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CS/M.TECH(EE)/SEM-1/PSM-103/2012-13

2012

POWER SYSTEM PLANNING & RELIABILITY

Time Allotted : 3 Hours *Full Marks* : 70

The figures in the margin indicate full marks.

Candidates are required to give their answers in their own words as far as practicable.

Answer any *five* questions. 5 × 14 = 70

1. What are the necessity of load forecasting ? How many types of load forecasting ? Discuss the various load forecasting methods and models of these types.

2. a) Discuss about the probabilistic generating unit models.

   b) Find the mathematical description of discrete state continuous transition Markov process. 6 + 8

3. a) Define the following reliability indices :

   i) SAIFI ii) CAIFI

   iii) SAIDI iv) CAIDI

   v) ASAI vi) MAIFI

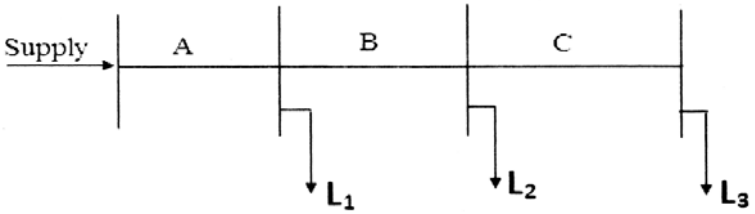
   vii) AENS.

b) With the help of the data as given in the Table-1 related to the figure, find the following indices :

i) SAIFI ii) SAIDI

iii) CAIDI iv) ASAI

v) AENS.



Simple three load point radial system

Table : 1

Load point	$\lambda_{i\,(f/yr)}$	$U_{i\,(Hr/Yr)}$	N_i (No. of customer)	L_i (Average load demand)
L_1	0·2	1·2	200	1000
L_2	0·3	1·7	150	700
L_3	0·45	2·9	100	400

4. a) Draw the four-state model of power system considering one reserve shut down unit. Explain the interrelation between the stages mathematically.

b) In a four-state model of a power system average unit Data are as follows :

Service Time = 640·73 Hrs, Available Time = 6403·54 Hrs, No. of Start = 38, No. of outages = 4, Force out time = 205·03 Hrs. Consider the probability of starting failure (Ps) is zero.

i) Find the conventional force outage rate

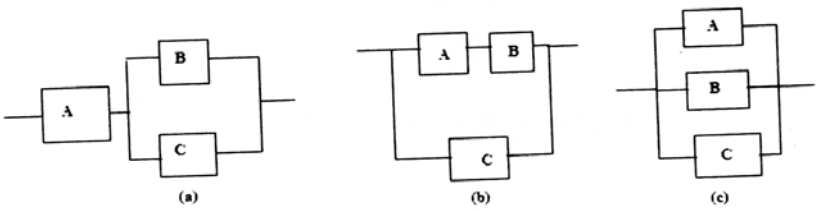
ii) Conditional probability. 7 + 7

5. a) Discuss the system reliability model, when

   i) Components are connected in series

   ii) Components are connected in parallel and also compare are these model with Non series parallel system.

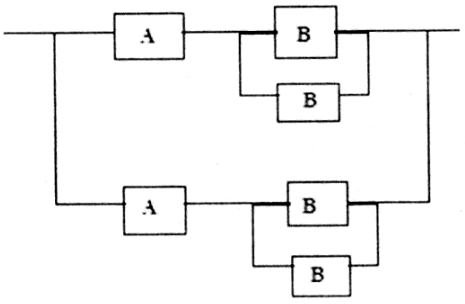
   b) Estimate the reliability and MTTF of the system in figure below, assuming that the subsystems are identical with $Z(t) = \lambda$.



6. a) i) Explain how component redundancy yields higher reliability then unit redundancy.

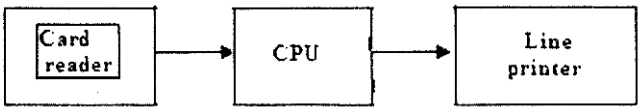
   ii) Discuss Weakest-link technique for the evaluation of redundancy of a system.

   b) i) Prove that the reliability of the system is $R = 1 - [1 - P_a P_b (2 - P_b)]^2$.



ii) A computer system has 3 units as shown in the figure below. Their reliabilities are as follows :

Card reader = 0·98, Central Processing Unit (CPU) = 0·98, Line printer = 0·85.



Determine the system reliability. If you want the system reliability to be not less than 0·95, what step would you take ? Draw the improved system diagram and calculate its Actual reliability. 7 + 7

7. a) What is a logic diagram ? Explain the difference between a tie-set logic diagram and cut-set logic diagram. Which method will you prefer to evaluate the reliability of a 2-out-of-5 : *G* system when the units are not identical. Why ?

b) The following 3 units are in operating in parallel in reliability sence.

Unit	Failure/o	Repair rate/h
A	0·004	0·1
B	0·005	0·15
C	0·003	0·06

If the system is operating as a one-out-of three parallel system determine

i) System reliability

ii) Frequency of system failure

iii) Mean down time

iv) Mean up time. 7 + 7

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