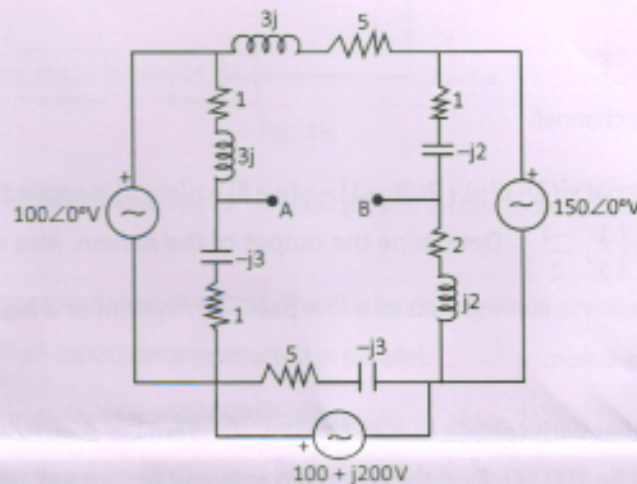Total Number of Questions : 20

Time : 2.00 Hours

Max. Marks : 100

1. What is Fill Factor (FF) in solar PV cell operation ? Illustrate it using power-voltage curve of solar PV cell. **(4 Marks)**

2. What is Charge-Coupled Device (CCD) sensor ? How CCD sensor is different from CMOS sensors ? **(4 Marks)**

3. For the following circuit, find V_{AB} by suitable method. **(5 Marks)**

4. Design a series voltage regulator for an output voltage of 5V. Input voltage is in the range of 6.6V to 10.6V. Assume fixed output current of 50 mA, transistor gain of 50, minimum Zener current of 9 mA and maximum Zener current of 49 mA. **(4 Marks)**

5. A 6 bit DAC has a step size of 10 mV. Determine the full-scale output voltage and percentage resolution. **(4 Marks)**

6. Explain the operation of execution of the 8085 instruction "MOV r, M" with the description of all the relevant pins (signals) of the microprocessor. **(4 Marks)**

7. Derive radar range equation. **(4 Marks)**

8. A multimode graded index fiber exhibits total pulse broadening of 0.2 μsec over a distance of 20 Km. Estimate (i) The maximum possible bandwidth on the link assuming no inter symbol interference. (ii) The pulse dispersion per unit length. **(4 Marks)**

9. An SCR in its forward blocking region has V_A = 25V, I_G = 1 μA and I_{CBO1} = I_{CBO2} = 50 nA. If α_1 = 0.5 and α_2 = 0.2, with these conditions, what is the anode current I_A and the dc resistance of the SCR. **(4 Marks)**

10. Determine the maximum sensitivity of 5 cm, 5 watts single turn 360° potentiometers of total resistance of 100 Ω and 1000 Ω. (4 Marks)

11. In an NMOS transistor W/L = 20 and μCOX = 100 $\mu A/V^2$ and V_t = 0.5 V. Find the value of V_{GS} required to operate the device as a 1 kΩ resistor at small V_{DS} operation. (6 Marks)

12. In a typical constant field CMOS scaling process, the channel dimension is scaled by $\frac{1}{2}$ and the oxide thickness and supply voltage are scaled by $\frac{1}{3}$.

Find the scaling in (6 Marks)

i) Gate area

ii) Gate capacitance

iii) Carrier density in the channel.

13. An input discrete time signal x[n] = $\delta[n]$ + 2u[n – 1] – u[n – 4] – u[n – 5] is applied to an LTI system with impulse response $h[n] = \left\{ \frac{1}{2}, \frac{-1}{2} \right\}$. Determine the output of the system. Also comment on the fact whether the impulse response corresponds to a low pass filter system or a high pass filter system with mathematical explanation. (5 Marks)

14. Design a summing amplifier with voltage gain of 10 using standard Op-amp to add two voltages. The input impedance should be 100 kΩ. Find the input currents and output voltage when the input voltages are 1V and –2V. (6 Marks)

15. For an N-bit adder, G_i (Carry Generate) and P_i (Carry Propagate) are expressed as follows : (6 Marks)

$P_i = A_i \oplus B_i$

$G_i = A_i B_i$

Give the generalized expression for output carry C_{i+1}. If carry C_2 is computed as a function of P, G, C_0 which is independent of another internal carries, then find the number of 'AND' gates required for C_2 computation.

16. a) Explain the hardware mechanism provided in 8051 microcontroller to handle external interrupts with the status of relevant SFRs. (3 Marks)

    b) Write an assembly language program to do the conversion of hexadecimal numbers to BCD numbers using a subroutine for 8051 microcontroller. (3 Marks)

17. Briefly explain inconsistency of Ampere's circuital law and how Maxwell modified it. (6 Marks)

18. A 1.5 MHz information signal with a dynamic range of 64 mW is sampled, quantized and encoded using a direct binary code. The quantization is linear with 512 levels. Determine maximum possible bit deviation and amplitude of one quantization level. (6 Marks)

19. Reduce the system shown in below Fig. 19 to a single transfer function.   (6 Marks)
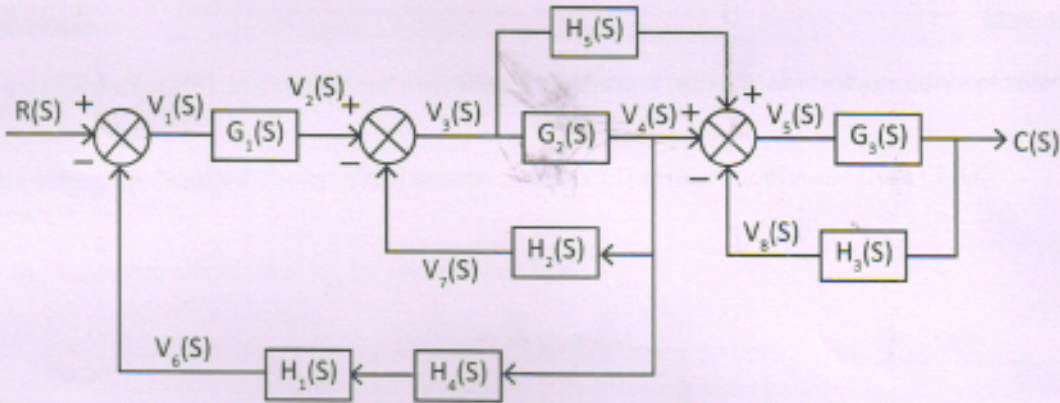

Fig. 19

20. A piezoelectric transducer has a capacitance of 1000 pF and a charge sensitivity of
    4×10^{-6} coulombs/cm.   (6 Marks)

    The connecting cable has a capacitance of 400 pF. The display device has an input impedance
    of 1 MΩ resistance and 50 pF capacitance connected in parallel.

    i) What is the voltage sensitivity of the piezoelectric transducer alone ?

    ii) What is the high frequency sensitivity in V/cm of the entire system ?

    iii) What is the lowest frequency that can be measured with 2% error ?

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