CBCS SCHEME

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17EE71

Seventh Semester B.E. Degree Examination, Jan./Feb.2021
Power System Analysis - II

Time: 3 hrs. Max. Marks: 100

Note: ***Answer any FIVE full questions, choosing ONE full question from each module.***

Module-1

1 a. Develop the relation between I_{BUS}, V_{BUS} and Y_{BUS} by assuming no mutual coupling between transmission lines of a 3-bus system. **(07 Marks)**

b. Derive the power flow equations and what are the specified practical limits of variables. **(06 Marks)**

c. Find the Y_{BUS} by direct inspection method for a system with the following data:

Element No.	1	2	3
Bus code (i – k)	1 – 2	2 – 3	3 – 1
Line impedence (pu)	j0.04	j0.02	j0.05
Half-line charging admittance (pu)	j0.02	j0.01	j0.04

(07 Marks)

OR

2 a. Define the following terms with an example:
(i) Oriented graph (ii) Tree and (iii) Co-tree **(05 Marks)**

b. Write the algorithm of Gauss-Siedel load flow solution for a power system with a slack bus and (n-1) number of PQ buses. **(08 Marks)**

c. The positive sequence reactances in pu are given for the network shown in Fig. Q2 (c). Take node-G as the reference bus. Form Y_{BUS} by singular transformation.

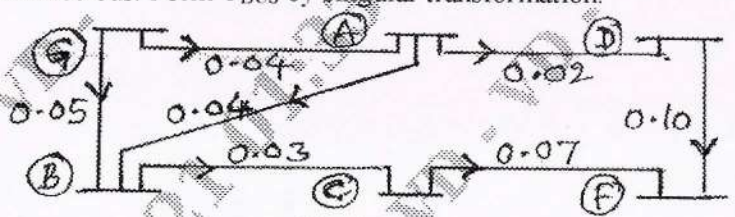

Fig. Q2 (c)

(07 Marks)

Module-2

3 a. Write the iterative algorithm for NR method of load flow analysis of power system having both PQ and PV buses. **(08 Marks)**

b. Explain the decoupled Newton method for load flow solution. **(06 Marks)**

c. Compare the Newton Raphson and Fast decoupled load flow methods with different parameters. **(06 Marks)**

OR

4 a. What are the simplifications and assumptions made in Fast Decoupled Load Flow method? **(06 Marks)**

b. Explain how the voltage profile is controlled by synchronous generators and VAR generators. **(07 Marks)**

c. Derive the Jacobian matrix elements equations from the load flow equations. **(07 Marks)**

Module-3

5 a. Explain the following terms in the optimal operation of generators :
(i) Input Output curve (ii) Heat rate curve (iii) Incremental fuel cost curve. **(06 Marks)**

b. Explain the optimal generation scheduling considering transmission losses. **(09 Marks)**

c. What are the needs and importance of unit commitment? **(05 Marks)**

OR

6 a. With the assumptions made, derive the formula of transmission loss and hence B- coefficients for a two-plants system. **(08 Marks)**

b. With random unit performance record obtain the probability of a unit being in up or down states for system reliability. **(05 Marks)**

c. A constant load of 300 MW is supplied by two 200 MW generators for which the incremental fuel costs are: $\frac{dC_1}{dP_{G_1}} = 0.1P_{G_1} + 20$ and $\frac{dC_2}{dP_{G_2}} = 0.12P_{G_2} + 15$

Determine:
(i) The most economical division of load between the generators
(ii) The saving in Rs./day there by obtained compared to equal load sharing between machines. **(07 Marks)**

Module-4

7 a. Explain the optimal power flow solution without inequality constraints. **(08 Marks)**

b. Explain the solution technique for hydrothermal scheduling problem. **(07 Marks)**

c. Briefly, explain the functions of system security analysis. **(05 Marks)**

OR

8 a. State the mathematical formulation of hydrothermal system with assumptions and constraints. **(10 Marks)**

b. Explain the loss of load probability. **(04 Marks)**

c. What are the inequality constaints on control variables in optimal power flow? **(06 Marks)**

Module-5

9 a. Explain the algorithm for short circuit studies of an n-bus system. **(10 Marks)**

b. For the power system shown in Fig. Q9 (b) the reactances are given in pu. A solid three phase fault occurs on bus-3. Calculate (i) Fault current (ii) all bus voltages (iii) Fault current in the lines. **(10 Marks)**

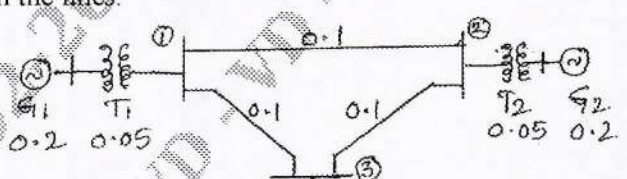

Fig. Q9 (b)

OR

10 a. Explain with relevant diagrams, the point by point method of solving the swing equation. **(10 Marks)**

b. Derive the generalize algorithm for finding the elements of Z_{BUS} when a branch is,
(i) Added between an old bus and reference bus
(ii) Added between two old buses. **(10 Marks)**

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17EE72

Seventh Semester B.E. Degree Examination, Jan./Feb.2021
Power System Protection

Time: 3 hrs. Max. Marks: 100

Note: ***Answer any FIVE full questions, choosing ONE full question from each module.***

Module-1

1 a. With a neat diagram, explain zones of protection in a power system. **(06 Marks)**

b. Derive an expression for torque produced by an induction relay. **(08 Marks)**

c. List the merits and demerits of static relays. **(06 Marks)**

OR

2 a. Draw a neat sketch of an induction disc relay and discuss its operating principle. **(07 Marks)**

b. What are the various types of over current relays? Discuss their area of applications. **(06 Marks)**

c. Describe the realization of a overcurrent relay using numerical technique. Show its flowchart with neat diagram. **(07 Marks)**

Module-2

3 a. With a neat schematic diagram, explain the construction and working of static reactance relay using an amplitude comparator. **(08 Marks)**

b. With a neat sketch, explain the construction and working principle of induction disc type reverse power relay. **(08 Marks)**

c. With neat diagram, explain induction cup type impedance relay. **(04 Marks)**

OR

4 a. Draw and explain the circuit connections of three MHO units used at a particular location for three zones of protection. **(07 Marks)**

b. With neat connection diagrams, explain the working of directional earth fault relay. **(07 Marks)**

c. With neat diagram, explain static impedance relay using amplitude comparator. **(06 Marks)**

