

(d) All of the above

(x) Rankine-Gordon formula is applicable to

(a) Cantilever columns with eccentricity

(b) Pin-jointed centrally loaded column

(c) Pin-jointed eccentrically loaded columns

(d) Any long column

2. (a) An axially loaded member of gradually varied solid cross-section can be conceptualized as a frustum of a cone with diameter at one end 50 mm gradually varied to 30 mm over a length of 3 mts. The material has a Young's modulus of 200×10^5 N/mm^2. If the member carries an axial load of 50 kN, determine the elongation. (8)

(b) If Young's modulus of a material is 200×10^5 N/mm^2 and its Poisson's ratio is 0.3, determine the value of its Rigidity Modulus. (3)

(c) Illustrate the difference between stress-strain diagrams of a brittle material and a ductile material. (4)

3. Referring to the Fig in Q1(iii), P=50 kN, α= 3 mts and the span of the beam is 10 mts. Given that the beam is prismatic over the whole span with section 150 mm × 300 mm:

(a) Determine the bending stress at top and bottom fibre of the beam at 3 mts from left support. Draw the stress profile. (3+2)

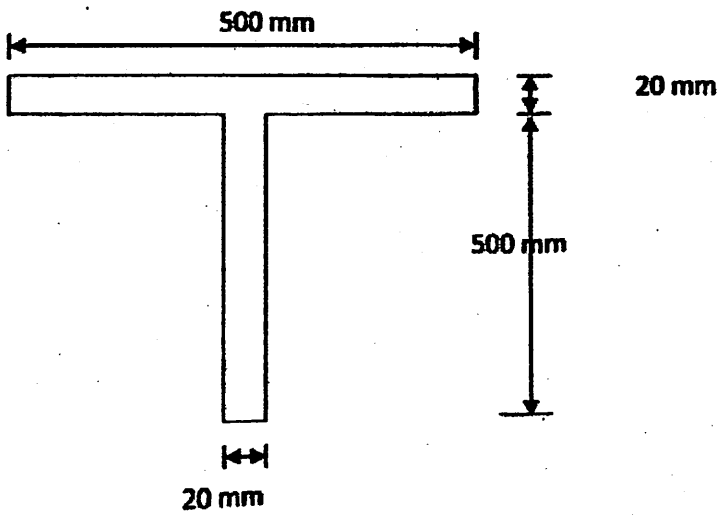
(b) Determine the shear stress at Neutral Axis of the beam section at 3 mts from the left. (3)

(c) Explain how a state of pure shear exists at the element in Prob 3(b). Determine the Principal stresses and the planes at which these act. (3+2+2)

4. (a) Establish that for a rectangular section maximum shear stress is 1.5 times the average shear stress. (6)

(b) Explain the concept of Complementary Shear stress. (2)

(c) A T-section as shown below is subjected to a shear stress of 50 kN. Draw the profile of shear stress distribution. (7)



5. (a) Differentiate between buckling and crushing of columns. (3)

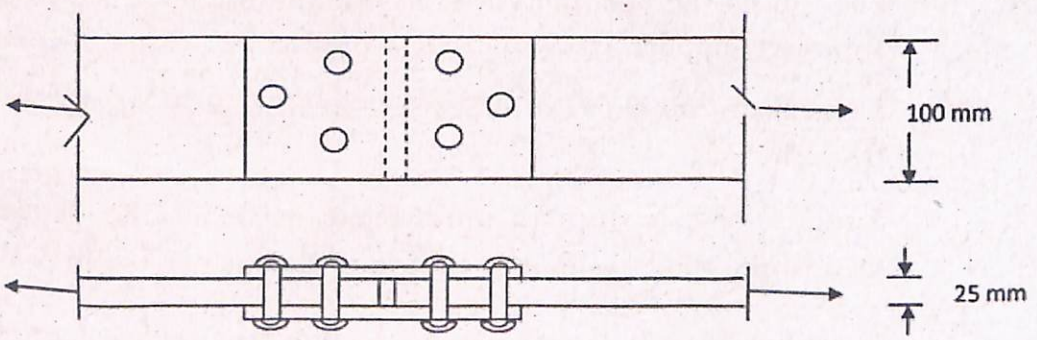
(b) Illustrate how imperfections are taken into account in design of columns using design curves based on Secant Formula. (5)

(c) Explain the concept of beam-column. (3)

(d) State the Rankine-Gordon formula and explain how slenderness ratio influences the safe load of column predicted by this formula. (4)

6. (a) The tube of a motorcycle is inflated to a pressure of 0.15 MPa. If mean diameter of the tube is 50 mm and the thickness of the tube is 2 mm, calculate hoop stress the tube material is subjected to. (6)

(b) A 100 mm × 25 mm steel strap is spliced with double cover butt joint as shown below The rivets are 22 mm in diameter. The allowable working stresses are: tensile strength of steel is 350 N/mm^2, shear strength of rivets is 300 N/mm^2 and bearing stress is 650 N/mm^2 . Calculate the safe load P for the spliced strap and the efficiency of the joint. (9)



7. (a) State the assumptions of theory of pure torsion. Explain the significance of each of these. (3+3)

(b) Determine the proper diameter for a solid shaft to transmit 300 hp at 3600 rpm. The working stress in shear for the material is 42.0 N/mm^2 . (4)

(c) A hollow shaft is of outer diameter d and inside diameter $d/2$. Calculate the proper value of d for the shaft if it has to transmit 200 hp at 105 rpm with a working stress in shear 42.0 N/mm^2 . (5)

Total No. of printed pages = 6

ECE 181304

Roll No. of candidate | | | | | | | | | | |

2021

B.Tech 3rd Semester End-Term Examination

ETE

NETWORK THEORY

(New Regulation)

(w.e.f. 2017–2018)

(New Syllabus)

(w.e.f. 2018–2019)

Full Marks – 70 Time – Three hours

The figures in the margin indicate full marks for the questions.

Answer question No. 1 and any *four* from the rest.

1. Answer the following : (10 × 1 = 10)

(i) Norton's theorem states that a complex network connected to a load can be replaced with an equivalent impedance

(a) In series with a current source

(b) In parallel with a voltage source

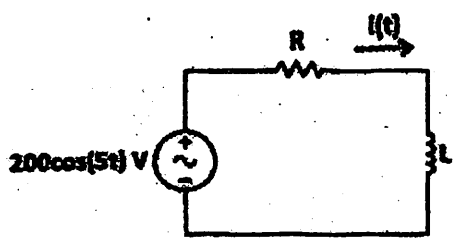
(c) In series with a voltage source

(d) In parallel with a current source

(ii) The current in the RL circuit shown below is $i(t) = 10\cos\left(5t - \frac{\pi}{4}\right)A$. Find the value of the inductor in Henry, rounded off to two decimal places?

