Total Pages: 2

Reg No.:_____ Name:_____

APJ ABDUL KALAM TECHNOLOGICAL UNIVERSITY
FIFTH SEMESTER B.TECH DEGREE EXAMINATION, DECEMBER 2017

Course Code: EE301

Course Name: POWER GENERATION, TRANSMISSION AND PROTECTION(EE)

Max. Marks: 100 Duration: 3 Hours

PART A

Answer all questions, each carries5 marks.

1		Write using figures and equations how the power factor is improved using capacitors in power system.	(5)
2	a)	A 3 phase 80km long Transmission line has its conductors of 1cm diameter spaced at the corners of the equilateral triangle of 100cm side. Find the inductance per phase of the system.	(3)
	b)	Define Ferranti effect.	(2)
3		Derive the equation for Sag in transmission lines, when the support is at equal and unequal heights.	(5)
4		Explain different types of DC links.	(5)
5		Define the terms Restriking voltage, Recovery voltage, Zones of protection, properties of SF_6 gas	(5)
6		Draw the block diagram of microprocessor based over current relay.	(5)
7		Explain Insulation Coordination.	(5)
8		Explain Buchholz Relay and write its importance in Transformer protection.	(5)

PART B

Answer any twofull questions, each carries10 marks.

9	a)	Explain Hydro Electric power plants using a neat sketch.	(6)
	b)	Explain the term Load factor, Load curve and write its features.	(4)
10	a)	What do you mean by Voltage Regulation and Efficiency of power transmission.	(3)
	b)	Derive the ABCD Constants for medium length lines using nominal π method draw its phasor diagram.	(7)
11	a)	Derive the L-L Capacitance of a two wire line.	(4)
	b)	A 3phase, 50 Hz, 132 kV OH Line has conductors placed in a horizontal plane 4m apart. Conductor diameter is 2 cm. If the line length is 100km calculate the charging currents per phase assuming complete transposition.	(6)

PART C

Answer any twofull questions, each carries10 marks.

12	a)	Find the optimum transmission voltage in power system for transmission and write its empirical formulae.	(4)
	b)	Explain corona and derive the equation for disruptive critical voltage and visual critical voltage.	(6)
13	a)	Explain with figures the configuration of **TCSC.**	(4)
	b)	Explain Intersheath grading of cables using figures.	(6)
14	a)	Explain different types of insulators used for transmission and distribution.	(3)
	b)	State the methods of improving string efficiency.	(3)

c) Each line of a 3-phase system is suspended by a string of 3 similar insulators. If the voltage across the line unit is 17.5 kV, calculate line to neutral voltage. Assume that the shunt capacitance between each insulator and earth is $1/8^{th}$ of the capacitance of the insulator itself. Also find the string efficiency. (4)

PART D

Answer any twofull questions, each carries 10 marks.

15 a) Explain the Operation the Vacuum CB using a neat sketch and write its advantages. (6)

b) Explain any two types of Amplitude Comparators. (4)

16 a) Explain Carrier – Current protection Scheme for long transmission lines. (4)

b) Explain the characteristics features of Surge Diverters and explain any two types of Surge Diverters. (6)

17 a) Drive the Essential Qualities of Protective relays. (3)

b) Explain using phasor diagram the directional feature of relays. (3)

c) A 2 wire dc ring distributor is 300m long and is fed at 240V at point A. At point B, 150m from A, a load of 120A is taken and at C, 100m in the opposite direction from A, a load of 80A is taken. If the resistance per 100m of single conductor is 0.03Ω find: (4)

i)Current in each section of distributor ii) Voltage at points B and C.