Module-3

5 a. With neat diagram, explain percentage differential protection of star-delta connected transformer. **(08 Marks)**

b. With neat diagram, explain the working of Buccholz relay. **(05 Marks)**

c. An 11 kV, 150 MVA alternator is provided with differential protection. The percentage of winding to be protected against phase to ground fault is 80%. The relay is set to operate when there is 20% out of balance current. Determine the value of the resistance to be placed in the neutral to ground protection. **(07 Marks)**

OR

6 a. Define the term 'pilot' with reference to power line protection. List the different types of wire pilot protection schemes and explain any one of the schemes. **(08 Marks)**

b. With neat diagram, explain harmonic restraint relay used to protect against magnetizing inrush current of transformer. **(08 Marks)**

c. With a neat circuit diagram, explain rotor earth fault protection of alternator. **(04 Marks)**

Module-4

7 a. In a 132 kV system, reactance and capacitance upto the location of the circuit breaker is 4Ω and 0.02 μF respectively. A resistance of 500 Ω is connected across the break of the C.B. Determine the (a) natural frequency of oscillation (b) damped frequency of oscillation. (c) critical value of resistance. **(08 Marks)**

b. Explain working of SF_6 circuit breaker with the help of diagrams. Write two of its advantages. **(08 Marks)**

c. Explain recovery rate theory to explain the zero current interruption of the arc. **(04 Marks)**

OR

8 a. Derive expressions for restriking voltage and RRRV in terms of system voltage, inductance and capacitance during fault on feeder. **(08 Marks)**

b. With neat circuit diagram, explain the synthetic testing of circuit breaker. **(06 Marks)**

c. With neat diagram, explain Air-break circuit breaker. Write any two of its applications. **(06 Marks)**

Module-5

9 a. Describe the construction and operation of the HRC cartridge fuse with indicator. Write any four of advantages of HRC fuses. **(08 Marks)**

b. Describe the phenomenon of lightning and explain the terms pilot streamer, stepped leader, return streamer, dart leader, cold lightning stroke and hot lightning stroke. **(08 Marks)**

c. Write short note on Arcing horn with diagram. **(04 Marks)**

OR

10 a. Describe the construction and principle of operation of valve type lightning arrester with detailed diagram. **(08 Marks)**

b. Write note on klydonograph and magnetic link. **(06 Marks)**

c. Describe the protection of stations and sub-stations against direct lightning strokes. **(06 Marks)**

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CBCS SCHEME

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17EE73

Seventh Semester B.E. Degree Examination, Jan./Feb. 2021
High Voltage Engineering

Time: 3 hrs. Max. Marks: 100

Note: ***Answer any FIVE full questions, choosing ONE full question from each module.***

Module-1

1 a. Derive an expression for the current growth in the air gap considering Townsend First ionization co-efficient. **(10 Marks)**

b. What is Paschen's law? How do you account for the minimum voltage for breakdown under a given PXD condition? **(10 Marks)**

OR

2 a. List the three important properties of liquid dielectrics and explain suspended particle theory of breakdown. **(10 Marks)**

b. List the various breakdown mechanisms in solid dielectrics and explain Thermal breakdown mechanism. **(10 Marks)**

Module-2

3 a. What are the advantages of high frequency transformers? Explain the 3-stage cascaded transformer for generation of HVAC. **(10 Marks)**

b. A Cockcroft – Walton type voltage multiplier has eight stages with capacitances, all equal 0.05μF. The supply transformer secondary voltage is 125kN at 150Hz frequency. If the load current is 5mA find the i) Percentage Ripple ii) Regulation iii) Optimum number of stages for minimum regulation. **(10 Marks)**

OR

4 a. With a circuit diagram, explain the tripping of an impulse generation with three electrode gap arrangement. **(10 Marks)**

b. An impulse generator has eight stages with each condenser rated for 0.16μF and 125kV. The load capacitor is of 1000pF. Find the series and damping resistance needed to produce 1.2/50μs impulse wave. What is the maximum output voltage of the generator, if the charging voltage is 120kV? **(10 Marks)**

Module-3

5 a. With a neat diagram, explain the construction and working principle of Electrostatic voltmeter. **(10 Marks)**

b. Explain the various factors that affect the spark over voltage of sphere gap. **(10 Marks)**

OR

6 a. With a block diagram, explain the cathode ray oscilloscope for impulse measurement. **(10 Marks)**

b. A generating voltmeter has to be designed so that it can have a range from 20 to 200kV DC. If the indicating meter reads a minimum current of 2μA and maximum current of 25μA, what should the capacitance of generating voltmeter be? **(06 Marks)**

c. List the limitations of series resistance micro ammeter in measuring HVDC. **(04 Marks)**

Module-4

7 a. Explain the different theories of charge formation in cloud. **(10 Marks)**

b. What is direct and indirect lighting stroke? Give reasons for induced voltage on the power line due to indirect stroke. **(10 Marks)**

OR

8 a. List the parameters to be considered for the selection of surge arrester voltage rating for EHV and UHV, also explain the types of surge arresters used. **(10 Marks)**

b. A transmission line has the following line constant R = 0.1 ohm/km, L = 1.26mH/km, C = 0.009μF/km and G = 0, If the line is a 3-phase line and is charged from one end at a line voltage of 230kV, find the rise in voltage at the other end, if the line length is 400km. **(10 Marks)**

Module-5

9 a. With a necessary circuit diagram and pattern, explain discharge detection using straight detector for partial discharge measurement. **(10 Marks)**

b. A Schearing bridge with following configuration.
The electrode effective area $100cm^2$ at balance
Arm AB – test object
Arm BC – Standard capacitor 100pF
Arm CD – Variable capacitor 50nF in parallel with resistor $\frac{1000}{\pi}$ ohms
Arm DA – Variable resistance 62.0/ohm
with 1mm thick Bakelite at 50Hz.
Determine the dielectric constant and loss factor. **(05 Marks)**

c. Write a note on :
i) Power frequency spark over test
ii) Hundred percent standard impulses spark over test in the view of surge arrester. **(05 Marks)**