(a) 1.82 (b) 2.82

(c) 3.82 (d) 4.82



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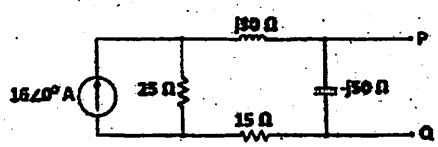
(iii) In the circuit shown below, the Norton equivalent current in amperes with respect to the terminals P and Q is?

(a) $6.4 - j4.8$ (b) $6.58 - j7.87$

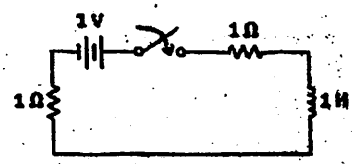
(c) $10 + j0$ (d) $16 + j0$



(iv) For the circuit given in the fIgure, find the magnitude of the loop current (in amperes, correct to three decimal places) 0.5 second after closing the switch?

(a) 0.136 (b) 0.613

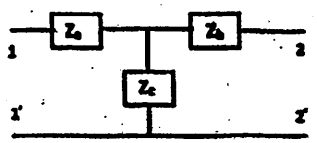
(c) 0.316 (d) 0.163



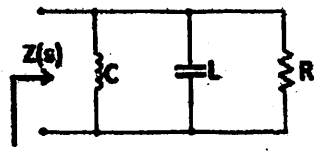
(v) The Z-parameter matrix for the two-port network shown is $\begin{bmatrix} 2j\omega & j\omega \\ j\omega & 3+2j\omega \end{bmatrix}$, where the entries are in Ω. Suppose $Z_0(j\omega) = R_0 + j\omega$. Then find the value of $R_s(in\ \Omega)$?

(a) 1.5 (b) 2

(c) 2.5 (d) 3



(vi) The driving point impedance of the following network is given by $Z(s) = \dfrac{0.28}{S^2 + 0.1S + 2}$



The component values are

(a) L=5H, R=0.5Ω, C =0.1F (b) L=01.H, R=0.5 Ω, C=5F

(c) L=5H, R=2Ω, C=0.1F (d) L=0.1H, R=2Ω, C=5F

(vii) For series RLC circuit, which one of the following statements is NOT correct?

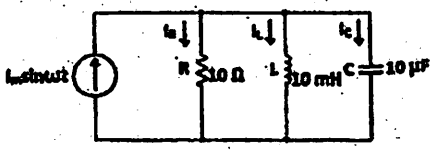
(a) The bandwidth of the circuit increases if R is increased

(b) The bandwidth of the circuit remains same if C is increased

(c) At resonance, input impedance is a real quantity

(d) At resonance, the magnitude of input impedance attains its maximum values.

(viii) The figure shows an RLC circuit with a sinusoidal current source



At resonance, the ratio $|I_L|/|I_R|$, i.e., the ratio of the magnitudes of the inductor current phasor and the resistor current phasor. is ————————

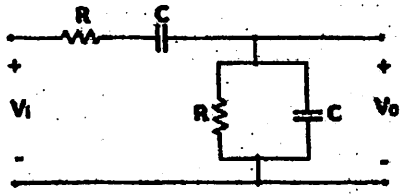
(a) 0.216 (b) 0.316

(c) 0.416 (d) 0.516

(ix) The RC circuit shown in the figure is

(a) a low-pass filter (b) a high-pass filter

(c) a band-pass filter (d) a band-reject filter

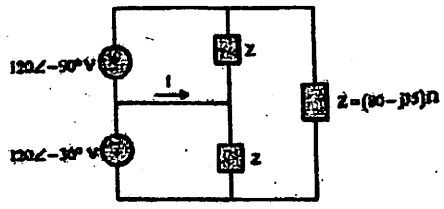


(x) The graph associated with an electrical network has 7 branches and 5 nodes. The number of independent KCL equations and the number of independent KVL. equations, respectively are

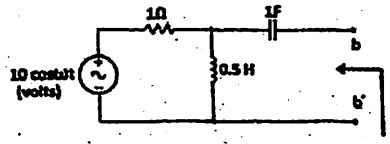
(a) 2 & 5 (b) 5 & 2

(c) 3 & 4 (d) 4 & 3

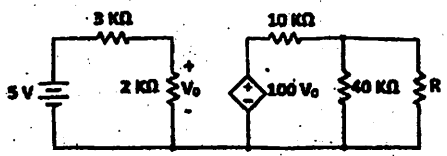
2. (a) Find the current I in the given network? (5)



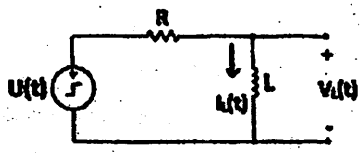
(b) In the circuit shown In the figure, the angular frequency ω (in rad/s), at which the Norton equivalent impedance as seen from terminals b-b is purely resistive, is ———— (5)



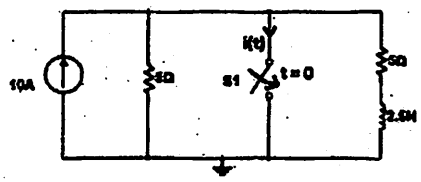
(c) In the circuit shown in the figure, the maximum power (in watt) delivered to the resistor R is ———— (5)



3. (a) Draw the waveform for $V_1(t)$ and $I_1(t)$ for the 1st order RL. network excited by Step input as shown in the figure below. (3)

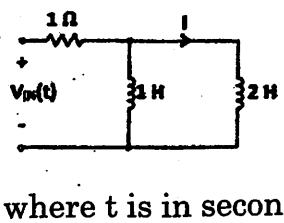


(b) The switch In the circuit, shown in the figure, was open for a long time and is closed at t = 0. The current i(t) (in ampere) at t = 0.5 seconds is ———— (5)



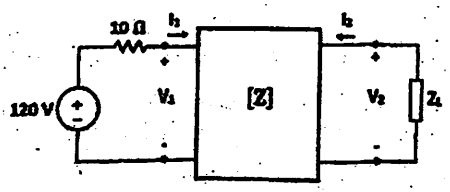
(c) In the circuit shown, the voltage V_{IN} (t) is described by:

$$V_m \begin{cases} 0, \text{ for } t < 0 \\ 15 \text{ volts for } 5 \geq 0 \end{cases}$$

