Total No. of printed pages = 7

END SEMESTER/RETEST EXAMINATION–2021

Semester : 5th (New/Old)

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 :

(i) *All* questions of PART–A are compulsory.

(ii) Answer any *five* questions from PART–B.

PART – A

Marks – 25

1. Fill in the blanks : 1×10=10

(i) A thermal power plant works on _____ cycle.

(ii) The overall efficiency of a coal-fired power plant is approximately _____ %.

[Turn over

(iii) In nuclear power plant, heat is generated by nuclear _____ reaction of U-235 isotope.

(iv) 1 MeV is equivalent to _____ Joules.

(v) Medium head hydropower plants operate under heads varying from _____.

(vi) The unit of reactive power is _____.

(vii) The nature of charge of an electron is _____.

(viii) Kaplan turbine belongs to the category of _____ turbine. (Impulse/Reaction)

(ix) Due to skin effect in the AC system, the effective resistance of the line _____. (increases/decreases)

(x) The distribution of electric power into the populated area is done by _____ system. (3-phase, 3-wire/3-phase, 4-wire).

2. Write true/false : 1×10=10

(i) In chemical reactions, the nuclei don't change and only the valence electrons are shared or exchanged.

(ii) Diversity factor is the ratio of average load to the maximum demand on power station.

(iii) The amount of one unit of electrical energy is equivalent to 1 kWh.

(iv) In surface condenser, the exhaust steam and cooling water come in direct contact with the condenser surface and come out as a single stream.

(v) In electric power distribution, underground system has less initial cost than the overhead system.

(vi) In a delta connected balanced 3-phase system, line voltage is equal to phase voltage.

(vii) Due to technical reasons, generated voltage is not more than 11 -15kV. This voltage is stepped upto 132kV or even more for transmission purposes.

(viii) Hydropower is renewable and non-polluting source of energy.

(ix) An α-particle possesses negative charge.

(x) One important advantage of diesel engine power station is, it can be started and stopped quickly.

3. Match each number of 'Column A' with the most appropriate number of 'Column B'. 1×5=5

Column-A	Column-B
(i) There is no ash disposal problems, does not produce any greenhouse effect	(a) Is a non-conventional energy source
(ii) Heavy water	(b) Is a moderating material
(iii) Wind power	(c) Natural draft and mechanical induced draft type
(iv) Economizer	(d) Hydropower plants
(v) Cooling towers	(e) Coal-fired power plant

PART–B

Marks–45

1. With a neat diagram, briefly write how electrical energy is generated in generating stations, stepped up for transmission and after changing voltage levels at different sub-stations, finally distributed to the end consumers. 9

2. The following are the details of load on a circuit connected through a supply meter :

Six lamps of 40 watts each working for 4 hours per day

Two fluorescent tubes 125 watts each working for two hours per day

One 1000 watts heater load working for 3 hours per day

If each unit of energy cost 60 paisa, what will be the electricity bill for the month of June ? 9

3. (a) 'Running cost of a thermal power station is high and required a large amount of water for its operation' — Explain. 3

(b) A 80MW coal-fired power station uses coal of calorific value 6400 Kcal/kg. Thermal efficiency of the station is 28% and electrical efficiency is 89%. Calculate the coal consumption per hour when the station is delivering its full rated output. 6

4. (a) How hydroelectric power plants are classified ? 6

(b) Draw a top view of hydroelectric power plant and clearly show the catchment area, reservoir, dam and intake house, inlet waterway, power house and tail race. 3

5. (a) What is the source of heat in nuclear reactors ? 1

(b) Why moderators are used in reactors ? 1

(c) Define nuclear fission and fusion reactions. 2+2=4

(d) In the following fission reaction, estimate the energy released in MeV. 3

$$^{235}_{92}U + ^{1}_{0}n \rightarrow ^{236}_{92}U \rightarrow ^{141}_{56}Ba + ^{92}_{36}Kr + 3^{1}_{0}n + Q$$

Given, mass of $^{235}_{92}U = 235.045733$ amu

$^{141}_{56}Ba = 140.9177$ amu

$^{92}_{36}Kr = 91.8854$ amu

$^{1}_{0}n = 1.008665$ amu

6. With neat diagrams, briefly write about primary and secondary AC power distribution system. 9

7 (a) What are daily and monthly load curves ? Write some importance of load curves. 2+3=5

(b) What material is used as insulator for overhead line conductors ? 1

(c) What are the three different classifications of overhead transmission lines ? 3

8. (a) Differentiate between Open Cycle and Closed Cycle Gas Turbine Power Plants. 5

(b) What is the function of starting motor in Gas Turbine Power Plants ? 2

(c) Write two advantages of Gas Turbine Power Plants. 2