OR

10 a. Explain the power frequency tests and impulse tests for i) Insulators ii) Bushings. **(10 Marks)**

b. Explain the different methods of conducting short circuit tests on circuit breakers. **(10 Marks)**

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17EE742

Seventh Semester B.E. Degree Examination, Jan./Feb. 2021
Utilization of Electrical Power

Time: 3 hrs. Max. Marks: 100

Note: ***Answer any FIVE full questions, choosing ONE full question from each module.***

Module-1

1 a. Derive and explain the design procedure for a circular and rectangular strip heating element. **(08 Marks)**

b. A 16kW resistance oven employing Nichrome wire is to be operated from a 220V, single phase power supply. If the temperature of the element is to be limited to 1170°C and average temperature of the charge is 500°C, find the diameter and length of the element wire. Radiating efficiency is 0.57, emissivity is 0.9, and specific resistance of Nichrome is 109×10^{-8} ohm-m. **(06 Marks)**

c. Explain high frequency dielectric Heating. **(06 Marks)**

OR

2 a. With a neat sketch, explain flash butt welding and spot welding. **(08 Marks)**

b. A worn-out cylinder shaft 14cm in diameter and 30cm long is to be repaired by coating it with a layer of 1.5mm Nickel. Determine the theoretical value of current required and the time taken if the current density used is 200Amp/m^2. ECE of Nickel is 0.000304gm/coulomb and density of Nickel is 8.9gm/cm^3. **(06 Marks)**

c. Discuss the factors affecting electro deposition process. **(06 Marks)**

Module-2

3 a. State and explain the laws of Illumination. **(06 Marks)**

b. A section of a road is to be illuminated by 2 lamps of 500cp and 400cp, both horizontally 20m apart and are suspended 6m above the surface level. Calculate the illumination at A directly below the lamp of 500cp and at B directly below lamp of 400cp. Also calculate illumination at C in the middle points of A and B. **(06 Marks)**

c. With a neat diagram. explain the construction and working of the sodium vapour lamp. **(08 Marks)**

OR

4 a. Define the following terms and mention their units.
i) Laminous flux
ii) Luminous Intensity
iii) Illumination
iv) Mean spherical candle power. **(08 Marks)**

b. Explain the following :
i) Flood lighting
ii) ii) Street lighting. **(06 Marks)**

c. Discus the factors to be taken into account for design of lighting scheme. **(06 Marks)**

Module-3

5 a. Define the following terms :
i) Crest speed
ii) Average speed
iii) Schedule speed. **(06 Marks)**

b. Derive expression for maximum speed of a Train interms of distance travelled, acceleration and retardation for Trapezoidal speed time curve. **(08 Marks)**

c. An electric train is to have a braking retardation of 3.2Kmphps. If the ratio of maximum speed to average speed is 1.3, the time for stops is 20sec, and acceleration is 0.8kmphps, find its schedule speed for a run of 1.5km. Assume Trapezoidal speed time curve. **(06 Marks)**

OR

6 a. Derive an expression for Tractive effort required for propulsion of a train considering gradient and resistance to train movement. **(08 Marks)**

b. A 220 tonne motor coach having 4 motors each developing a torque of 7500N-m during acceleration starts from rest. If up gradient is 25 in 1000, gear ratio 3.2, gear transmission 90%, wheel diameter 92cms, train resistance 45N/tonne, rotational inertia effect 8%, calculate :

i) the time taken by the coach to attain a speed of 75kmph

ii) If the supply voltage is 3000V and motor efficiency is 87%, estimate current taken each motor during acceleration period. **(08 Marks)**

c. Discuss the mechanical and electrical characteristics of electric motors used for traction work. **(04 Marks)**

Module-4

7 a. Mention the advantages and disadvantages of Regenerative braking of electric traction motors. **(05 Marks)**

b. Derive an expression for energy returned to the line regenerative braking on a level track. **(08 Marks)**

c. Write short notes on :

i) Compressed air brakes

ii) Magnetic track brakes. **(07 Marks)**

OR

8 a. Write short notes on :

i) Trolley buses

ii) Pantograph collector

iii) Trolley wires. **(10 Marks)**

b. With a neat sketch, explain the function of a negative booster in a tramway system. **(10 Marks)**

Module-5

9 a. With relevant block diagram, discuss the working principle of Hybrid electric vehicle. **(10 Marks)**

b. Discuss the performance of electric vehicle using speed-power characteristics. **(10 Marks)**

OR

10 a. Discuss electric vehicle performance interms of maximum cruising speed, gradeability and acceleration. **(10 Marks)**

b. Discuss the electric energy consumption in an electric vehicle. **(10 Marks)**

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17EE752

Seventh Semester B.E. Degree Examination, Jan./Feb. 2021
Testing and Commissioning of Power System Apparatus

Time: 3 hrs. Max. Marks: 100

Note: Answer any FIVE full questions, choosing ONE full question from each module.

Important Note : 1. On completing your answers, compulsorily draw diagonal cross lines on the remaining blank pages.
2. Any revealing of identification, appeal to evaluator and /or equations written eg, 42+8 = 50, will be treated as malpractice.

Module-1

1 a. What is artificial respiration? Explain. **(10 Marks)**
b. Explain the methods of measuring insulation resistance in case of a transformer. **(10 Marks)**

OR

2 a. List out different types of transformer tanks. Explain methods of testing transformer tanks. **(10 Marks)**
b. Explain briefly the drying of transformers. **(10 Marks)**

Module-2

3 a. List out different steps to be followed while installing an alternator. **(10 Marks)**
b. List out factory tests, commissioning tests and performance tests to be conducted on alternators. **(10 Marks)**

OR

4 a. Explain line charging capacity test on alternators. **(10 Marks)**
b. Write a note on drying out of synchronous machines. **(10 Marks)**

Module-3

5 a. Explain different methods used to dry out the windings of an induction motor. **(10 Marks)**
b. Mention various stages in the installation of an Induction Motor. **(10 Marks)**