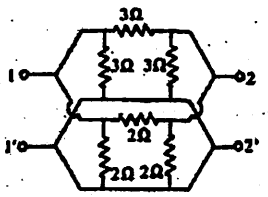


where t is in seconds. Find the tine (in seconds) at which the current I in the circuit will reach the value 2 Amperes? (7)

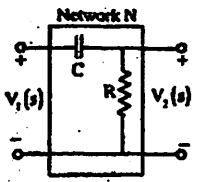
4. (a) In the given circuit, the two-port network has the impedance matrix $[z]=\begin{bmatrix}40 & 60\\ 60 & 120\end{bmatrix}$. Find the value of Z_1 for which maximum power is transferred to the load? (5)



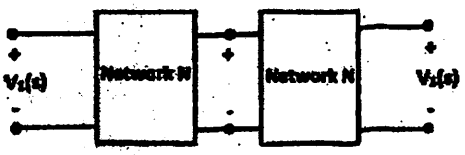
(b) Find the equivalent h-parameters of the 2-port network for the figure shown below. (5)



(c) Consider the building block called 'Network N' shown in the figure. Let $C=100\mu F$ and $R=10K\Omega$.

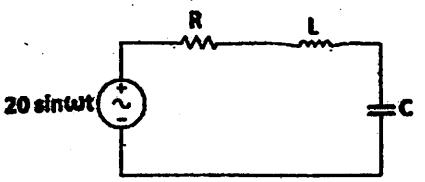


Two such blocks are connected in cascade, as shown in the figure.



Find the transfer function $\frac{V_2(2)}{V_1(2)}$ of the cascade network? (5)

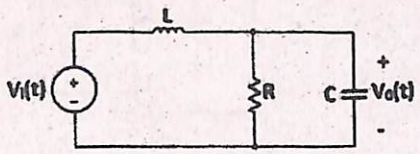
5. (a) In the circuit of fig shown, R=2Ω, L = 1 mH and C = 0.4 μF (i) Find the resonant frequency and the half-power frequencies. (ii) Calculate the quality factor and bandwidth. (iii) Determine the amplitude of the current at w_0, w_1, and w_2. (6)



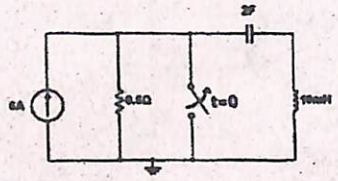
(b) Compare series resonance and parallel resonance in a RIC circuit? (9)

6. (a) What is an electrical filter circuit? What are the limitations of passive filters and how this can be overcome by an active filter? List some of the applications of electrical filters. (2+4+2=8)

(b) Determine what type of filter as shown in the Fig. below. Calculate the corner or cut off frequency. Take R = 2 KΩ, L = 2H and C = 2 μF. (7)



7. (a) State duality principle? Construct the dual of the circuit in the figure. (2+3=5)

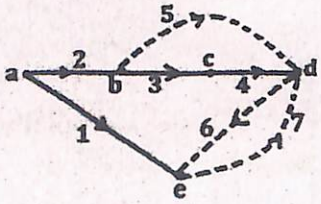


(b) Define the terminologies related to a network topology. (4)

(i) Graph (ii) Tree

(iii) Link (iv) Forest

(c) For the graph shown, write the tie-set matrix and f-cut-set matrix. (6)



Total No. of printed pages = 4

ECE 181303

Roll No. of candidate | | | | | | | | | | |

2021

B.Tech. 3rd Semester End-Term Examination

ECE, ETE, PEIE

DIGITAL CIRCUITS

(New Regulation (w.e.f 2017-2018) and New Syllabus (w.e.f 2018-2019))

Full Marks – 70 Time – Three hours

The figures in the margin indicate full marks for the questions.

Question no. 1 is mandatory. Answer any *four* from question no. 2 - 6

1. Choose the correct answer of the following : (10 × 1 = 10)

(i) A 14 pin NOT gate IC 7404 has how many NOT gate?

(a) 2

(b) 4

(c) 6

(d) 8

(ii) When one input of an EXOR gate is connected to logic "1", it functions as

(a) OR gate

(b) NOR gate

(c) NOT gate

(d) EXNOR gate

(iii) Which of the following statement is correct?

(a) A XOR 0 = $\overline{A}$

(b) A XOR 0 = A

(c) A XNOR 0 = 1

(d) A XNOR 0 = A

[Turn over

(iv) The binary numbers 0101 and 11110 can be represented in gray format as

(a) 0111, 10011

(b) 0110, 10001

(c) 0111,10001

(d) None of the above

(v) The octal equivalent of $(4A.\ FB)_{16}$ and $(1000)_2$ are

(a) 112.766,12

(b) 12.15, 12

(c) 12.15, 10

(d) 112.766, 10

(vi) The smallest number that can be represented in 10 bits 2's complement representation is

(a) –256

(b) –512

(c) –1024

(d) None of the above

(vii) As compared to TTL, ECL has

(a) Lower power dissipation

(b) Higher propagation delay

(c) Lower propagation delay

(d) Higher noise margin

(viii) Among the digital IC families, ECL, TTL and CMOS

I. ECL has the least propagation delay

II. TTL has the largest fan-out

III. CMOS has the biggest noise margin

IV. TTL has the lowest power consumption

Which of the statements are correct?

(a) I and III

(b) I, II, III

(c) I, IV

(d) I, II, III, IV

(ix) A ripple counter is a

(a) Synchronous counter

(b) Asynchronous counter

(c) Parallel counter

(d) None of the above

(x) The FPGA refers to

(a) First Programmable Gate Array

(b) Field Programmable Gate Array

(c) First Program Gate Array

(d) Field Program Gate Array

2. (a) What is the difference between synchronous and asynchronous sequential circuit? Explain with example. (5)

(b) How latches are different from flip-flops? How race around condition can be eliminated? (2 + 4)

(c) Design a SR flip-flop using JK flip flop. (4)

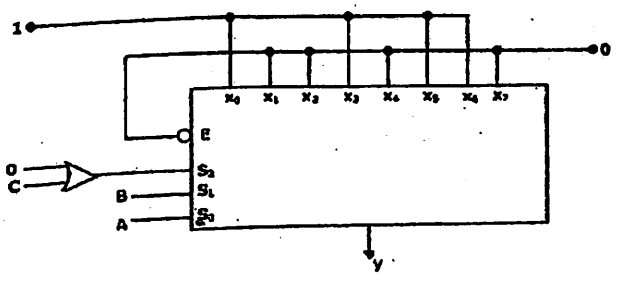
3. (a) Explain the working of full adder with truth table and logic diagram. Derive the sum and carry equations using k-map. Implement the same with (4 + 3 + 3)

(i) NAND gates

(ii) Half adders only

(b) Implement f (A, B, C) = Σ m (0, 1, 5, 6) using 4:1 mux using AB as select line. (5)

4. (a) In the following circuit, S_2, S_1 and S_0 are select lines and X_7 to X_0 are input lines. S_0 and X_0 are LSBs. Find the output Y. (5)



(b) Write short note on any two of the following : (2 × 5 = 10)

(i) Fan out

(ii) Johnson's counter

(iii) CMOS logic family

(iv) Mealy and Moore state machine

5. (a) With neat diagram, explain the working of TTL NAND gate using Totem Pole output configuration. (7)

(b) The four variable function f is given in terms of mm-terms as- (4+4)

$f(A, B, C, D) = \Sigma m(2, 3, 8, 10, 11, 12, 14, 15)$

Using K-map, minimize the function in the sum of product form. Also give the realization using only two input NAND gates.

