



Total No. of Printed Pages – 4

AEUD
ELECTRICAL ENGINEERING
PAPER – II
SUBJECT CODE : 13

Full Marks : 200

Time : 3 Hours

Instructions For Candidates :

Please read each of the following instructions carefully before attempting questions.

- (1) *Answers must be written in **ENGLISH** only.*
- (2) *The question paper contains a total of 8 questions in **TWO** Sections : Section-A and Section-B. (**FOUR** questions in each section)*
- (3) *Question No. 1 of Section 'A' and Question No. 5 of Section 'B' are compulsory.*
- (4) *Candidates have to attempt another **THREE** questions from remaining **SIX** questions choosing atleast **ONE** question from each section.*
- (5) *Assume suitable data if found necessary.*
- (6) *Wherever any assumption be made for answering a question, they must be clearly indicated.*
- (7) *Marks carried by a question / section is indicated against it.*
- (8) *Unless struck off, attempt of question shall be counted even if attempted partly.*
- (9) *Any page or portion of the page left blank in the Answer Booklet must be clearly struck off.*

SECTION – A

Marks

5 × 8 = 40

- | | | | |
|----|-------|---|---|
| 1. | (i) | Derive the expression for saving in copper for an autotransformer as compared to a conventional two winding transformer. | 8 |
| | (ii) | A 2-pole, 50-MVA, 11 KV generator is supplying full load power at 0.8 p.f. lagging. If the inertia constant of the moving part of the generator is 6 MJ/MVA, calculate the energy stored when the generator is running at the synchronous speed of 3000 rpm. If the net input of the generator is suddenly increased to 62000 metric HP, calculate the acceleration produced. | 8 |
| | (iii) | Explain Impulse function and impulse response function. | 8 |
| | (iv) | Briefly discuss the Full – Adder with its truth table and logic diagram. | 8 |



- (v) Calculate the signal energy for the given signal. Also calculate the signal power. 8

$$x(t) = e^{-4t} \cdot u(t)$$

$$\text{Where } u(t) = \begin{cases} 1 & \text{for } t > 0 \\ 0 & \text{for } t < 0 \end{cases}$$

2. (a) Discuss the applications of different types of D.C. motor with the field of speed v/s armature current and torque v/s armature current characteristics. 20
- (b) A 1500 KVA, 6.6 KV, 3- ϕ star connected alternator has effective armature resistance of 0.5 Ω /phase and synchronous reactance of 5 Ω /phase. Find the percentage change in terminal voltage at
- unity p.f.
 - 0.8 lagging p.f.
 - 0.8 leading p.f.
- The speed and excitation current remains unchanged. 20

3. (a) Explain the different factors for the site selection of Hydro-power plant. Also draw and explain its layout. 20
- (b) For the system shown in figure 1, where a 3-f fault occurs at point P. 20

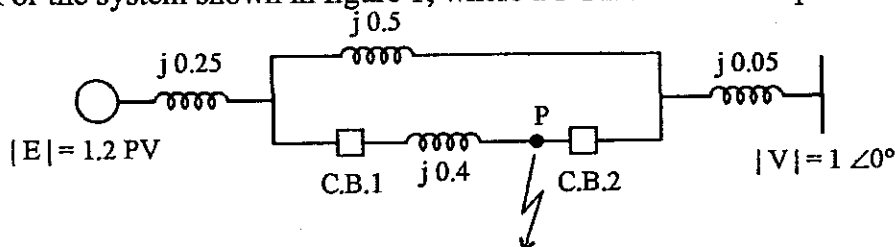


Figure – 1

Find the critical clearing angle for clearing the fault with simultaneous opening of the breaker 1 and breaker 2. The reactance value of various components are indicated in the figure 1. The generator is delivering 1.0 PU power at the instant preceding the fault.

4. (a) For the load – frequency control of a single area system ; derive the speed governing system model, turbine model and generator load model. Also draw its complete block diagram. 20
- (b) A 440 V, 6-pole, 50 Hz, 3-phase delta connected induction motor running on full load develops a useful torque of 160 Nm when the rotor emf makes 120 complete cycle / min. Determine the shaft power output. If the mechanical torque lost in friction and core loss is 10 Nm, estimate :
- Copper loss in rotor windings
 - Input to the motor
 - Efficiency
- The total stator loss is 1 KW. 20