OR

6 a. Write a note on balancing the rotor while installing an Induction Motor. **(10 Marks)**
b. Explain vibration tests carried out on an Induction Motor. **(10 Marks)**

Module-4

7 a. Explain inspection, storage, handling and transportation of power cables. **(10 Marks)**
b. How is insulation strength of a cable measured? Explain. **(10 Marks)**

OR

8 a. Explain various aspects to be considered while laying underground power cables. **(10 Marks)**
b. Explain how cable faults are located using Megger. **(10 Marks)**

Module-5

9 a. What are the various steps to be followed while installing a circuit breaker? **(10 Marks)**
b. Explain the maintenance schedule of SF_6 circuit breaker. **(10 Marks)**

OR

10 a. How is the electrical insulation of a building tested before commissioning? **(10 Marks)**
b. Write a note on Testing of earthing continuity in a building wiring. **(10 Marks)**

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15EE71

Seventh Semester B.E. Degree Examination, Jan./Feb.2021
Power System Analysis - II

Time: 3 hrs. Max. Marks: 80

Note: ***Answer any FIVE full questions, choosing ONE full question from each module.***

Module-1

1 a. What is primitive network? Explain its significance. **(06 Marks)**

b. The impedance data for a sample power system is given below. Find the admittance matrix of the system in bus frame of reference by singular transformation method. (Using ground as reference) **(10 Marks)**

Bus code	Impedence	Line Charging admittance
1 – 2	0.08+j0.24	0.0
1 – 3	0.02+j0.06	0.0
2 – 3	0.06+j0.18	0.0

OR

2 a. Define subgraph, tree, co-tree as applied to graph theory. Give example for each. **(06 Marks)**

b. Using Gauss-Seidel load flow method, find bus voltage at the end of one iteration for the system shown in Fig. Q2 (b). Ignore resistance and line changing.
Assume initial voltage at all buses to $1.0\angle 0^\circ$. Use 1.0 as acceleration factor.
The bus data is given in the table below:

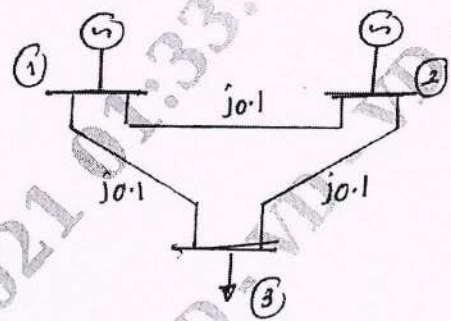

Fig Q2 (b)

Bus data table

Bus No.	Specified P (PU)	Injection Q (PU)	Specified voltage (PU)
1	-	-	1.0
2	0.3	-	1.0
3	0.5	0.2	-

(10 Marks)

Module-2

3 a. Explain the algorithmic procedure for load flow analysis using Newtonian Raphson's method in polar co-ordinates. **(08 Marks)**

b. List the advantages and limitation of Gauss-Seidel method and Newton-Raphson's of load flow analysis. **(08 Marks)**

OR

4 a. Explain the step by step procedure of fast decoupled load flow analysis and the assumptions made. **(08 Marks)**

b. Explain any two methods of voltage control in power system. **(08 Marks)**

Module-3

5 a. Explain the following with respect to optimal operation of power system:
(i) Input-output curve.
(ii) Cost-curve.
(iii) Incremental cost curve.
(iv) Heat rate curve. **(08 Marks)**

b. The incremental fuel costs in ruppes/Mwh for a plant consisting of two units are given by,

$$\frac{dC_1}{dP_1} = 0.16P_1 + 30$$

$$\frac{dC_2}{dP_2} = 0.20P_2 + 25.$$

Assume that both units are operating all the time throughout the year. The maximum and minimum loads on each unit are 200 MW and 50 MW respectively. If the load varies between 100 MW and 400 MW, find the load division between two units as the system load varies over the full range in steps of 100 MW. **(08 Marks)**

OR

6 a. Derive the exact co-ordination equation for economic load dispatch in a thermal power system with the consideration of transmission losses. **(08 Marks)**

b. Explain unit commitment using dynamic programming method. **(08 Marks)**

Module-4

7 a. Discuss in detail optimal scheduling for Hydrothermal system. **(08 Marks)**

b. Clearly explain availability and un-availability of reliability consideration. **(08 Marks)**

OR

8 a. Explain with a flow chart for optimal load flow solution. **(08 Marks)**

b. Explain state space method used for power system reliability evaluation. Discuss Loss Of Load Probability (LOLP). **(08 Marks)**

Module-5

9 a. For the system shown in Fig. Q9 (a) with bus 1 as reference and line data impedance as shown. Compute Z_{bus} by adding 1-2, 2-3 and 1-3. **(08 Marks)**

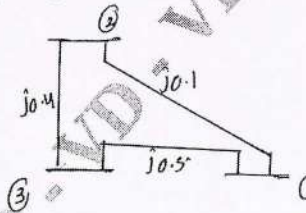

Fig. Q9 (a)

b. Discuss in detail the point by point method of solving the SWING EQUATION. **(08 Marks)**

OR

10 a. Discuss the various steps for determining multi machine stability of power system. **(08 Marks)**

b. Derive the generalized algorithm for finding the elements of bus impedance matrix when a branch is added to the partial network. Discuss the special cases. **(08 Marks)**

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CBCS SCHEME

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15EE72

Seventh Semester B.E. Degree Examination, Jan./Feb. 2021
Power System Protection

Time: 3 hrs. Max. Marks: 80

Note: ***Answer any FIVE full questions, choosing ONE full question from each module.***

Module-1

1 a. Explain the nature is causes of faults. Discuss the consequences of faults on a power system. **(08 Marks)**

b. Discuss how an amplitude comparator can be converted to a phase comparator. **(08 Marks)**

OR

2 a. Compare numerical relay with an electromechanical relay. **(05 Marks)**

b. Explain various methods of backup protection. **(05 Marks)**

c. Briefly explain the essential qualities of a protective relay. **(06 Marks)**

Module-2

3 a. An earth fault develops at point F on the feeder shown in Fig Q3(a) and the fault current is 16000A. The IDMT relays at points A & B are fed via 800/5 A CTs. The relay at B has a plug setting of 125% and Time Multiplier Setting (TMS) of 0.2. The circuit breakers take 0.20s to clear the fault, and the relay error in each case is 0.15s for a plug setting of 200% on the relay A, determine the minimum TMS on that relay for it not to operate before the circuit breaker at B has cleared the fault. Assume the operating time at PSM of 10 for a TMS of 1 = 3.0s. **(08 Marks)**

