MIZORAM PUBLIC SERVICE COMMISSION

GENERAL COMPETITIVE EXAMINATIONS FOR RECRUITMENT TO THE POST OF
JR. GRADE OF MIZORAM FOREST SERVICE (ASST. CONSERVATOR OF FORESTS)
UNDER ENVIRONMENT, FOREST & CLIMATE CHANGE DEPARTMENT, GOVERNMENT OF MIZORAM, 2023

ELECTRONICS ENGINEERING

Time Allowed : 3 hours   Full Marks : 100

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

Answer any 10 (ten) questions
*taking 5 (five) questions from each section.*

SECTION - A

1. (a) Explain the phenomenon of superconductivity. Briefly explain its salient features, mechanism and applications. **(5)**

   (b) With the help of energy band diagram, distinguish between insulators, conductors and semiconductors. **(5)**

2. (a) Explain the mechanism of conduction in intrinsic semiconductors due to electrons and holes. **(5)**

   (b) In a full-wave rectifier the input is from a 30-0-30 V transformer. The load and diode forward resistance are 100 ohms and 10 ohms respectively. Calculate the average voltage and efficiency. **(5)**

3. (a) Determine the inverse Laplace transform of $(S) = \dfrac{1}{(s+2)(s^2+s+1)}$. **(6)**

   (b) State and prove the final value theorem with regard to Z transform. **(4)**

4. (a) State and explain Thevenin's theorem. **(4)**

   (b) Determine the current in all the resistors in the circuit given below. Also find the voltage across each element and show the power delivered by the source is equal to the power dissipated by the resistors. **(6)**
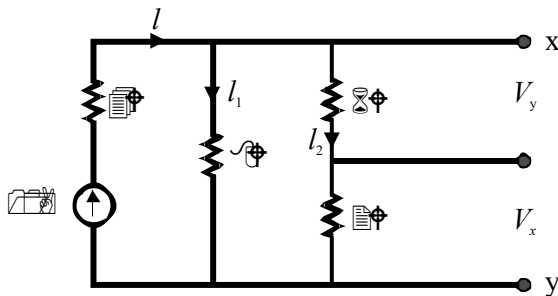
5. (a) Derive Poisson's and Laplace equation. **(5)**

   (b) Derive the relationship between Standing wave ratio and reflection coefficient. **(5)**

6. (a) What are the different errors encountered in measurements? Explain with suitable examples. **(4)**

(b) For the following given data, $x_1 = 49.7$, $x_2 = 50.1$, $x_3 = 50.2$, $x_4 = 49.6$, $x_5 = 49.7$, calculate **(6)**

    i. Arithmetic Mean

    ii. Deviation of each value

    iii. Algebraic sum of the deviations

    iv. Average deviation

SECTION - B

7. (a) Derive the expression for ripple factor and efficiency of a half wave rectifier. **(4)**

(b) Explain how an opamp can be used as a summer. **(6)**

8. (a) Simplify the Boolean function using K-Map technique and implement using logic gates **(6)**
$f(A,B,C,D,E)=\Sigma m$ (0, 1, 2, 4, 5, 6, 10, 13, 14, 18, 21, 22, 24, 26, 29, 30)

(b) Explain the operation of a binary-weighted register DAC? What is its main disadvantage? **(4)**

9. (a) State Routh-Hurwitz's criterion. Describe the necessary conditions for stability. **(4)**

(b) Determine the range of values of K so that the system having the following characteristic equation will be stable: $s (s^2+2s+3) (s+2) + K=0$. **(6)**

10. (a) Amplitude modulation is essentially a nonlinear process, producing the sum and difference frequencies, which contain the information to be transmitted and the unmodulated carrier frequency. Can we say that AM is a linear modulation in its strict sense? **(5)**

(b) Determine the modulation index for the sinusoidal FM signal for which $V_c(max) = 10$ V, $f_c = 20$ kHz, $V_m(max) = 3V$, $f_m = 1$ kHz and deviation constant, $k_f = 2000$ Hz/V. Also write the resulting expression for FM signal. **(5)**

11. (a) Explain why a dielectric filled waveguide cannot support TEM waves. **(5)**

(b) Discuss the principle of "MASER" and its applications. **(5)**

12. (a) Write an 8085 assembly language program to arrange a group of numbers in an ascending order. **(6)**

(b) How does pipelining in 8086 increase its through put? Explain. **(4)**

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