6. Design any three of the following as directed : $(3 \times 5 = 15)$

(a) 2 input AND and NAND gate using 2:1 multiplexer only

(b) 8:1 multiplexer using 2:1 multiplexers only

(c) Synchronous 3-bit updown counter

(d) Full subtractor circuit using a 8:1 multiplexer

Total No. of printed pages = 3

ECE 181305

Roll No. of candidate | | | | | | | | | | |

2021

B.Tech. 3rd Semester End-Term Examination

ECE, ETE

SIGNALS AND SYSTEMS

(New Regulation w.e.f. 2017 – 18)

(New Syllabus w.e.f. 2018 – 19)

Full Marks – 70 Time – Three hours

The figures in the margin indicate full marks for the questions.

Answer question No. 1 and any *four* from the rest.

1. Answer the following questions : (10 × 1 = 10)

   (a) At $x=0$, $\text{sinc}(x)=$ ————————

   (b) What are the relationships between unit impulse, unit step and unit ramp signal?

   (c) ———————— is a process of converting a continuous time signal to discrete time signal.

   (d) The minimum rate at which a signal can be sampled and still be reconstructed from its samples is called as ————————.

   (e) Ideally, an impulse signal is a signal with ———————— magnitude and ———————— duration.

   (f) What is meant by region of convergence (ROC) in Z-transform?

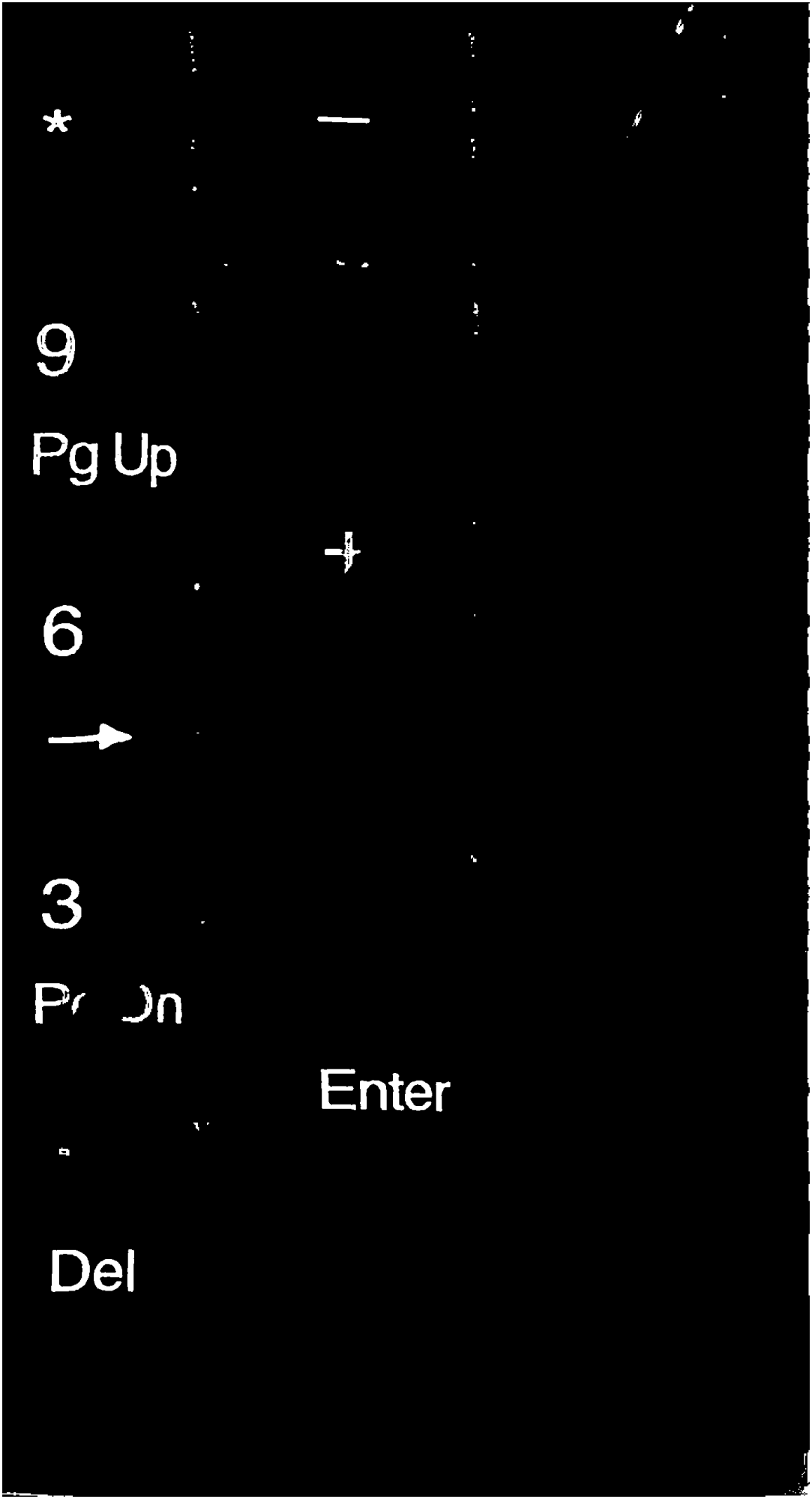
   (g) The forced response is the solution of the difference equation for the given input when the initial conditions are ————————.

   (h) The Fourier series exists only if ———————— conditions are satisfied.

   (i) The Fourier transform of a real ———————— valued time signal has ———————— symmetry.