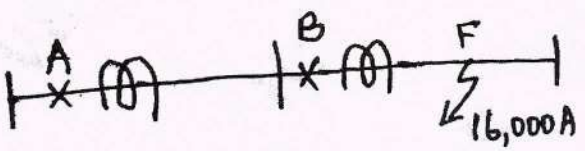

Fig Q3(a)

b. What is an impedance relay? Explain its operating principle, torque equation and operating characteristics for impendence relay. **(08 Marks)**

OR

4 a. Describe the operating principle of reverse power or directional relay with neat diagram. **(08 Marks)**

b. Explain Angle impedance relay with neat diagram. **(08 Marks)**

Module-3

5 a. Describe the balanced voltage (or opposed voltage) differential protection scheme. **(08 Marks)**

b. With a neat sketch, discuss the differential scheme for bus zone protection. **(08 Marks)**

OR

6 a. Describe with a neat sketch, the percentage differential protection of a modern alternator. **(08 Marks)**

b. Define the term pilot, with reference to power line protection lit the difference types of wire pilot protection schemes and explain any one of the scheme. **(08 Marks)**

Module-4

7 a. With a neat sketch, explain the recover rate theory and energy balance theory of arc interruption in a circuit breaker. **(08 Marks)**

b. For a 132KV system, the reactance and capacitance up to the location of the circuit breaker is 3Ω and 0.015μF, respectively. Calculate the following :

i) The frequency to transient oscillation

ii) The maximum value of restriking voltage across the contacts of the circuit breaker

iii) The maximum value of RRRV. **(08 Marks)**

OR

8 a. With a neat sketch, explain the direct testing of circuit breaker. **(05 Marks)**

b. List the classification of circuit breaker. **(05 Marks)**

c. What are the merits and demerits of SF_6 circuit breaker? **(06 Marks)**

Module-5

9 a. What do you mean by discrimination? Discuss discrimination between i) two fuses ii) a fuse and an over current relay. **(08 Marks)**

b. Describe the protection of stations and substations against direct lighting strokes. **(08 Marks)**

OR

10 a. What is GIS? What are the various component of a GIS? Briefly, describe their functions. **(08 Marks)**

b. Write short notes on :

i) Klydonograph

ii) Rod gap. **(08 Marks)**

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CBCS SCHEME

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15EE73

Seventh Semester B.E. Degree Examination, Jan./Feb. 2021
High Voltage Engineering

Time: 3 hrs. Max. Marks: 80

Note: ***Answer any FIVE full questions, choosing ONE full question from each module.***

Module-1

1 a. Mention few preferred properties of gaseous dielectric for high voltage applications. Give any three example of gaseous dielectric. **(06 Marks)**

b. Explain the process of ionization by collision. Derive an expression for the current in the air gap considering Townsend's first ionization coefficient. **(10 Marks)**

OR

2 a. State and explain Paschen's Law. **(06 Marks)**

b. Briefly explain electro mechanical breakdown and thermal breakdown in solid dielectrics. **(10 Marks)**

Module-2

3 a. Explain the need of generating very high voltages in the laboratory. **(04 Marks)**

b. With a neat sketch, explain Cockcroft Walton principle for generating high dc voltages. **(06 Marks)**

c. Explain the working principle of a series resonant transformer. **(06 Marks)**

OR

4 a. Explain the Marx circuit arrangement for generation of high impulse voltages. **(08 Marks)**

b. A 12 stage impulse generator has 0.126μF capacitors. The wave front and wave tail resistance are 800Ω and 5000Ω respectively. If the load capacitor is 1000pF. Find the front time and tail time of the impulse wave produced. **(08 Marks)**

Module-3

5 a. Explain the Chubb and Fortescue method for measurement of pack value of an ac voltage waveform. **(08 Marks)**

b. Explain the principle of operation of an electrostatic voltmeter for measurement of high dc and ac voltages. **(08 Marks)**

OR

6 a. Discuss the factors influencing the spark over voltages of sphere gaps. **(08 Marks)**

b. Explain measurement of high impulse currents using Rogowski coil, with a neat figure. **(08 Marks)**

Module-4

7 a. Discuss the chief causes of over voltages in electric power systems. **(06 Marks)**

b. Explain charge formation in clouds using Simpson's cloud model. **(10 Marks)**

OR

8 a. With typical wave shapes, mention the characteristic of switching surge voltages. **(08 Marks)**

b. What is meant by insulation coordination? **(04 Marks)**

c. Discuss the ideal characteristics of protective devices connected in shunt for protection of electrical apparatus. **(04 Marks)**

Module-5

9 a. With the help of a diagram of a Schering bridge, explain how the capacitance and tan δ, can be measured. **(08 Marks)**

b. What is meant by partial discharge? Explain how it can be measured using balanced detection method. **(08 Marks)**

OR

10 a. Explain the testing of circuit breakers and insulators. **(08 Marks)**

b. What are the tests on transformers and explain the impulse testing of transformers. **(08 Marks)**

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15EE742

Seventh Semester B.E. Degree Examination, Jan./Feb. 2021
Utilization of Electrical Power

Time: 3 hrs. Max. Marks: 80

Note: *Answer any FIVE full questions, choosing ONE full question from each module.*

Module-1

1 a. Explain with a neat diagram the working of "Direct arc furnace". Mention its applications. **(08 Marks)**

b. Explain :
i) Direct resistance heating
ii) Indirect resistance heating. **(08 Marks)**

OR

2 a. Explain first and second laws of Faraday of electrolysis. **(08 Marks)**

b. Calculate the ampere hours required to deposit a coating of silver 0.05 mm thick on a sphere of radius of 5cms electrochemical equivalent of silver is 0.001118 and density of silver is 10.5 gms per cubic centimeter. **(08 Marks)**

Module-2

3 a. State and explain the two laws of illumination. **(08 Marks)**

b. Deduce the relation to find illumination at any point on the surface due to a light source suspended at a height "h" above the surface. **(08 Marks)**

