

**FEDERAL UNIVERSITY OF TECHNOLOGY OWERRI**  
**SCHOOL OF ELECTRICAL SYSTEMS ENGINEERING AND TECHNOLOGY**  
**DEPARTMENT OF ELECTRICAL AND ELECTRONIC ENGINEERING**  
**2019/2020 HARMATTAN SEMESTER EXAMINATION**  
**PSE 513: POWER SYSTEM PLANNING, RELIABILITY & ECONOMICS: 3Units**  
**Instruction: Answer Any Five Questions: Time Allowed: 3 hours: Date: 16/02/2021**

- 1(a) Give a three point objective justification for need of planning in power system. (6marks)  
(b) Outline three methods that may be deployed in carrying out long term load forecast. (6marks)  
(c). Using an appropriate model, discuss the concept and applicability of load driving parameters in the development of improved deregulated power industry in Nigeria (8marks)
- 2(a). Explain the five major activities involved in power system planning and present a generalized interrelationship between them (10marks)  
(b). (i) State ten power system planning tools and/or software packages you have studied. (5marks)  
(ii) Explain specifically how you can implement one tool/package in each of the five activities. (5marks)
- 3(a) Perform a two point characteristic comparison between single and multi-bus generation expansion planning. (4marks)  
(b) From 1<sup>st</sup> principal develop the generalized single-bus expansion planning model which encompasses the objective functions and constraints. (7marks)  
(c) Using appropriate one-line diagrams, explain the three major types of substation layouts you studied; and discuss a critical condition that will necessitate your presenting each to your client as a must use plan (9marks).
- 4(a) Explain the concept of power system deregulation and state two essential distinguishing characteristics features from regulated system. (4marks)  
(b)(i) Discuss three major weaknesses in Nigeria's implementation processes of deregulation and privatization. (3marks)  
b(ii) Recommend appropriate remedial actions which Nigerian Electricity Regulation Commission can adopt to resolve each of these identified problems in 4b(i). (3marks)  
(c)(i) Design an appropriate distribution system configuration with five Cummins generator rated 600Volts, 2000AF/2000AT that will be used to supplying power to the proposed Owerri industrial layout with seven feeder breakers rated 800Amp on a bus of 1.2kV, 60Hz and 5000A given no space restriction. (6marks)  
(c(ii)) Explain the use of any four major components that are critical to make your design reliable. (4marks)
- 5(a) Explain the term failure rate as applied in power system reliability. (5marks)  
(b) An organization has a power plant distributing energy to its clients. The plant was designed to generate and distribute at its installed capacity, but unfortunately in real time what the company is experiencing is not in optimal level. As a student of reliability engineering, discuss the necessary factors that you could advice the management to look inward to in order to attain optimal reliance. (15marks)
- 6(a) RAM relation could be used to measure the field performance of equipment supplied by different firms. Explain how the relationships can enhance the reliability of an electric utility or distribution system. (12marks)  
(c) Describe any two ways reliability could be aided to achieve optimum desire. (8marks)
7. Probability of non-failure in the interval of  $0 - t$  is the reliability  $R(t)$ . The probability of failure in the above interval is the unreliability  $Q(t)$ . Show with necessary equations, how time relate with probability density function. (12marks)