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Reg No.:_____ Name:_____

APJ ABDUL KALAM TECHNOLOGICAL UNIVERSITY

FIFTH SEMESTER B.TECH DEGREE EXAMINATION, APRIL 2018

Course Code: EE301

Course Name: POWER GENERATION, TRANSMISSION AND PROTECTION (EE)

Max. Marks: 100 Duration: 3 Hours

PART A

Answer all questions, each carries 5 marks Marks

1		Explain the significance of load factor and diversity factor.	(5)
2		Derive an expression for capacitance of a single-phase transmission line.	(5)
3		Compare the volume of conductor required for a two-wire dc system with a single phase two wire ac system.	(5)
4		Explain the different methods of grading of underground cables.	(5)
5		Derive an expression for rate of rise of restriking voltage in circuit breakers.	(5)
6		With the help of a block diagram, explain the working of a microprocessor based relay.	(5)
7		With the help of a diagram, explain the percentage differential protection used in transformers.	(5)
8		Explain the different causes of over voltages in power system.	(5)

PART B

Answer any two full questions, each carries 10 marks

9	a)	With the help of a block diagram, explain the working of a thermal power plant.	(5)
	b)	A power station is to supply four regions of loads whose peak values are 10,000 kW, 5000 kW, 8000 kW and 7000 kW. The diversity factor of the load at the station is 1.5 and the average annual load factor is 60%. Calculate the maximum demand on the station and annual energy supplied from the station.	(5)
10	a)	With the help of a block diagram, explain the working of a wind energy conversion system.	(5)
	b)	A three phase, 50 Hz, 3300 V, star connected induction motor develops 250HP, the power factor being 0.707 lagging and the efficiency 0.86. Three capacitors in delta are connected across the supply terminals and power factor is raised to 0.9 lagging. Calculate: i) The kVAR rating of the capacitor bank and ii) The capacitance of each unit.	(5)
11	a)	Derive an expression for inductance of a three-phase transmission line with unsymmetrical spacing.	(5)
	b)	A three phase, 66 kV, 50 Hz line has a resistance of 9.6Ω, inductance of 0.097H and capacitance of 0.765 μF per phase respectively. It delivers 24 MVA at 66 kV at 0.8 power factor lagging. Find the voltage regulation and transmission efficiency. Use nominal T method.	(5)

PART C

Answer any two full questions, each carries 10 marks

12 a) An overhead line has a span of 122m, the diameter of the conductor is 1.15 cm. Calculate the sag at mid span when the conductors have an ice coating of 0.96 cm thick and the wind pressure is 382 N/m^2 of projected area. The weight of conductor is 5.83 N/m, ice weighs 8920 N/m^3 and the permissible tension is 3.56 x 10^4 N. (5)

b) A string has five suspension discs. The capacitance between each unit and earth is one-fifth of the mutual capacitance: (5)
i) Find the voltages across different discs as percent of total string voltage
ii) Find the string efficiency.

13 a) Differentiate between disruptive critical voltage and visual critical voltage. (3)

b) What are the factors affecting corona? (3)

c) Explain the working of any two FACTS devices. (4)

14 a) What are the advantages of dc transmission over ac transmission? (2)

b) Explain the different types of dc links. (2)

c) A 2.2 km long, 11 kV, 3 phase, 3 – core, belted cable gave the following results in a test for capacitance: (6)
Capacitance between two conductors joined to sheath and the third conductor is 1.5μF and capacitance between all the three conductors joined and sheath is1.8 μF. Find:
i) Effective capacitance of each core to neutral and
ii) Capacitance between any two cores

PART D

Answer any two full questions, each carries 10 marks

15 a) With the help of a diagram, explain the working of a vacuum circuit breaker. (4)

b) With the help of a block diagram, explain the working of a static over current relay. (6)

16 a) With the help of a diagram, explain the working of a watt hour meter type electromagnetic relay. (5)

b) With the help of a neat diagram, explain the working of a Buchholz Relay (5)

17 a) With the help of a diagram, explain the working of a surge diverter. (4)

b) A single-phase a. c. distributor AB is fed from end A and has a total impedance of (0.2 + j3) Ω. At the far end, the voltage V_B = 240V and the current is 100 A at a power factor of 0.8 lagging. At the midpoint M, a current of 100 A is tapped at a power factor of 0.6 lagging with reference to the voltage V_M at the midpoint. Calculate the supply voltage V_A and phase angle between V_A and V_B. (6)

