13.801

ELECTRICAL SYSTEM DESIGN (E)
(MODEL QUESTION-A)

Time: Three Hours Maximum: 100 marks

*(Answer **all** questions from Part A and any **four** questions from Part B)*
(Approved data manual as per syllabus to be permitted)

PART A

1. Explain the importance of building services in the design of electrical systems.
2. What are the design aspects of electrical installation? List two major risk factors to be included in electrical system design.
3. What are the standard voltages for three phase AC systems? List also the permissible voltage tolerance.
4. Distinguish between MCB, MCCB and ELCB.
5. Describe briefly the methods available for conservation of energy in electric lighting
6. Describe how industries are classified from the point of view of connected load.
7. A medium industry has a single large motor rated at 7.5 kW, 415V, 3 phase, and squirrel cage type. Suggest a suitable cable size and the control gear with back up fuse for installing the motor 3m away from the switch board. Draw the schematic diagram
8. What are the deciding factors that fix the starting methods for induction motors?
9. What are the commonly used light sources for external lighting? List them in the order of increasing lumen output per watt.
10. What are the different forms of exterior lighting? Briefly explain

(10 × 2 = 20 marks)

PART B

(Assume any suitable data that is missing)

(Module I)

11 a) Discuss the role of NEC 2011 in Electrical systems design (10)
b) What are the salient features of Indian Electricity Act 2003? (10)

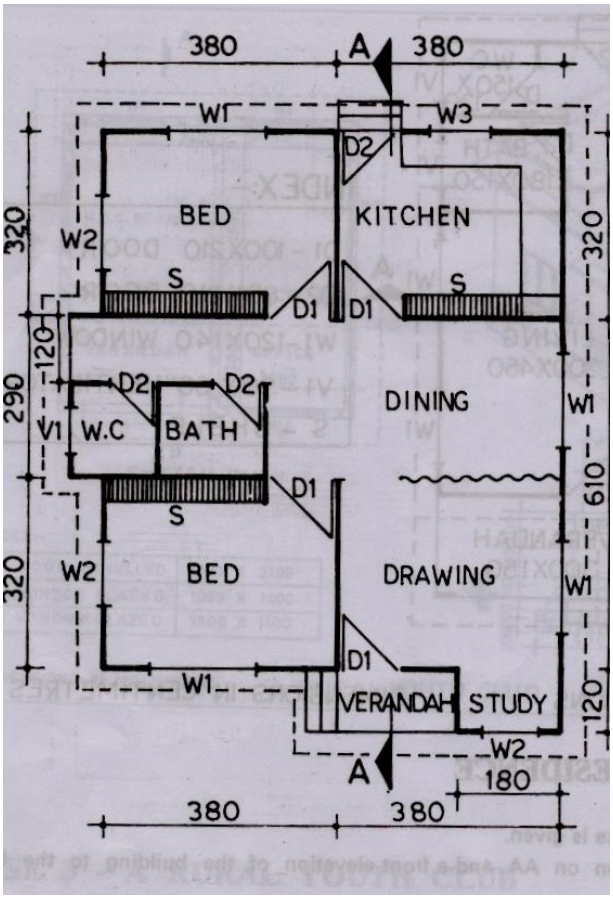
OR

12 a) Explain the safety features to be included in electrical systems design (10)
b) Write a note on Indian Electricity Rules 1956. (10)

(Module II)

13 The plan layout of a two bed room domestic building is shown below. Prepare the electrical installation plan showing the positions of light, fan, socket points etc and compute the following:

1 Connected load of the building
2 Maximum demand in kW
3 Type of supply required
4 Number of light and power circuits and
5 The details of the distribution board.



OR

14 a) A residential building has the following loads. Design the electrical system for the building and draw the single line schematic diagram. (8)

Number of light points	36
Number of power points	6
Room airconditioners-1T each	2

Also, determine:

1 Connected load of the building and Maximum demand
2 Number of Light and Power circuits
3 Type of power supply required
4 Specification of the distribution board (4x3=12)

(Module III)

15 An industry has the following connected loads.

- 37kW, 415V,3 phase Squirrel cage motor 1No
- 15kW,415V,3 phase Squirrel cage motor 2Nos
- 3.7kW, 415V, 3 phase Induction Motor 6Nos
- 0.735W,240V, 1 phase Induction motor 6Nos
- Lighting load 10kW

1 Draw the schematic diagram of the electrical instillation with details of starting devices

2 Determine the size of the transformer with specifications to be used

3 Determine the sizes of the incoming and outgoing feeders of the switch board(MSB) and the associated switchgears. (Assume an outdoor substation). (20)

OR

16 a) Discuss the various factors that are to be considered while selecting a motor drive for a machine? (10)

b) A 22 kW (30HP) ,415 V, three phase squirrel cage induction motor is started against full load using a direct on line starter with rated voltage applied from a source whose impedance including the impedance of the cables is 0.01+j 0.025 ohm per phase. Assuming a blocked rotor power factor of 0.4 lagging and a blocked rotor kVA per HP of 6, calculate the voltage drop during starting using a) constant impedance model and b) constant current model. (10)

(Module IV)

17 An industry is fed by an 11kV over head line from a substation 3 km away from the industry. The industry has a transformer of 500 kVA, 11kV/433V, 4% reactance, delta/star connected. The line reactance is 0.20 ohms per kilometer. If the three phase fault level at the substation is 350 MVA, design the earthing system for the transformer yard at the industry. (The soil resistivity may be taken as 90 ohm-metre). (20)

OR

18 a) A parking area measuring 135m in length and 90 m in width is to be provided with area lighting. The specifications given are

- Illumination required =10 lux
- Mounting height restriction =10m
- Lamps per pole =2
- The available lamp details are

Details	HPSV	LPSV
CU	**0.60**	**0.55**
LLF	**0.75**	**0.9**

Determine the layout of the lighting scheme with the wattage of lamps required. (10)

b) A high way is to be provided with street lighting. The specifications for the work are given below.

- Width of the high way =12 m
- Illumination required =15 lux
- Mounting height of lamps =10 m
- Spacing to mounting height ratio 3 to 5

The details of the lamps available are given

Details	**HPSV**	**LPSV**
CU	**0.65**	**0.5**
LLF	**0.7**	**0.9**

Determine the spacing and the wattage of the lamps for the lighting scheme. Which alternative will you suggest from the point of view of energy conservation? (10)

(20 × 4 = 80 marks)