OR

4 a. Mention and Briefly explain the factors to be considered in the design of lighting schemes. **(08 Marks)**

b. A small assembly shop 16m long, 10m wide and 3m up to trusses is to be illuminated to a level of 200 Lux. The utilisation and maintenance factors are 0.74 and 0.8 respectively. Calculate the number of lamps required to illuminate the whole area/if the lumen output of the lamp selected is 3000 lumens. **(08 Marks)**

Module-3

5 a. Sketch and explain typical speed –time curves for :
i) Main line service
ii) Suburban service
iii) Urban service in traction services. **(08 Marks)**

b. An electric train has an average speed of 42Kmph on a level track between stops 1400m apart. It is accelerated @ 1.7kmph ps and is braked at 3.3kmph ps. Draw the speed time curve for the train. **(08 Marks)**

OR

6 a. Explain the operating characteristics of DC series motors. Discuss the advantages and disadvantage of using DC series motor for traction duty. **(08 Marks)**

b. Write a note on starting and speed control of DC traction motors explaining Rheostatic control and series parallel control in detail. **(08 Marks)**

Module-4

7 a. What are the different types of mechanical braking of electric trains? **(08 Marks)**

b. What are the advantages and disadvantages of regenerative braking? **(08 Marks)**

OR

8 a. Explain Bow Collector and pantograph collectors used as current collectors in over head systems with suitable sketches. **(08 Marks)**

b. A train weighing 500tormes is going down a gradient of 1 in 50. It is desired to keep train speed at 40Kmph by regenerative braking. Calculate the power fed into the line. Tractive resistance is 40N/tone. Rotational inertia : 10% and efficiency of conversion : 75%. **(08 Marks)**

Module-5

9 a. Compare electric vehicles with conventional IC engine vehicles. **(06 Marks)**

b. Discuss the concepts and configuration of modern electric drives in detail with suitable sketches. **(10 Marks)**

OR

10 a. Explain the concept and working principle of hybrid electric drive trains. With its architecture with suitable sketches. **(08 Marks)**

b. Write a note on the performance of electric vehicles. **(08 Marks)**

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17EE71

Seventh Semester B.E. Degree Examination, July/August 2021
Power System Analysis – II

Time: 3 hrs. Max. Marks: 100

Note: Answer any FIVE full questions.

1 a. Define the following terms with an illustrative example :
(i) Oriented graph (ii) Tree (iii) Co-tree **(06 Marks)**

b. The Bus Incidence matrix of a power system network is shown below. Construct the oriented graph of the system.

$$A = \begin{bmatrix} 1 & 0 & 0 & -1 & 0 & 0 & 1 \\ -1 & -1 & -1 & 0 & 0 & 0 & -1 \\ 0 & 0 & 1 & 0 & -1 & 1 & 0 \\ 0 & 0 & 0 & 0 & 0 & -1 & 0 \end{bmatrix}$$ **(06 Marks)**

c. Derive the expression from Y-bus using singular transformation. **(08 Marks)**

2 a. Explain the load flow studies procedure with expressions as per Gauss-Seidel method for power system having all types of buses. **(08 Marks)**

b. Using Gauss –Seidel load flow method compute at the end of iteration (i) Voltages at buses 2 and 3 (ii) Real and Reaction powers at the slack bus.

LINE DATA

Bus p - q	$Z_{p,q}$	Y'_{pq}
1 - 2	j0.4	j0.2
2 - 3	j0.2	j0.1
3 - 1	j0.4	j0.2

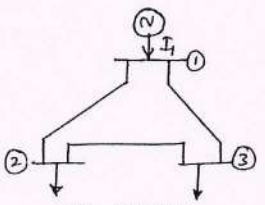

Fig.Q2(b)

INPUT DATA

Bus (i)	P_i	Q_i	V_i	Remarks
1	-	-	$1.03\underline{0}^{o}$	Slack
2	-0.4	-0.3	-	PQ
3	-0.5	-0.4	-	PQ

(12 Marks)

3 a. Draw the flow chart of Newton-Raphson method in polar coordinated for load flow analysis. **(12 Marks)**

b. Find the values of x_1 and x_2 for the following equations by Newton-Raphson method upto 2^{nd} iteration.

$x_1^2 - 4x_2 - 4 = 0$; $2x_1 - x_2 - 2 = 0$ using $x_1^{(0)} = 1$ and $x_2^{(0)} = -1$. **(08 Marks)**

4 a. Deduce the fast decoupled load flow model, clearly stating all the assumptions made and give the flow chart. **(10 Marks)**

b. Explain the concept of controlling voltage profile by the use of (i) Generators (ii) VAR Generators (iii) Transformers. **(10 Marks)**

5 a. Derive the condition for minimum total fuel cost in a system comprising of K-thermal generating units, considering transmission losses. **(08 Marks)**

b. Incremental fuel costs in Rs./MWh for a plant consisting of two units are

$$\frac{dC_1}{dP_1} = 0.2P_1 + 40 \; ; \qquad \frac{dC_2}{dP_2} = 0.4P_2 + 30$$

and the generator limits are as follows,

$30MW \le P_1 \le 175$ MW

$20MW \le P_2 \le 125$ MW

Assume that both units are operating at all times. How will the load be shared between the two units as the system load varies over the full range of the load values? What are the corresponding values of the plant incremental costs? **(12 Marks)**

6 a. What is optimal unit commitment and also explain Dynamic Programming method. **(08 Marks)**

b. Explain Reliability consideration in unit commitment problem. **(06 Marks)**

c. Explain optimal generation scheduling. **(06 Marks)**

7 a. Discuss the problem formation and solution procedure of optimal scheduling for hydrothermal plants. **(10 Marks)**

b. What are transmission line loss coefficients? Derive an expression for transmission loss as a function of plant generation for a two plant system. **(10 Marks)**

8 a. Explain the major function of security analysis. **(05 Marks)**

b. Explain the three major function of system security. **(05 Marks)**

c. Write a note on :

(i) Maintenance Scheduling (ii) Power System Reliability **(10 Marks)**

9 a. Explain the algorithm for short circuit studies. **(10 Marks)**

b. Derive the generalized algorithm for finding the elements of bus impedance matrix when a LINK is added to the partial network. **(10 Marks)**