   (j) If Laplace transform of $x(t) = X(s)$, then Laplace transform of $K.x(t)$ is ————————

[Turn over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2. (a) What do you understand by LTI system? What is the condition for stability of an LTI system? Determine whether the given system is time- invariant or not $y(n)=x(n)+nx(n-I)$. (2+1+2=5)

(b) Compute the convolution $x(n)$ of the sequences: (5)

$x_1(n)=\{1,2,1\}$

$x_1(n)=\begin{cases}1, & 0\le n\le 5\\ 0, & otherwise\end{cases}$

(c) Define energy and power of a signal. Find the Nyquist rate and Nyquist interval of the signal: $\text{sinc}(200t) + \text{sinc}^2(200t)$ (2+3=5)

3. (a) What do you mean by aliasing effect that is observed while sampling a signal? What steps are to be taken to combat this effect? A signal $x(t) = \cos(200\pi t) + 2\cos(320\pi t)$ is ideally sampled at $f_S = 300$Hz. If the sampled signal is passed through an ideal low pass filter with a cut-off frequency of 250Hz, what frequency components will appear at the output? (2+2+2=6)

(b) Draw the one-sided and two-sided line spectra of the following signal. (6)

$x(t)=2+6\cos(20\pi t+30^\circ)+3\sin(60\pi t)-4\cos(70\pi t)$

(c) If $X(z)=2+3z^{-1}+4z^{-2}$, find the initial and final values of the corresponding sequence $x(n)$. (3)

4. (a) Write down the Dirichiees conditions for the existence of Fourier transform. Using time convolution theorem, prove that the convolution of a function $x(t)$ with a unit impulse function results the function itself. (2+3=5)

(b) Derive the relationship between Fourier and Laplace transform. Find the Laplace transform and ROC of the signal $x(t)=e^{-4t}u(t)$. (2+4=6)

(c) Given $x(n)=a^n u[-(n+1)]$, obtain its DTFT. (4)

5. (a) Sketch the following signals: (3+3=6)

(i) $u(t)-2u(t-1)+u(t-2)$

(ii) $r(t)-2r(t-1)+r(t-2)$

(b) Determine if the system described by the following input-output equation is linear or non-linear. (4)

$y(n)=Ax(n)+B$

(c) Write a note on 'Application of Signals and Systems'. (5)

6. (a) Find the Z-transform and ROC of $2^n u(n)$ (5)

(b) Using long division method, determine the inverse Z-transform of $X(z)=(1+2z^{-1})/(1-2z^{-1}+z^{-2})$ (5)

(c) Obtain the inverse Laplace transform of the given signal. (5)

7. (a) Find the natural response of the system described by the difference equation: $y(n)-1.5y(n-1)-0.5y(n-2)=x(n)$; given $y(-1)=1$ and $y(-2)=0$ (5)

(b) Find the DPT of the sequence: $x(n)=\{1,1,2,2,3,3\}$. (5)

(c) State and prove Parsevars theorem for energy signals. (1+4=5)

Total No. of printed pages = 6

ECE 181302

Roll No. of candidate | | | | | | | | | | |

2021

B.Tech. 3rd Semester End-Term Examination

Electronics and Telecommunication

SEMICONDUCTOR DEVICES AND CIRCUITS

(New Regulation w.e.f. 2017-18) &

(New Syllabus w.e.f. 2018-19)

Full Marks – 70 Time – Three hours

The figures in the margin indicate full marks for the questions.

Answer question No. 1 and any *four* from the rest.

1. Answer the following (MCQ/ Fill in the blanks) : (10 × 1 = 10)

   (i) Intrinsic semiconductor is also called as

   (a) Impure semiconductor

   (b) Non- degenerated

   (c) Degenerated

   (d) Internal

   (ii) The reverse current in a diode is of the order of ————

   (a) kA

   (b) mA

   (c) μA

   (d) A

(iii) The leakage current in a crystal diode is due to ————

(a) minority carriers

(b) majority carriers

(c) junction capacitance

(d) none of the above

(iv) The mobility of electron for Silicon at 300K is ————

(v) In a step graded diode the electric field is maximum at ————

(vi) Punch through is witnessed in

(a) FET

(b) BJT

(c) NMOS

(d) PMOS

(vii) What is impurity concentration of Tunnel Diode?

(a) $1 : 10^3$

(b) $1 : 10^4$

(c) $1 : 10^5$

(d) $1 : 10^6$

(viii) There is no need for a transformer in a

(a) half-wave rectifier

(b) centre-tap full-wave rectifier

(c) bridge full-wave rectifier

(d) none of the above

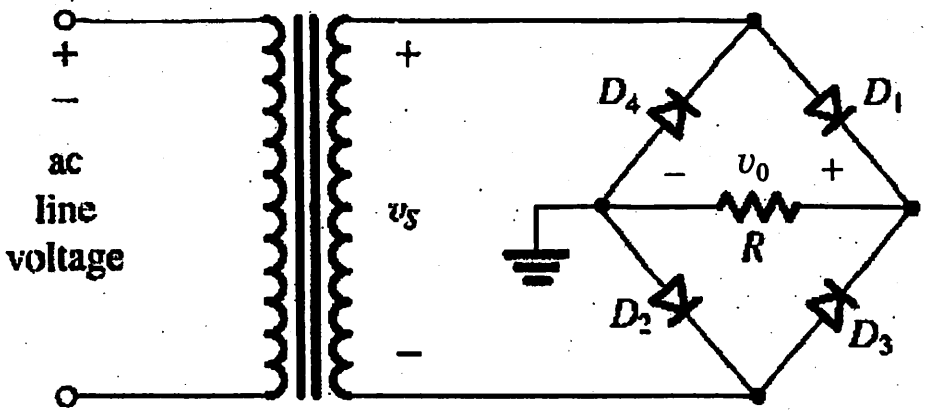
(ix) The main cause of avalanche breakdown is ————

(x) Channel length modulation occurs in ————

2. (a) A uniform bar of n-type silicon of 2–μm length has a voltage of 1 V applied across it. If $ND = 10^{16}/cm^3$ and μ_n =1350 $cm^2/V.s$, find (i) the electron drift velocity, (ii) the time it takes an electron to cross the $2-\mu m$ length, (iii) the drift-current density, and (iv) the drift current in the case that the silicon bar has a cross-sectional area of 0.25 μm^2. (10)

(b) The reverse saturation current rating of a p-n junction diode is 50 nA at 32°C. Find the value of the forward current and the dynamic ac resistance. The forward voltage drop is 0.5V. $V_T = KT/q$ at 32°C = 26 mv. (5)