SECTION – B

5. (i) Draw and explain the torque speed characteristics of a single phase induction motor based on revolving field theory. 8
- (ii) In a power system the full input per-hour of plants 1 and 2 are given as :
 $F_1 = 0.20 P_1^2 + 30P_1 + 100$ ₹ per hour
 $F_2 = 0.25 P_2^2 + 40P_2 + 150$ ₹ per hour
 The limits of generator are
 $20 \leq P_1 \leq 80$ MW
 $40 \leq P_2 \leq 200$ MW
 Find the economic operating schedule of generation, if the load demand is 130 MW. Neglect transmission losses. 8
- (iii) Discuss the co-relations between time domain and frequency domain parameters. 8
- (iv) An AM broadcast station transmits a total power of 50 KW when the carrier is modulated by a sinusoidal signal with a modulation index of 0.707, calculate :
 (a) the carrier power
 (b) the transmission efficiency, and
 (c) the peak amplitude of the carrier assuming the antenna to be represented by a $(50 + j0) \Omega$ load. 8
- (v) Realize AND, OR, NOT logic gates, using universal gates. 8
6. (a) Discuss the advantages and drawbacks of closed loop control system. 6
- (b) Derive the unit step response of a standard 2nd order system for underdamped case and discuss it. 14
- (c) Obtain the time response of the system described by the state equation and output equation as
 $\dot{X}(t) = \begin{bmatrix} -1 & 1 \\ 0 & -2 \end{bmatrix} X(t) + \begin{bmatrix} 0 \\ 1 \end{bmatrix} u(t)$
 and $y(t) = [1 \ 0] X(t)$
 with $x(0) = \begin{bmatrix} -1 \\ 0 \end{bmatrix}$ and $u(t) = 1$ for $t > 0$ 20
7. (a) Derive expression for the signal $v_3(t)$ in the figure 2 given below for $v_1(t) = 10 \cos(2000 \pi t) + 4 \sin(200 \pi t)$. Assume that $v_2(t) = v_1(t) + 0.1 v_1^2(t)$ and that the BPF is an ideal unity gain filter with pass band from 800 Hz to 1200 Hz. 20

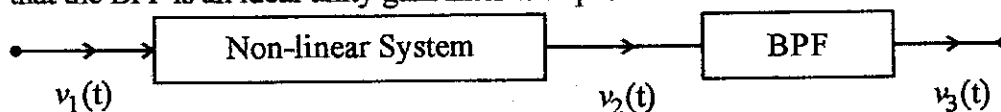


Figure – 2



- (b) For a system the impulse response $h(t)$ is given as

$$h(t) = e^{-t} u(t) + e^{2t} u(-t)$$

The system is excited by

$$x(t) = e^{-2t} u(t)$$

Find the output $y(t)$ for this system.

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8. (a) Minimize the combinational logic circuit as shown in figure 3.

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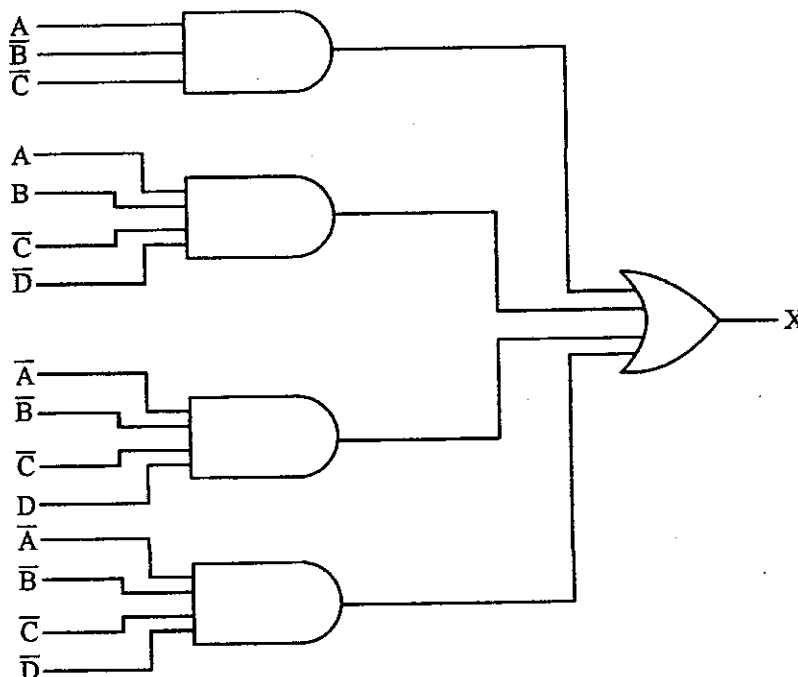


Figure – 3

- (b) Design a counter with the irregular binary count sequence shown in the state diagram of figure 4 using J-K flip – flop.

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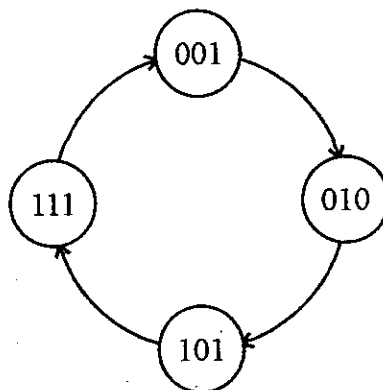


Figure – 4