10 a. Explain point-by-point solution of swing equation. **(08 Marks)**

b. Explain the steps involved in determining multimachine stability. **(05 Marks)**

c. Explain modified Euler's method of solving swing equation. **(07 Marks)**

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17EE752

Seventh Semester B.E. Degree Examination, July/August 2021
Testing and Commissioning of Power System Apparatus

Time: 3 hrs. Max. Marks: 100

Note: *Answer any FIVE full questions.*

1 a. Describe briefly the various electrical tools and equipments required for electrical installation. **(10 Marks)**
b. Describe briefly the workmen's safety equipments used in electrical installation. **(10 Marks)**

2 a. State the important steps in maintenance of power transformers. **(10 Marks)**
b. Explain the different methods of drying out of power transformers. **(10 Marks)**

3 a. State and explain the various abnormal conditions in a synchronous generator and their effects. **(08 Marks)**
b. Explain the suitability of hydrogen as coolent in turbo alternators. **(06 Marks)**
c. Define short circuit ratio of a synchronous machine and explain how it is obtained. **(06 Marks)**

4 a. Explain briefly the various steps of installation of a synchronous machine. **(08 Marks)**
b. Explain briefly the various tests conduct on synchronous machines. **(06 Marks)**
c. Mention the various specifications of synchronous machine. **(06 Marks)**

5 a. State and explain the various tests on 3-phase induction motors. **(08 Marks)**
b. Explain the procedure of High voltage test on rotating machine. **(06 Marks)**
c. Explain the procedure of storing Induction machine at site. **(06 Marks)**

6 a. State and explain the various abnormal conditions in induction motors. **(10 Marks)**
b. State the different types of electrical tests done on induction motor. Explain any one method in detail. **(10 Marks)**

7 a. Explain briefly the causes of dim and flickering of light. **(06 Marks)**
b. What are the various factors which causes loose neutral connections? **(07 Marks)**
c. What are the various advantages of gas pressure cables? **(07 Marks)**

8 a. State the factors to be considered while selecting a cable. **(10 Marks)**
b. Explain how to check cable fault by means of megger. **(10 Marks)**

9 a. Explain briefly the steps involved in installation of circuit Breaker. **(10 Marks)**
b. State the various steps in installation and commissioning of outdoor circuit Breaker. **(10 Marks)**

10 a. Explain the protective devices used in residential electrical installation. **(10 Marks)**
b. Describe typical low voltage, 3-phase, 4 wire and single phase AC supply system for residential building. **(10 Marks)**

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17EE81

Eighth Semester B.E. Degree Examination, July/August 2021
Power System Operation and Control

Time: 3 hrs. Max. Marks: 100

Note: *Answer any FIVE full questions.*

1 a. What are the states of power system, explain in brief with a suitable diagram. **(06 Marks)**
b. With usual notations, explain following with reference to SCADA systems. SCADA/AGC, EMS, DMS, LMS, AMR. **(06 Marks)**
c. Explain the constraints in UC. **(08 Marks)**

2 a. Explain the major components of Energy Management Center. **(06 Marks)**
b. Explain in brief the components of Remote Terminal Unit for power system SCADA. **(07 Marks)**
c. Explain with Flow Chart the Dynamic Programming Method of unit commitment. **(07 Marks)**

3 a. Write a note on Scheduling of Hydrosystems with necessary formulae involved into it. **(05 Marks)**
b. Explain the Mathematical formulation, Discritization, Algorithmic steps involved in Discrete Time Interval Method of Hydro Thermal Scheduling. **(10 Marks)**
c. Explain the need for Automatic Generation Control (AGC) in power system operation and control. **(05 Marks)**

4 a. Write a brief note features of hydropower plants that participate in Hydrothermal Scheduling. **(05 Marks)**
b. Explain with a suitable Flow chart the short Term Hydrothermal Scheduling using $\gamma - \lambda$ Iterations. **(10 Marks)**
c. Explain the Basic Generator Control loops with reference to AGC in PSOC. **(05 Marks)**

5 a. Obtain the Mathematical Model ALFC components Speed Governor, Turbine. **(10 Marks)**
b. Obtain the Transfer function of a AGC with Integral controller from its relevant block diagram representation of ALFC. **(10 Marks)**

6 a. Analyse the effects of changes in loads of two area ALFC system with primary loop. **(10 Marks)**
b. Obtain the state space Model of an Isolated system. **(10 Marks)**

7 a. Explain the state space Model for Two-Area ALFC system. **(12 Marks)**
b. Explain in brief the issues related in AGC implementation. **(08 Marks)**

8 a. With a suitable assumptions made in Two-Area ALFC system, obtain the Tie-line oscillations formula and analyse different damping conditions. **(10 Marks)**

b. Two Area ALFC control system has follows data Area :

i) Area① : $R_1 = 0.1$pu, $D_1 = 0.8$pu, $MVA_{1rated} = 1500$

ii) Area② : $R_2 = 0.098$pu, $D_2 = 0.9$pu $MVA_{2rated} = 500$

In Area – 1 Load increase = 100mW. Find steady state frequency and Tie- line power flow change. **(06 Marks)**

c. Write an explanatory note on production absorption of reactive power and listout the methods of voltage control in power system operation and controls. **(04 Marks)**

9 a. Explain the power system reliability and system security levels. **(10 Marks)**

b. Write a note on Reliability cost, LOLE, LOEE, LOLF, and LOLD. **(10 Marks)**

10 a. With a suitable flow chart explain the contingency analysis procedure. **(10 Marks)**

b. What are the state variables, measurements involved in state estimator, explain in brief state estimation problem formulation. **(10 Marks)**

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17EE82

Eighth Semester B.E. Degree Examination, July/August 2021
Industrial Drives and Applications

Time: 3 hrs. Max. Marks: 100

Note: ***Answer any FIVE full questions.***

1 a. Explain the speed control conventions and four quadrant operation of motor driving a hoist load. **(08 Marks)**

b. Explain different power modulators that are used in drive system. **(04 Marks)**

c. A drive has the following parameters J = 10 kg-m^2, T = 15 + 0.05N, T_l = 5 + 0.06N N-m. Initially drive is working in steady state. Now the drive is braked by electrical braking. Torque of the motor during braking is given by T = -10 – 0.04N N-m. Calculate the time taken to stop. **(08 Marks)**

