

## ELECTRICAL ENGINEERING - II (Optional)

Standard : Degree

Total Marks : 200

Nature : Conventional

Duration : 3 Hours

## Note :

- (i) Answers must be written in **English**.
- (ii) Question No. 1 is **Compulsory**. Of the remaining questions, attempt **any four** selecting one question from **each section**.
- (iii) Figures to the **RIGHT** indicate marks of the respective question.
- (iv) Use of log table, Non-Programmable calculator is permitted, but any other Table/Code/Reference book are not permitted.
- (v) Make suitable assumptions, wherever be necessary and state the same.
- (vi) Number of optional questions upto the prescribed number in the order in which they have been solved will only be assessed. Excess answers will not be assessed.
- (vii) Credit will be given for orderly, concise and effective writing.
- (viii) Candidate should not write roll number, any name (including their own), signature, address or any indication of their identity anywhere inside the answer book otherwise he/she will be penalised.

1. Answer **any four** of the following (10 Marks each) : 40
- (a) Explain working of single phase fully controlled converter supplying R-L-E load. 10
  - (b) What is delta modulation technique ? Explain with the help of typical block diagram of delta modulation system. 10
  - (c) Find the fourier transform of function  $x(t) = \delta(t)$  and sketch it's magnitude and phase spectrum. 10
  - (d) Enlist advantages of variable speed wind generation scheme and fixed speed wind generation scheme. 10
  - (e) Calculate the internal rate of return for the following cash flows of a project. 10

Year	0	1	2	3	4
Cash flow	(-100000)	30000	30000	40000	45000

## SECTION - A

2. Answer the following sub-questions :
- (a) (i) Draw various characteristics of Power MOSFET. 5
  - (ii) Write a code in 8085 for generation of time delay by using register pair. 5

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- (b) State types of choppers and explain four quadrant chopper. Marks  
15
- (c) Write an assembly language program for 8051 to arrange the given '8', 8 bit numbers in ascending order. 15
3. Answer the following sub-questions :
- (a) (i) A single phase full bridge diode rectifier is supplied from 230 V, 50 Hz source. The load consists of  $R=10\ \Omega$  and a large inductance so as to render the load current. Determine. 5
- (A) Average value of output voltage and current.
- (B) Average and rms values of diode currents.
- (ii) Give the details of Program status word of 8085. 5
- (b) A single phase half bridge inverter has load  $R=2\ \Omega$  and dc source voltage  $V_s/2=115\text{ V}$ . 15
- (i) Sketch the waveforms for  $v_o$ ,  $i_{o1}$  current through thyristor 1 and diode 1 only fundamental is to be considered.
- (ii) Find power delivered to load due to fundamental current.
- (c) Explain various modes by which memory or data byte can be addressed/laccessed in micro-controller. Give suitable examples. 15

#### SECTION - B

4. Answer the following sub-questions :
- (a) With the help of wave-forms and circuit diagrams using IC 555 explain 15
- (i) PWM and
- (ii) PPM modulator
- (b) State the requirements of materials for optical fibers. Also explain schematic of a Fiber drawing apparatus. 15
- (c) In connection with point-to-point fiber links, explain basic system requirements of the system. Also state to fulfill these above requirements, the choice of the components and their associated characteristics. 10
5. Answer the following sub-questions :
- (a) Define the term Modulation Index. A carrier wave with an RMS voltage of 2 V and a frequency of 1.5 MHz is modulated by a sine wave with a frequency of 500 Hz and an amplitude of 1 V rms. 15
- (i) Write the equation for the resulting signal.
- (ii) Determine modulation index
- (iii) Write the equation for the resulting signal in terms of modulation index.

Marks

- (b) State and explain the various advantages of optical fibers as compared to copper wire. 15

Also explain following terms :

- (i) Channel capacity.  
(ii) Refractive Index.

Find the channel capacity which operates between 3 MHz and 4 MHz and in which the signal to noise ratio is 20 dB.

- (c) What is specialty fibers ? State and explain three examples of specialty fibers and their examples. 10

### SECTION - C

6. Answer the following sub-questions :

- (a) Find the convolution of two sequences  $x_1(n) = \{1, \underset{\uparrow}{-1}, 2, 3\}$  and 10

$$x_2(n) = \{1, -2, 3, -1\}$$

$\uparrow$

[Note : Use matrix or tabular convolution method]

- (b) Find the natural response of the system described by difference equation : 10

$$y(n) - 1.5y(n-1) + 0.5y(n-2) = x(n)$$

Given  $y(-1) = 1$  and  $y(-2) = 0$ .

- (c) State and explain various (three) quantization error due to finite word length registers in digital filter. 10

- (d) Find out the output  $y(n)$  of a filter whose impulse response is 10  
 $h(n) = \{1, 1, 1\}$  and input signal  $x(n) = \{3, -1, 0, 1, 3, 2, 0, 1, 2, 1\}$  using overlap save method.

7. (a) Determine whether the following continuous time systems are time invariant or not : 10

(i)  $y(t) = t x(t)$

(ii)  $y(t) = x(t^2)$

- (b) A continuous LTI system is specified by differential equation 10

$$\frac{d^2 y(t)}{dt^2} + 5 \frac{dy(t)}{dt} + 6y(t) = \frac{dx(t)}{dt} + 4x(t) \text{ where } x(t) = e^{-t} u(t)$$

Find natural response for incondition  $y(0^+) = 3$  and  $\frac{dy(0^+)}{dt} = 0$ .

P.T.O.

- (c) Design an FIR filter approximating the ideal response 10
- $$H_d(e^{jw}) = e^{-j\alpha w} \quad \text{for } |w| \leq \pi/6$$
- $$= 0 \quad \text{for } \pi/6 \leq w \leq \pi$$
- Determine the filter coefficient for  $N=13$ .
- (d) Why FFT is needed ? Compute the eight - point DFT of the sequence 10
- $$x(n) = \{0.5, 0.5, 0.5, 0.5, 0, 0, 0, 0\}$$
- using the inplace radix - 2 DFT algorithm.

## SECTION - D

8. Answer the following sub-questions :
- (a) Explain major factors influencing the electrical design of solar array. 15
- (b) Obtain flux linkage model of a synchronous generator. 15
- (c) A generator is transferring power to a load through a short line. The power angle equation is  $P = P_m \sin \delta$ . The initial power is  $P_{ipu}$  when a 3 phase fault occurs at the terminals of generator. Find critical clearing angle and critical clearing time if  $P_m = 2 \text{ pu}$ ,  $P_i = 1 \text{ pu}$ ,  $H = 6 \text{ MJ/MVA}$  and frequency 50 Hz. 10
9. Answer the following sub-questions :
- (a) Explain grid connected wind power system. Also explain brief factors considered in interfacing of wind generators into grid. 15
- (b) What are power system stabilisers ? Explain effects of power system stabilisers. 15
- (c) A synchronous generator of reactances 1.2 pu is connected to an infinite bus bar through transformer and a line of total reactance of 0.6 pu. The generator no load voltage is 1.2 pu and its inertia constant is  $H = 4 \text{ MJ/MVA}$ . The resistance and machine damping may be assumed negligible. The system frequency is 50 Hz. 10
- Calculate the frequency of natural oscillations if the generator is loaded
- (i) 50% and
- (ii) 80% of its maximum power limit.

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