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Reg No.:_____ Name:_____

APJ ABDUL KALAM TECHNOLOGICAL UNIVERSITY

FIFTH SEMESTER B.TECH DEGREE EXAMINATION, DECEMBER 2018

Course Code: EE301

Course Name: POWER GENERATION, TRANSMISSION AND PROTECTION

Max. Marks: 100 Duration: 3 Hours

PART A

Answer all questions, each carries5 marks. Marks

1		With the help of a block diagram explain wind power generation	(5)
2		What is transposition of lines? Comment on its necessity in the system.	(5)
3		Comment on the effect of wind and ice loading on transmission line with respect to change in sag calculation.	(5)
4		List the advantages and disadvantages of HVDC transmission.	(5)
5		Clarify the term duality in terms of amplitude and phase comparators.	(5)
6		Discuss the problems associated with capacitive current chopping.	(5)
7		State the main types of distribution systems and compare their applications.	(5)
8		What is meant by earth fault protection of an alternator? How is it implemented?	(5)

PART B

Answer any two full questions, each carries 10 marks.

9	a)	A proposed station has the following load cycle: Time in hours: 6-8 8-11 11-16 16-19 19-22 22-24 24-6 Load in MW: 20 40 50 35 70 40 20 Draw the load curve and select suitable generator units from 10,000, 20,000, 25,000, 30,000 kVA. Prepare the operation schedule for the selected machines and determine the load factor from the curve.	(5)
	b)	State Skin Effect and Ferranti Effect and elucidate them with necessary diagrams	(5)
10	a)	Enlighten upon the various components and their operation in a hydroelectric power plant for energy production.	(5)
	b)	Derive the expression for capacitance in a single phase overhead line under the influence of earth effect.	(5)
11	a)	Mention the merits and demerits of solar power generation in bulk and explain with respect to live examples.	(5)
	b)	Classify transmission lines according to their length and enlist the line models. Derive the ABCD constants for medium lines using nominal π method.	(5)

PART C

Answer any two full questions, each carries 10 marks.

12 a) Illustrate the methods used for improving string efficiency of overhead line insulators. (5)

b) Derive the expressions for capacitance and insulation resistance of a single core cable. (5)

13 a) Explain the advantages and disadvantages of corona. (5)

b) With the aid of single line diagrams, differentiate between mono polar and bipolar types of HVDC links. Comment on their use in the system. (5)

14 a) Discuss the various conductor materials used for overhead lines. What are their relative merits and demerits? (5)

b) Draw the configuration of FC+TCR. Explain its operation. (5)

PART D

Answer any two full questions, each carries 10 marks.

15 a) Derive the expression for Rate of Rise of Restriking Voltage. (5)

b) What factors cause difficulty in applying circulating current principle to a power transformer? (5)

16 a) With a neat diagram, explain the arc extinction in VCB. (5)

b) Explain the working of a surge diverter. (5)

17 a) Explain the operation of a microprocessor based over-current relay with the aid of a block diagram. (5)

b) A single phase distributor AB has a total impedance of $(0.1 + j0.2)\Omega$. At the far end B, a current of 80A at 0.8 p.f. lagging and at mid-point C a current of 100A at 0.6 p.f. lagging are tapped. If the voltage of the far end is maintained at 200V, determine: (i) Supply end voltage V_A and (ii) Phase angle between V_A and V_B. The load power factors are with respect to the voltage at the far end. (5)

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Reg No.:_____ Name:_____

APJ ABDUL KALAM TECHNOLOGICAL UNIVERSITY

FIFTH SEMESTER B.TECH DEGREE EXAMINATION(S), MAY 2019

Course Code: EE301

Course Name: POWER GENERATION, TRANSMISSION AND PROTECTION

Max. Marks: 100 Duration: 3 Hours

PART A

Answer all questions, each carries5 marks. Marks

1		What are the limiting factors in tapping the wind and solar potential?	(5)
2		Explain the principle and causes of proximity effect and Ferranti effect using appropriate figures	(5)
3		What are the critical voltages in the formation of Corona? What is the effect of Corona?	(5)
4		With a neat cross sectional view show the constructional features of an EHT Cable.	(5)
5		What are the essential qualities required by any insulating medium used for arc quenching? What are the usual insulating media used?	(5)
6		Explain the significant features of a Microprocessor based relay.	(5)
7		What makes the differential protection very significant in the protection schemes of electrical machines and transformers?	(5)
8		Calculate the voltage drop and Power loss for a radial load of 120A, 0.8 pf lag supplied by a 6.6kV Three Phase system with a branch impedance of 2 +j2 ohms.	(5)

PART B

Answer any two full questions, each carries10 marks.