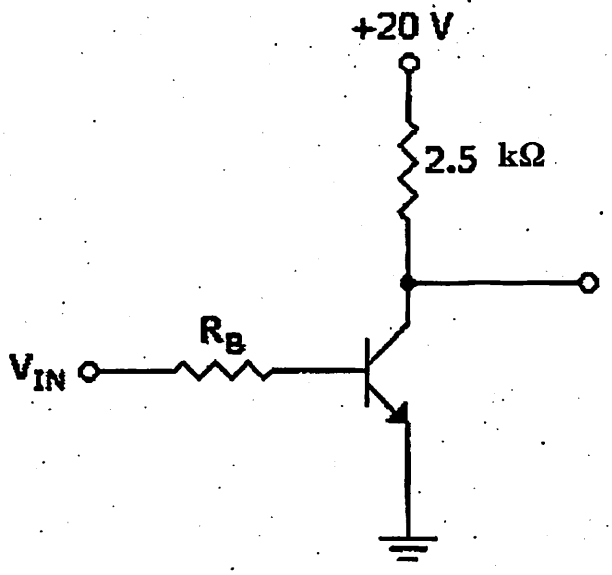
3. (a) For the bridge-rectifier circuit shown in the figure use the constant-voltage-drop diode model to find (i) the average (or dc component) of the output voltage is V_O (ii) the peak diode current, and (iii) the PIV for the case in which Vs is a 12-V (rms) sinusoid, V_D = 0.7 V, and R = 100Ω. (10)



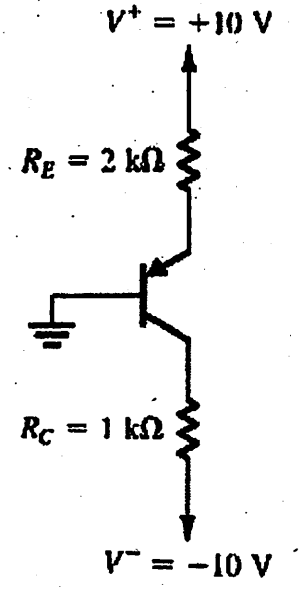
(b) Explain clipping and clamping circuit with suitable diagram. (5)

4. (a) Explain the input and output characteristics of CC and CE transistors in various modes of operation. (10)

(b) For the circuit shown below what value of value of R_B will result in saturation if $\beta = 100$ and $V_{IN} = 8V$. (5)



5. (a) For the circuit in given below, find the largest value to which R_C can be raised while the transistor remains in the active mode. Assume $\beta = 100$. (10)

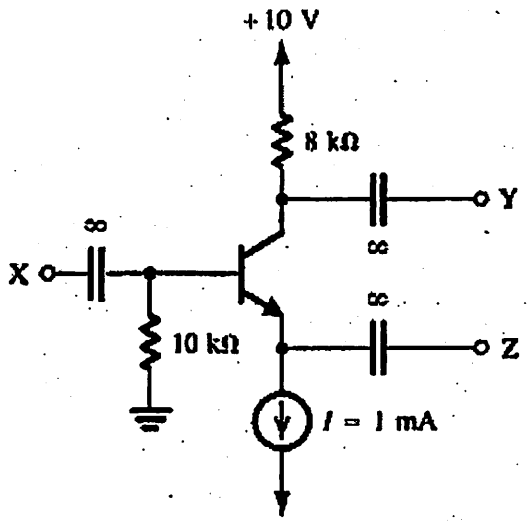


(b) Explain if we can use the BJT as a switch. (5)

6. (a) The transistor in the circuit is biased with a constant current source I = 1 mA and has β =100 and V_A = 100 v.

(i) Neglecting the Early effect, find the dc voltages at the base, emitter, and collector.

(ii) Find g_m, r_π, and r_o. (10)

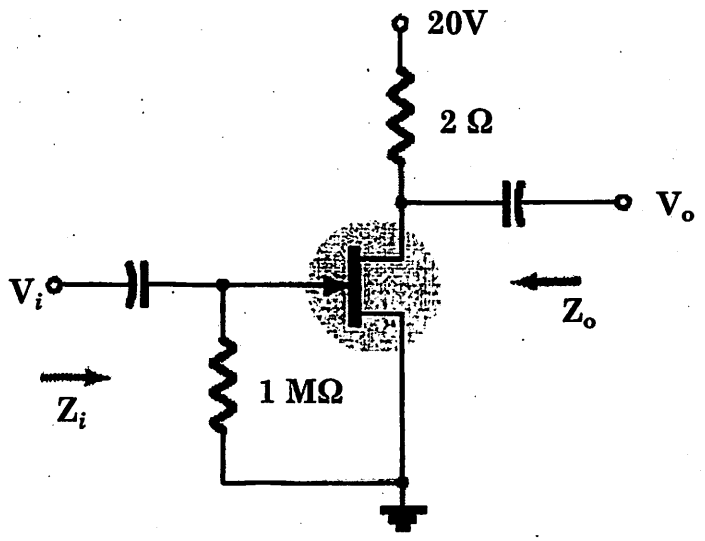


(b) Explain :

(i) Why I_G is effectively zero amperes for a JFET transistor.

(ii) Why is the input impedance to a JFET so high? (5)

7. (a) Circuit shows a self-bias JFET. Find Z_i, Z_o and A_v if $I_{DSS} = 6$ mA, $V_P = 6V$ and $y_{os} = 40\mu S$. (10)



(b) What is channel modulation? Explain with suitable diagram. (5)

8. Write short notes (any *three*) :

(a) Schotky diode

(b) Drift and diffusion current

(c) Bridge Rectifier

(d) MOSFET

(e) Ebers-Moll Model.

Total No. of printed pages = 6

ECE 181304

Roll No. of candidate | | | | | | | | | | |

2021

B.Tech 3rd Semester End-Term Examination

ETE

NETWORK THEORY

(New Regulation)

(w.e.f. 2017–2018)

(New Syllabus)

(w.e.f. 2018–2019)

Full Marks – 70 Time – Three hours

The figures in the margin indicate full marks for the questions.

Answer question No. 1 and any *four* from the rest.

1. Answer the following : (10 × 1 = 10)

(i) Norton's theorem states that a complex network connected to a load can be replaced with an equivalent impedance

(a) In series with a current source

(b) In parallel with a voltage source

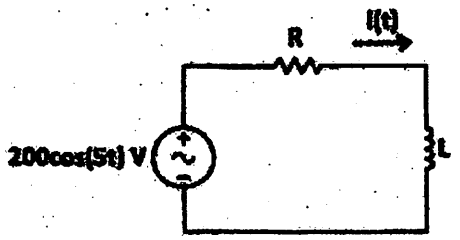
(c) In series with a voltage source

(d) In parallel with a current source

(ii) The current in the RL circuit shown below is $i(t) = 10\cos\left(5t - \frac{\pi}{4}\right)A$. Find the value of the inductor in Henry, rounded off to two decimal places?

