

Code No: 114AD

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD

B.Tech II Year II Semester Examinations, May - 2015

**POWER SYSTEMS-I**

(Electrical and Electronics Engineering)

Time: 3 Hours

Max. Marks: 75

**Note:** This question paper contains two parts A and B.

Part A is compulsory which carries 25 marks. Answer all questions in Part A.

Part B consists of 5 Units. Answer any one full question from each unit.

Each question carries 10 marks and may have a, b, c as sub questions.

**Part- A****(25 Marks)**

- 1.a) What is a gas turbine plant? [2M]
- b) List the properties of control rods. [3M]
- c) What are the requirements of a distribution system? [2M]
- d) What is the importance of load power factors in a.c. distribution? [3M]
- e) What is a transformer sub-station? [2M]
- f) What is the need of a sub-station in the power systems? [3M]
- g) Why is unity power factor not the most economical power factor? [2M]
- h) Tap-changing is generally performed on load. Why? [3M]
- i) Why is tariff for power load less than the lighting load? [2M]
- j) The values of demand factor and load factor are always less than one. Why? [3M]

**Part-B****(50 Marks)**

- 2.a) Explain the function of feed water heater and air pre-heater.
- b) Calculate the average power in kW that can be generated in a hydro-electric project from the following data:  
Catchment area =  $5 \times 10^6 \text{ m}^2$ ; Mean head,  $H = 40 \text{ m}$   
Annual rainfall,  $F = 1.35 \text{ m}$ ; Yield factor,  $K = 80 \%$   
Overall efficiency = 75%.  
If the load factor is 50%, what is the rating of generators installed? [4+6]

**OR**

- 3.a) Explain with neat diagram various parts and its function in nuclear power plant.
- b) The overall efficiency of a 100 MW thermal power station is 30%. If the load factor of the station is 40% and the coal consumption is 0.9 kg/kWh, find the annual coal bill if the cost is Rs. 50 per tonne. [6+4]
- 4.a) Write short notes on the following:
  - i) Difference between d.c. and a.c. distribution.
  - ii) Current distribution in a 3-wire d.c. system.
- b) In a 500/250 V d.c. 3-wire system, there is a current of 1200 A on the positive side and 1000 A on the negative side and a motor load of 200kW across the outers. The loss in each balancer machine is 5kW. Calculate load on each balancer machine. [4+6]

**OR**

5. A 3-phase, 4-wire system supplies power at 400V and lighting at 230 V. If the lamps are used require 70, 85 and 44 amperes in each of the three lines, what should be the current in the neutral wire? If a 3-phase motor is now started, taking 220 A from the lines at a p.f. of 0.3 lagging, what should be the total current in each line and neutral wire? Find also the total power supplied to the lamps and the motor. [10]

- 6.a) Make a list of the main equipment in a sub-station. Draw layout of a sub- station.  
b) Draw the key diagram of a typical 11kV/ 400V indoor substation. [5+5]

**OR**

7.a) What are the different types of bus-bar arrangements used in sub-stations? Illustrate our answer with suitable diagrams.

- b) Draw the key diagram of a typical 66kV/ 11kV substation. [5+5]

8.a) Derive an expression for the most economical value of power factor which may be attained by a consumer.

- b) A 12500 kVA load is supplied at a power factor of 0.8 lagging by a 3-phase transmission line whose voltage is to be maintained at 33kV at both ends. Determine the capacity of the synchronous condenser to be installed at the receiving end. The impedance of the line is  $(3+j12) \Omega$  per phase. [4+6]

**OR**

9.a) Describe the off-load tap changing transformer method of voltage control. What are the limitations of the method?

- b) A synchronous motor improves the power factor of a load of 200 kW from 0.8 lagging to 0.9 lagging. Simultaneously the motor carries a load of 80kW. Find  
i) the leading kVAR taken by the motor  
ii) kVA rating of the motor and  
iii) power factor at which the motor operates. [5+5]

10.a) Describe different types of tariff commonly used in practice.

- b) The equipment in a power station costs Rs 15,50,000 and has a salvage value of Rs 60,000 at the end of 25 years. Determine the depreciated value of the equipment at the end of 20 years on the following methods.  
i) Diminishing value method  
ii) Sinking fund method at 5% compound interest annually. [4+6]

**OR**

11.a) Define and explain the importance of the following terms in generation:

- i) connected load ii) demand factor iii) average load.  
b) Calculate annual bill of a consumer whose maximum demand is 100kW, power factor = 0.8 lagging and load factor = 50%. The tariff used is Rs 75 per of maximum demand plus 20 paise per kWh consumed. [3+7]