Total No. of printed pages = 8

END SEMESTER EXAMINATION – 2019

Semester : 5th

Subject Code : CAI-502

GENERATION, TRANSMISSION AND DISTRIBUTION OF POWER

Full Marks – 70

Time – Three hours

The figures in the margin indicate full marks for the questions.

Instructions :

1. *All* questions of PART – A are compulsory.
2. Answer any *five* questions from PART – B.

PART – A

Marks – 25

1. Fill in the blanks : 1×10=10

   (a) The most commonly used material for insulators of overhead lines is _____.

   (b) In hydroelectric power stations, surge tanks are constructed to protect_____. (Penstocks/generators)

[Turn over

(c) The chances of faults in underground system are _____ as compared to overhead system. (more/less)

(d) The major reason for low lagging power factor of supply system is due to the use of _____ motors. (Induction / DC series)

(e) The unit of real power is _____.

(f) 1 kWh is equivalent to _____ Kcal.

(g) In diesel engine driven power house, the fuel used is _____.

(h) The knowledge of diversity factor helps in determining _____.

(i) In medium transmission lines, effect of _____ is taken into account.

(j) The economic size of conductor is determined by _____ law.

2. Write true or false : 1×10=10

(a) Primary transmission is done by 3-phase, 3-wire AC system.

(b) A diesel power station is generally used as a base load station.

(c) The load factor is the ratio of average load to the maximum demand.

(d) Francis turbine is a reaction turbine.

(e) 1 kWh is equivalent to 360000 J.

(f) In a hydroelectric plant, spillways are used to discharge surplus water on the downstream side of dam.

(g) Thermal power plants are the cleanest plant with low running cost.

(h) The service mains connect the distributor and the consumer's terminal.

(i) Control rods used in a nuclear reactor are made of copper.

(j) The active power loss in an overhead transmission line is mainly due to the ground conductor.

3. Choose the most appropriate option : 1×5=5

(a) Consider the nuclear equation ${}^{235}_{92}U + {}^{1}_{0}n \rightarrow {}^{140}_{54}Xe + {}^{A}_{Z}Sr + 2{}^{1}_{0}n + \text{energy}$. The value of Z and A are

(i) Z = 39, A = 92 (ii) Z = 37, A = 93

(iii) Z = 38, A = 95 (iv) Z = 38, A = 94

(b) Solar and wind power plants are called

(i) Conventional power generating plants

(ii) High efficient power generating plants

(iii) Low efficient power generating plants

(iv) Renewable energy power plants

(c) An electric transformer is a machine

(i) Which changes the voltage and frequency

(ii) Which changes voltage, power and current levels

(iii) Which changes voltage level only keeping power and frequency unchanged

(iv) Which changes current level only keeping voltage, power and frequency unchanged

(d) Which of the following is not the voltage at which power is usually transmitted

(i) 132 kV (ii) 66 kV

(iii) 33 kV (iv) 20 kV

(e) In a star-connected 3-phase system

(i) Line voltages are equal to phase voltages

(ii) Line voltages are equal to neutral voltages

(iii) Magnitude of line voltages are 230V

(iv) Line currents are equal to phase currents.

PART – B

Marks – 45

4. (a) What are the uses of cooling towers in thermal power stations ? 2

(b) Why water treatment is required in thermal power plants ? Briefly explain. 3

(c) A thermal station has the following data :

Maximum demand = 20,000 kW

Load factor = 40%

Boiler efficiency = 85%

Coal consumption = 0.9 kg/kWh

Turbine efficiency = 90%

Cost of 1 ton of coal = Rs. 300

Determine thermal efficiency and coal bill per annum. 4

(1 ton is equivalent to 1000 kg)

5. (a) Write about the following : 3

(i) Feeder

(ii) Distributor

(iii) Service mains

(b) 'Proper voltage, availability of power on demand and reliability are the three essential requirements of a good distribution system'. Briefly explain in your own words. 6

6. (a) What do you mean by load frequency control in power generating stations ? 4

(b) A hydroelectric power station has a reservoir of area 2.4 square kilometers and capacity 5×10^6 m^3. The effective head of water is 100 meters. The penstock, turbine and generation efficiencies are respectively 95%, 90% and 85%. If a load of 15000 kW has been supplied for three hours, find the fall in reservoir level. 5

7. (a) Write three important criteria for the site selection of nuclear power plant. 3

(b) In a nuclear reactor, fission is produced in 1 gm of U-235 (235.0439 amu) in 24 hours by a slow neutron (1.0087 amu). Assuming

that $^{92}_{36}Kr$ (91.8973 amu) and $^{141}_{56}Ba$ (140.9139 amu) are produced in all reactions and no energy is lost. Write the complete reaction and calculate the total energy produced in MeV and in kilowatt-hours. Given 1 amu = 931.5 MeV. 6

8. (a) Define voltage regulation and transmission efficiency in the study of performance of transmission lines. 1½+1½=3

(b) A short 3-phase transmission line with an impedance of (6+j.8)Ω per phase has sending and receiving end voltages of 120 kV and 110 kV respectively for some receiving end load at a p.f. of 0.9 lagging. Determine the power output and sending end power factor. 6

9. (a) What do you mean by power factor improvement ? Draw power triangles for lagging and leading loads. 1+2=3

(b) Write the names of main component of gas turbine plant. 4

(c) What is the function of starting motor in gas turbine plant ? 2

10. (a) Compare the volume of conductor material needed for 3-phase, 3-wire system with two wire DC system with one conductor earthed. 5

(b) What do you mean by base load and peak load power stations ? 2+2=4