

**Bihar Engineering University, Patna**

**End Semester Examination - 2022**

**Course: B.Tech.**

**Semester: V**

**Time: 03 Hours**

**Code: 100507**

**Subject: Power System-I(Apparatus and Modelling)**

**Full Marks: 70**

**Instructions:-**

- (i) The marks are indicated in the right-hand margin.
- (ii) There are NINE questions in this paper.
- (iii) Attempt FIVE questions in all.
- (iv) Question No. 1 is compulsory.

**Q.1 Choose the correct answer of the following (Any seven question only):**

**[2 x 7 = 14]**

- (a) Ferranti effect on long overhead line is experienced when it is
  - (i) lightly loaded
  - (ii) on full load at unity pf
  - (iii) on full load at 0.8pf lead
  - (iv) on any load.
- (b) For the flue gas flow, tick the correct sequence
  - (i) Boiler – ID Fan – Air preheater – Economizer – chimney
  - (ii) Boiler – Air preheater – Economizer – ID Fan –chimney
  - (iii) Boiler – Economizer – Air preheater – ID Fan – chimney
  - (iv) None of the above.
- (c) Single line diagram does not represents:
  - (i) Ratings of machines
  - (ii) Neutral wire of transmission lines
  - (iii) Delta connection of transformer winding
  - (iv) Star connection of transformer winding
- (d) The function of a surge tank is :
  - (i) To supply water at constant pressure
  - (ii) To relieve water hammer pressures in the penstock pipe
  - (iii) To provide surge in the pipeline
  - (iv) None of the above.
- (e) The length of medium Transmission line
  - (i) 0 – 80 Km
  - (ii) 80 – 160 Km.
  - (iii) more than 160 km
  - (iv) None of the above.
- (f) Bundled conductors are used for EHV transmission lines primarily for reducing the:
  - (i) Corona loss
  - (ii) Surge impedance
  - (iii) Voltage drop
  - (iv) Skin effect
- (g) The inductance of the line is minimum when:
  - (i) GMD is low
  - (ii) GMD is high
  - (iii) GMD is constant
  - (iv) None of these.
- (h) Transient in synchronous generator is similar to which of the following circuit?
  - (i) Parallel RLC circuit
  - (ii) Series RL circuit
  - (iii) Series RLC circuit
  - (iv) Parallel RL circuit
- (i) A 25 MVA, 33 KV transformer has a p.u. impedance of 0.9. The p.u. impedance at a new base 50 MVA at 11 KV would be \_\_\_\_\_
  - (i) 10.4
  - (ii) 12.2
  - (iii) 14.4
  - (iv) 16.2
- (j) Which type of Resistor is used for over voltage protection.
  - (i) Sensistors
  - (ii) Thermistors
  - (iii) Varistors
  - (iv) Inductor.

- Q.2**
- (a) Three generators are rated as follows: Generator 1 – 100 MVA, 33 KV, reactance 10%, generator 2 – 150 MVA, 32kV, reactance 8%, Generator 3 – 110 MVA, 30 KV, reactance 12%. Determine the reactance of the generator corresponding to base values of 200 MVA, 35 KV. **[7]**
  - (b) Find the A,B,C & D parameters of Nominal –T transmission line. Also draw its phasor diagram. **[7]**

**P.T.O**

- Q.3** (a) The 3 conductor of a 3- $\phi$  transmission lines are arranged in horizontal and 2m apart. The diameter of each conductor is 3cm. Determine inductance per km of each phase. [7]
- (b) Derive the expression of capacitance for a 1-  $\phi$  transmission line. Explain the effect of Earth on the capacitance calculation of the overhead transmission line. [7]
- Q.4** (a) Explain the working of Thermal power based electricity generation with proper diagram. [7]
- (b) What are the advantages of three-phase system. Explain the role of Reactive power in AC circuit. [7]
- Q.5** (a) How DC transmission system works? Explain with suitable connection diagram along with the function line-commutated converters and voltage source converters. [7]
- (b) Draw the I-V and P-V characteristics of PV pannels. Also draw the power curve of wind turbine with their application. [7]
- Q.6** (a) What are the possible connections for a 3-phase transformer bank? State the significance of the three-phase transformer group. [7]
- (b) Explain the working of Tap-changing transformers. Write its application in power system. [7]

**Q.7** Discuss in detail about the steady state performance characteristics of a synchronous machine operation, when connected to infinite bus and also real and reactive power capability curve of the generators. [14]

**Q.8** A generator transformer unit is connected to a line through a circuit breaker. The unit ratings are: [14]

Generator : 15MVA, 11kV,  $X_d'' = 0.3 p.u.$ ,  
 $X_d' = 0.3 p.u.$ ,  $X_d = 0.6 p.u.$

Transformer : 15 MVA, 12.7/66kV,  
 reactance = 0.06 p.u.

The system is operating at no load at a line voltage of 132kV, when a three-phase fault occurs on the line just beyond the circuit breaker. Find -

- the initial symmetrical r.m.s. current in the breaker;
- the maximum possible d.c. offset current in the breaker;
- The momentary current rating of the breaker;
- The current to be interrupted by the breaker and the interrupting kVA;
- The sustained short-circuit current in the breaker.

**Q.9** Write short notes on any two of the following: - [7x 2=14]

- Super heater and Economizer
- Surge Impedance Loading
- Per-unit system
- Wind Turbine.