9	a)	With a neat sketch explain the principle of working of a High Head Hydro-electric Power Station.	(5)
	b)	An 80 km long transmission line has a series impedance of (0.15+j0.75) ohm per km and a shunt admittance of j5.1 x 10^{-6} ohm per km. Find the A, B, C, D parameters by Nominal Pi method.	(5)
10	a)	Derive the inductance of a single phase transmission line with three conductors arranged vertically in Side A and two conductors in Side B. The distance between adjacent conductors in each Side is 6m and that between the	(5)

sides are 8m. Each conductor is of radius 0.3cm.

b) A generating station has the following maximum loads: 16000kW, 12000kW, 10000kW, 7000kW and 800kW. The annual load factor is 50%. Calculate the diversity factor and annual energy consumption if the maximum demand on the station is noted as 24000kW. (5)

11 a) A 3-phase 500-HP 50Hz, 11kV star connected induction motor has a full load efficiency of 85% and a lagging p.f. of 0.8. It is connected to a feeder and it is desired to correct the p.f. to 0.95 lagging. Determine : (5)

(i) The Capacitor bank rating in kVAR and

(ii) The capacitance of each unit if the units are connected in Star.

b) Derive the Capacitance of a single phase overhead transmission line considering the effect of earth. (5)

PART C

Answer any two full questions, each carries10 marks.

12 a) Following results are obtained by making experiments on three phase, three core metal sheathed cable: (5)

(a) Capacitance between all the three bunched conductors and sheath is 1.2 micro Farad.

(b) Capacitance between any one conductor and sheath and the other two being insulated is 0.8 micro Farad.

Calculate the capacitance (C) between any two conductors when the third conductor is connected to the sheath.

b) A transmission line conductor at a river crossing is supported from two towers at a height of 45m and 75m above the water level. The span length is 300m. Weight of the conductor is 0.85kg/m. Determine the clearance between the conductor and water at a point midway between towers if the tension in the conductor is 2050kg. (5)

13 a) What is the expansion of FACTS? What are the devices used as FACTS devices? Why are they significant in the present scenario? (5)

b) A three phase overhead transmission line is supported by three disc suspension insulators. The potentials across the first and second insulator are 9kV and 12kV respectively. Find out: (5)

(i) The line voltage and

(ii) The string efficiency

14 a) What are the advantages and disadvantages of HVDC transmission systems? (4)

b) Derive Kelvin's law for conductors (4)

c) What are the advantages of bundling of conductors? (2)

PART D

Answer any two full questions, each carries 10 marks.

15 a) In a short circuit test on a 132kV three phase system, the breaker gave the following result: power factor of the fault =0.6, recovery voltage 0.97of full line value; the breaking current is symmetrical and the restriking transient had a natural frequency of 16kHz. Determine the rate of rise of restriking voltage. Assume that the fault is grounded. (6)

b) Derive the equations for voltage drop and current loss in a two wire ring main distributor supplied by (i) DC and (ii) AC Voltages. (4)

16 a) With a neat sketch explain the principle of operation of an Air Blast Circuit Breaker (5)

b) What are the primary causes of over voltages? How are the equipments protected from over voltages? (5)

17 a) Explain the principle of operation of a static over current relay. (5)

b) What are the three main protection aspects included in the protection of alternators? Why are they significant? (5)

