

**BIRLA INSTITUTE OF TECHNOLOGY, MESRA, RANCHI  
(END SEMESTER EXAMINATION)**

CLASS: M.TECH  
BRANCH: EE

SEMESTER : II  
SESSION : SP/22

**SUBJECT: EE 631 POWER SYSTEM RELIABILITY EVALUATION**

TIME: 2 Hrs

FULL MARKS: 50

**INSTRUCTIONS:**

1. The question paper contains 5 questions each of 10 marks and total 50 marks.
2. Attempt all questions.
3. The missing data, if any, may be assumed suitably.
4. Before attempting the question paper, be sure that you have got the correct question paper.
5. Tables/Data hand book/Graph paper etc. to be supplied to the candidates in the examination hall.

Q.1(a) Evaluate reliability in terms of mean time to failure. [5]

Q.1(b) A hard plastic box designed to house a multi-meter is tested for its impact strength by dropping it from a fixed height and observing for any damage. A total of 500 boxes were tested and the results are tabulated as: [5]

No. of drops:	10	12	13	15	17	20	21	23	25
No. of boxes damaged:	30	50	30	110	90	130	17	35	8

Obtain failure density, hazard rate and reliability?

Q.2(a) Evaluate reliability for complex dependent dissimilar components in a system as in Fig.1. [5]

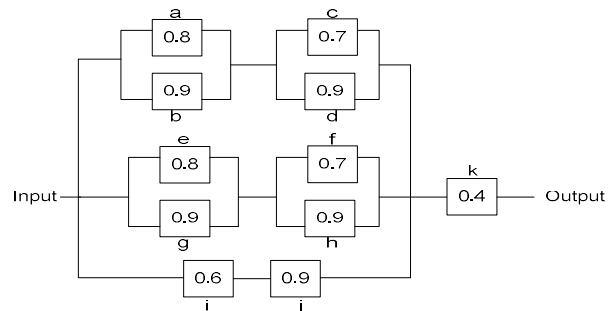


Fig.1

Suggest a suitable design modification to enhance the reliability of the system further

Q.2(b) A system consists of three units connected in series, with reliabilities  $R_1=0.70$ ,  $R_2=0.80$ ,  $R_3=0.90$ . It is desired that the reliability of the system be 0.65. How should this be apportioned among the three units? Determine using minimum-effort method and the general method. [5]

Q.3(a) For the provided system states as in Fig. 2 analyze the limiting state probabilities [5]

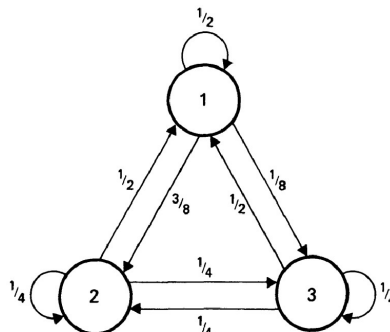


Fig.2

- Q.3(b) Three generating units are operating in parallel: [5]  
2\*3 MW unit with FOR-0.02  
1\*5 MW unit with FOR-0.03  
If another 1\*5 MW unit needs to be added, obtain the COPT using recursive formulation method.
- Q.4(a) Two generating units are operating in parallel. Design to determine the rate of departure, state [5]  
probabilities, frequency of encounters, mean duration of individual states, cycle time between  
individual states.
- Q.4(b) Analyze the different reliability indices for HLI and HL2 of power system network. [5]
- Q.5(a) Design using Markov model and determine the state probabilities of two identical components [5]  
constituting a system. Also analyze its availability and unavailability when these components are  
connected in (i) series, (ii) parallel.
- Q.5(b) Estimate the reliability of a complex system constituting a generator and two parallel transmission [5]  
lines for feeding a load.

:::::25/04/2022:::::