(a) 1.82 (b) 2.82

(c) 3.82 (d) 4.82



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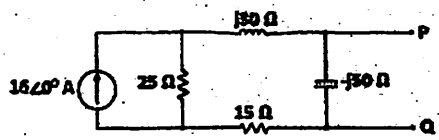
(iii) In the circuit shown below, the Norton equivalent current in amperes with respect to the terminals P and Q is?

(a) $6.4 - j4.8$ (b) $6.58 - j7.87$

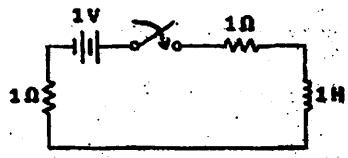
(c) $10 + j0$ (d) $16 + j0$



(iv) For the circuit given in the fIgure, find the magnitude of the loop current (in amperes, correct to three decimal places) 0.5 second after closing the switch?

(a) 0.136 (b) 0.613

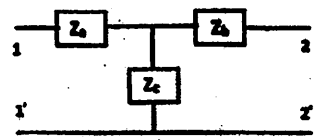
(c) 0.316 (d) 0.163



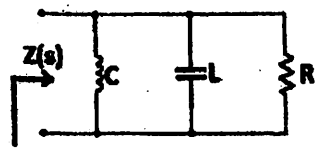
(v) The Z-parameter matrix for the two-port network shown is $\begin{bmatrix} 2j\omega & j\omega \\ j\omega & 3+2j\omega \end{bmatrix}$, where the entries are in Ω. Suppose $Z_0(j\omega) = R_0 + j\omega$. Then find the value of $R_s(in\ \Omega)$?

(a) 1.5 (b) 2

(c) 2.5 (d) 3



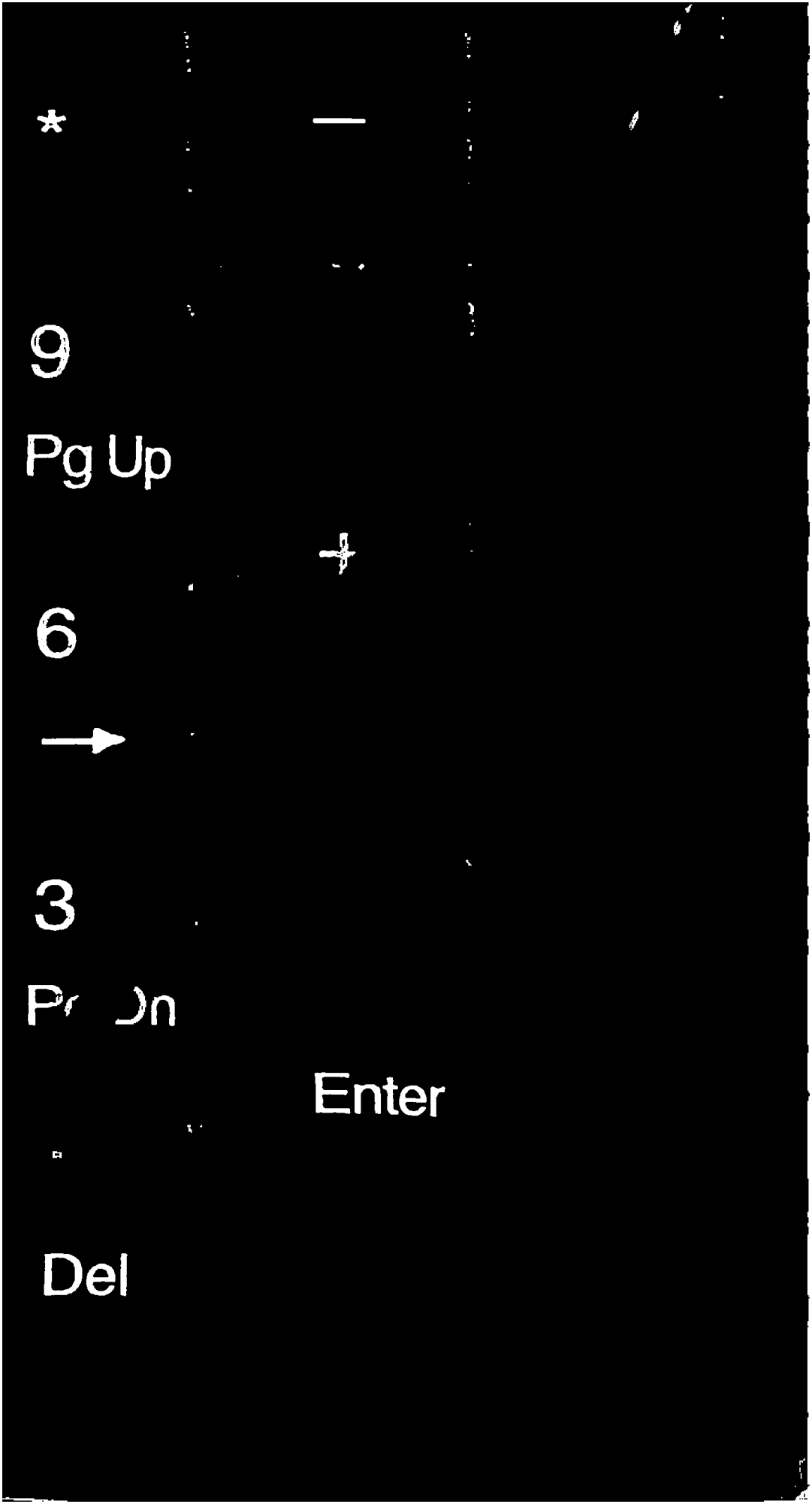
(vi) The driving point impedance of the following network is given by $Z(s) = \dfrac{0.28}{S^2 + 0.1S + 2}$



The component values are

(a) L=5H, R=0.5Ω, C =0.1F (b) L=01.H, R=0.5 Ω, C=5F

(c) L=5H, R=2Ω, C=0.1F (d) L=0.1H, R=2Ω, C=5F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(vii) For series RLC circuit, which one of the following statements is NOT correct?

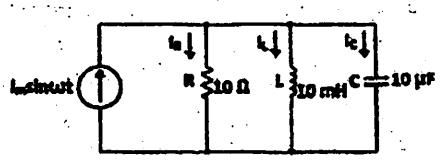
(a) The bandwidth of the circuit increases if R is increased

(b) The bandwidth of the circuit remains same if C is increased

(c) At resonance, input impedance is a real quantity

(d) At resonance, the magnitude of input impedance attains its maximum values.

