Roll Number: _____

HPAS Etc. Combined Competitive (Main) Examination, 2019

Electrical Engineering-II

Time Allowed: 3 Hours   Maximum Marks: 100

Note:

1. This question paper contains total eight questions. *Attempt five questions taking at least one from each part, but Question No.1 is compulsory.*
2. Each question carries equal marks. Marks are divided and indicated against each part of the question. Write answer in legible handwriting. Each part of the question must be answered in sequence and in the same continuation.
3. Attempts of questions shall be counted in sequential order. Unless struck off, attempt of question shall be counted even if attempted partly. Any page or portion of the page left blank in answer book must be clearly struck off.
4. *Re-evaluation / Re-checking of answer book is not allowed.*

Part A

1. (a) Find the time response, initial value and final values of the following transfer function   (10)

$$F(s) = \frac{12\,(S+1)}{S\,(S+3)(S+2)(S+2)}$$

    (b) Semiconductor Ge has a band gap of 0.67 eV with intrinsic carrier concentration $n_i = 2\times10^{13}$ cm^{-3} at 300 K. What dopant type and concentration would shift the Fermi level 0.2 eV above the intrinsic Fermi level.   (10)

2. (a) For the system shown in Fig. 2.1, determine the value of k_t so that the value of damping ratio ζ becomes = 0.5. Calculate the corresponding values of peak overshoot M_p, peak time t_p, damped natural frequency ω_d and setteling time t_s.

                                                                                                                     (10)
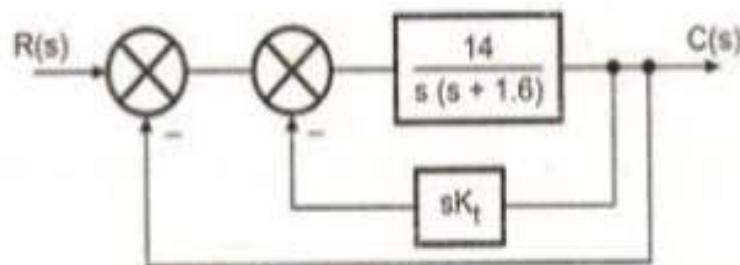

Fig. 2.1

(b) Sketch the Nyquist plot and determine therefrom the stability of the system whose open loop transfer function with unity feedback is

$$GH(s) = \frac{S + 0.25}{(S + 1)(S^2)(S + 0.5)}$$

(10)

Part B

3. (a) Draw a block diagram showing a DMA Controller operate in a microcomputer. Also explain why DMA data transfer is faster than doing the same data transfer with program instructions? (10)

(b) Explain the *Lithography Technique* and *Ion implantation Technique* used in fabricating the MOS circuits. (10)

4. (a) Describe with suitable diagram the working principle of strain gauges. Also, define the terms Poission's ratio and gauge factor. (10)

(b) Derive the general expression for balance in ac bridges. Show that both magnitude and phase conditions to be satisfied for balancing an ac bridge. (10)

Part C

5. (a) What is meant by Natural loading of transmission lines? Explain with reasons whether the economic loading for (i) overhead and (ii) underground cables are more / less than their natural loadings. (10)

(b) A string of eight suspension insulators is to be fitted with grading ring. If the pin to earth capacitances are equal to C, find the values of line to pin capacitances that would give a uniform voltage distribution over the string. (10)

6. (a) What is meant by percent bias? How is this achieved in practice in a differential relay? Under what circumstances is a percentage differential initial relay preferred over the differential relay? (10)

(b) Draw the block diagram & explain in brief the function of each blocks of
(i) Wind energy system
(ii) Solar photovoltaic system (10)

7. (a) What is the difference between a geosynchronous and a geostationary satellite? Calculate the slant range of a geostationary satellite orbiting at 42200 Km from an earth station making an elevation angle of 25^0. Also, find the view angle of the satellite. (10)

(b) What is the principle of CRC? Why it is better than parity check codes? In a digital transmission using CRC, the received code is 10011100 and the CRC generated is 1010. Find out whether the received code has an error or not. (10)

7. (a) Explain the basic principle of DPCM and what is the need for adaptive DPCM?
A PCM system uses a uniform quantizer followed by a 7-bit binary encoder. The bit rate of the system is equal to 50×10^6 bits/sec. Find

(i) What is the maximum message signal bandwidth for which the system operates satisfactorily?

(ii) Calculate the output signal – to - quantization noise ratio when a full – load sinusoidal modulating wave of frequency 1 Mhz is applied to the input.

(10)

(b) Explain the difference between WDM and OFDM systems. (10)
Nyquist pulses are used in a single – polarization system based on QAM-64. The symbol rate is 10Gsym/s and the number of channels is 12. Calculate

(i) the channel spacing to have a spectral efficiency of 6 b/s / Hz,

(ii) the signal bandwidth in a channel and the total bandwidth of the WDM signal

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