2 a. Obtain the fundamental torque equation of a motor load system. **(06 Marks)**

b. Explain closed loop speed control of drives. **(06 Marks)**

c. A weight of 500kg is being lifted up at a uniform speed of 1.5 m/sec by a winch driven by a motor running at a speed of 1000rpm. Moment of inertia of the motor and winch are 0.5 and 0.3 kg-m^2 respectively. Calculate the motor torque and equivalent moment of inertia referred to motor shaft. In the absence of weight motor develops a toque of 100Nm when running at 1000rpm. Assume efficiency of winch = 100%. **(08 Marks)**

3 a. Develop an expression of overloading factor K while selecting the motor rating for short time duty. **(10 Marks)**

b. A 220V, 960rpm, 12.8A separately excited dc motor has R_a = 2Ω, L_a = 150mH. It is fed from a 1 ϕ half controlled rectifier with an AC source voltage of 230V, 50Hz. Calculate:

i) Motor torque for firing angle = 60° and speed = 600rpm

ii) Motor speed for firing angle = 60° and toque = 20Nm. **(10 Marks)**

4 a. Explain chopper control of DC series motor for motoring and regenerative operation. **(10 Marks)**

b. Select the motor for driving the equipment which has the load curve shown in Fig.Q.4(b). Last 46 sec torque is constant at 8N-m. **(10 Marks)**

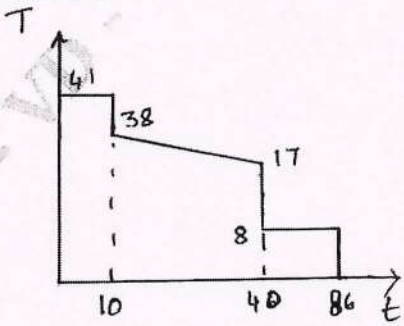

Fig.Q.4(b)

5 a. Describe the operation of induction motor operating with unbalanced voltages. **(10 Marks)**

b. A 400V, Y connected, 3 phase, 6 pole, 50Hz induction motor has following parameters referred to stator: $R_s = R'_r = 1\Omega$, $X_s = X'_r = 2\Omega$. For regenerative braking operation of this motor determine:

i) Maximum overhauling torque it can hold and range of speed for safe operation.

ii) Speed at which it will hold an overhauling load with a toque of 100N-m. **(10 Marks)**

6 a. Explain variable frequency control of induction motor with relevant diagram. **(08 Marks)**

b. A 2200V, 2600kW, 735rpm, 50Hz, 8pole, 3phase squirrel cage induction motor has following parameters referred to the stator $R_s = 0.075\Omega$, $R'_r = 0.1\Omega$, $X_s = 0.45\Omega$, $X'_r = 0.55\Omega$ stator winding is delta connected.

i) Calculate starting torque and maximum torque as a ratio of rated torque, if the motor is started by star delta starting what is the maximum value of line current during starting?

ii) Calculate transformation ratio of an auto transformer so as to limit the maximum starting current to twice the rated value. **(12 Marks)**

7 a. Explain the braking and multiquadrant operation of voltage source inverter fed induction motor. **(10 Marks)**

b. Explain pull in process in synchronous motor operation from fixed frequency supply. **(10 Marks)**

8 a. Describe the current source inverter control of induction motor. **(10 Marks)**

b. For inverter fed induction motor drive calculate approximate values of

i) Speed for a frequency of 30Hz and 80% of full load torque

ii) Frequency for a speed of 40Hz and speed of 1100rpm.

Given data for induction motor:
Y connected, 400V, 50Hz, 4 pole, 1370rpm. **(10 Marks)**

9 a. Explain the self controlled synchronous motor drive, employing load commutated thyristor inverter. **(10 Marks)**

b. Explain brushless DC motor drive for servo applications. **(10 Marks)**

10 a. With a neat block diagram, explain the true synchronous mode variable frequency control of multiple synchronous motor drive. **(10 Marks)**

b. Explain the drive requirements of cranes and hoist drive. **(10 Marks)**

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17EE831

Eighth Semester B.E. Degree Examination, July/August 2021
Smart Grid

Time: 3 hrs. Max. Marks: 100

Note: ***Answer any FIVE full questions.***

1 a. Define Smart Grid. Compare Today's grid with Smart grid. **(08 Marks)**
b. What are the functions of Smartgrid components and explain in details. **(12 Marks)**

2 a. Explain with neat diagram Multiagent System Technology (MAS) implementation and Specification. **(12 Marks)**
b. Explain load flow for Smartgrid design with flow chart. **(08 Marks)**

3 a. Explain the strength and weakness of existing voltage stability analysis tools. **(10 Marks)**
b. Explain optimizing stability constraint through preventive control of voltage stability with flow chart. **(10 Marks)**

4 a. Explain voltage stability Assessment Techniques. **(10 Marks)**
b. Explain "Angle Stability Assessment". **(10 Marks)**

5 a. Explain classical optimization methods in detail. **(10 Marks)**
b. Explain Heuristic optimization in detail. **(10 Marks)**

6 a. Explain general level of automation required for an effective operation of smartgrid. **(10 Marks)**
b. Explain different types of evolutionary computational techniques in detail. **(10 Marks)**

7 a. What are the sustainable energy options for the Smart Grid? Explain. **(10 Marks)**
b. Write a short note on:
i) Electric vehicles and plug in Hybrids
ii) PHEV Technology. **(10 Marks)**

8 a. What is interoperability? Explain state of the art and model for interoperability in the Smart Grid Environment. **(10 Marks)**
b. Explain in detail Smart Grid cyber security. **(10 Marks)**

9 a. Explain Research areas for Smart Grid development. **(10 Marks)**
b. List out Research and Multidisciplinary Research activities in Smart grid. **(10 Marks)**

10 a. Explain approach for Smart Grid Applications in detail. **(10 Marks)**
b. What are the challenges faced in Smart transmission and Benefits of Smart transmission. **(10 Marks)**

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