(viii) The figure shows an RLC circuit with a sinusoidal current source



At resonance, the ratio $|I_L|/|I_R|$, i.e., the ratio of the magnitudes of the inductor current phasor and the resistor current phasor. is ————————

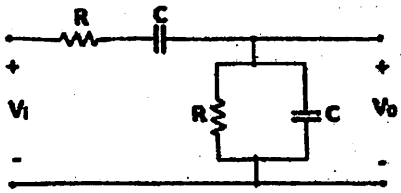
(a) 0.216 (b) 0.316

(c) 0.416 (d) 0.516

(ix) The RC circuit shown in the figure is

(a) a low-pass filter (b) a high-pass filter

(c) a band-pass filter (d) a band-reject filter.

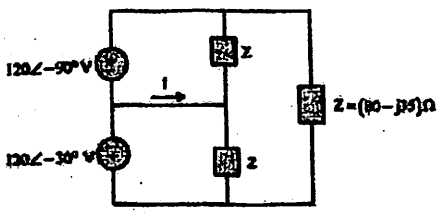


(x) The graph associated with an electrical network has 7 branches and 5 nodes. The number of independent KCL equations and the number of independent KVL. equations, respectively are

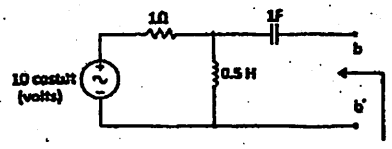
(a) 2 & 5 (b) 5 & 2

(c) 3 & 4 (d) 4 & 3

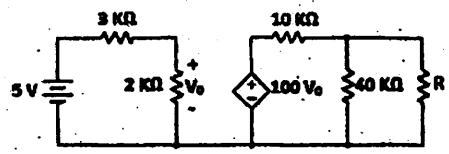
2. (a) Find the current I in the given network? (5)



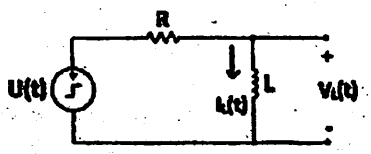
(b) In the circuit shown In the figure, the angular frequency ω (in rad/s), at which the Norton equivalent impedance as seen from terminals b-b is purely resistive, is ———— (5)



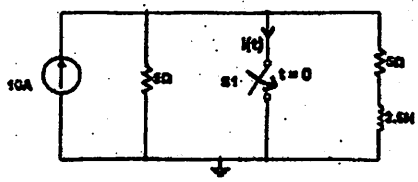
(c) In the circuit shown in the figure, the maximum power (in watt) delivered to the resistor R is ———— (5)



3. (a) Draw the waveform for $V_1(t)$ and $I_1(t)$ for the 1st. order RL. network excited by Step input as shown in the figure below. (3)

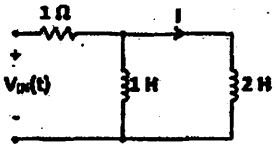


(b) The switch In the circuit, shown in the figure, was open for a long time and is closed at t = 0. The current i(t) (in ampere) at t = 0.5 seconds is ———— (5)



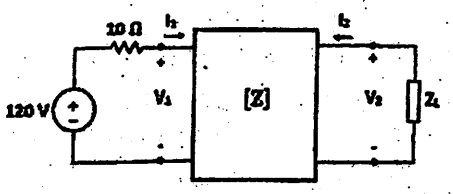
(c) In the circuit shown, the voltage $V_{IN}(t)$ is described by:

$$V_m \begin{cases} 0, \text{ for } t < 0 \\ 15 \text{ volts for } 5 \geq 0 \end{cases}$$

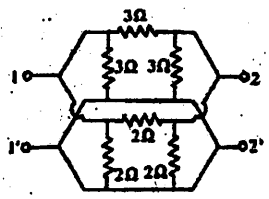


where t is in seconds. Find the tine (in seconds) at which the current I in the circuit will reach the value 2 Amperes? (7)

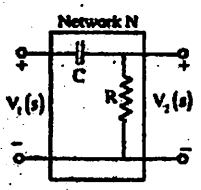
4. (a) In the given circuit, the two-port network has the impedance matrix $[z]=\begin{bmatrix}40 & 60\\ 60 & 120\end{bmatrix}$. Find the value of Z_1 for which maximum power is transferred to the load? (5)



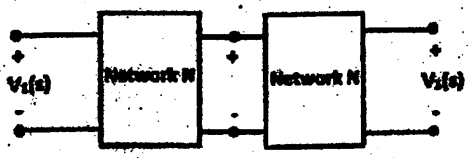
(b) Find the equivalent h-parameters of the 2-port network for the figure shown below. (5)



(c) Consider the building block called 'Network N' shown in the figure. Let $C=100\mu F$ and $R=10K\Omega$.

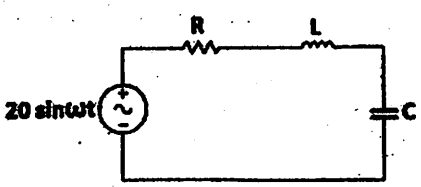


Two such blocks are connected in cascade, as shown in the figure.



Find the transfer function $\frac{V_2(2)}{V_1(2)}$ of the cascade network? (5)

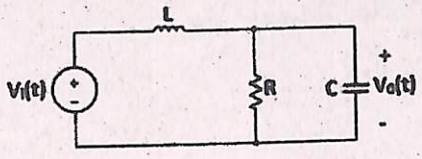
5. (a) In the circuit of fig shown, R=2Ω, L = 1 mH and C = 0.4 μF (i) Find the resonant frequency and the half-power frequencies. (ii) Calculate the quality factor and bandwidth. (iii) Determine the amplitude of the current at w_0, w_1, and w_2. (6)



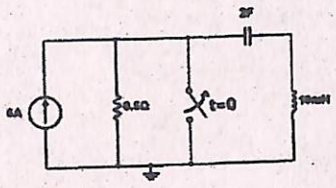
(b) Compare series resonance and parallel resonance in a RIC circuit? (9)

6. (a) What is an electrical filter circuit? What are the limitations of passive filters and how this can be overcome by an active filter? List some of the applications of electrical filters. (2+4+2=8)

(b) Determine what type of filter as shown in the Fig. below. Calculate the corner or cut off frequency. Take $R = 2\,K\Omega$, $L = 2H$ and $C = 2\,\mu F$. (7)



7. (a) State duality principle? Construct the dual of the circuit in the figure. (2+3=5)



(b) Define the terminologies related to a network topology. (4)

(i) Graph (ii) Tree

(iii) Link (iv) Forest

(c) For the graph shown, write the tie-set matrix and f-cut-set matrix. (6)