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Reg No.:_____ Name:_____

APJ ABDUL KALAM TECHNOLOGICAL UNIVERSITY

FIFTH SEMESTER B.TECH DEGREE EXAMINATION(R&S), DECEMBER 2019

Course Code: EE301

Course Name: POWER GENERATION, TRANSMISSION AND PROTECTION

Max. Marks: 100 Duration: 3 Hours

PART A

Answer all questions, each carries5 marks. Marks

1		What is Load curve. Explain the significance of Load curve.	(5)
2		Derive an expression for the capacitance of a single phase transmission line.	(5)
3		Each line of a 3-phase system is suspended by a string of three similar insulators. If the voltage across the line unit is 17.5kV. Calculate the line to neutral voltage. Assume that the shunt capacitance between each insulator and earth is $1/8^{th}$ of the capacitance of the insulator itself. Also calculate the string efficiency.	(5)
4		Explain TCR configuration	(5)
5		A circuit breaker interrupts the magnetising current of 100MVA transformer at 220kV.The magnetising current of the transformer is 5% of the full load current. Determine the maximum voltage which may appear across the gap of the breaker when the magnetising current is interrupted at 53% of its peak value. The stray capacitance is 2500μF.The inductance is 30H.	(5)
6		With the help of a block diagram explain the working of a microprocessor based over current relay.	(5)
7		With help of a neat diagram explain the working of a Buchholz relay.	(5)
8		Distinguish between radial and ring main distribution systems. Enlist their advantages and disadvantages.	(5)

PART B

Answer any twofull questions, each carries10 marks.

9	a)	With a neat figure explain the working of Hydro electric power plant.	(6)
	b)	A power station has a maximum demand of 15000kW.The annual load factor is 50% and capacity factor is 40%. Determine the reserve capacity of the plant.	(4)

10 a) Power Factor of a 3-φ load of 25kW at 415V, 50Hz is to be improved from 0.6 to 0.9. Calculate the value of the capacitance required in each branch , if the capacitor bank is in delta configuration. (6)

b) Explain Ferranti Effect. (4)

11 a) Derive an expression for the inductance of an isolated current carrying conductor. (5)

b) A 15km long 3 phase line has a resistance of 5.31ohms per phase and inductive reactance of 5.54ohms per phase. The sending end voltage is 11kV.The receiving end load is 1200kW at a power factor of 0.8 lagging. Find the receiving end voltage and line current.(Sending end and receiving end are star connected) (5)

PART C

Answer any twofull questions, each carries10 marks.

12 a) A two conductor cable 1km long is required to supply a constant current of 200A throughout the year. The cost of cable including installation is Rs. (20a+20)per metre where a is the area of cross section of the conductor in cm^2. The cost of energy is 5P per kWh and interest and depreciation charges amount to 10%. Calculate the most economical conductor size. Assume resistivity of conductor material is 1.73μΩcm. (5)

b) What is Corona? What are the factors affecting Corona? What are the methods to reduce Corona. (5)

13 a) The capacitances of a 3-phase belted cable are 12.6μF between the three cores bunched together and the lead sheath and 7.4μF between one core and the other two connected to sheath. Find the charging current drawn by the cable when connected to 66kV, 50Hz, star connected supply. (6)

b) What are the advantages of dc transmission over ac transmission. (4)

14 a) Explain the configuration of a TCSC (4)

b) A transmission line at a river crossing is supported by two towers 50m and 55mabove water level. The horizontal distance between towers is 300m. The tension in the conductor is 2000kg and weight of conductor is 0.85 kg/m. a) Find the minimum clearance between conductor and water b) Determine the position of minimum clearance. (6)

PART D

Answer any twofull questions, each carries 10 marks.

15 a) With the help of a neat diagram explain the working of Puffer type SF_6 circuit breaker. (4)

b) In a 220kV system, the reactance and capacitance up to the location of circuit breaker is 8Ω and 0.025μF respectively. A resistance of 600Ω is connected across the contacts of the circuit breaker. Determine the following. (6)

a)Natural frequency of oscillation

b)Damped frequency of oscillation

c) Critical value of resistance which will give no transient oscillation.

16 a) With the help of neat diagram explain the working of a watt hour metre type electromagnetic relay. (5)

b) With the help of a neat diagram explain the working of percentage differential protection used in transformer. (5)

17 a) An 11kV, 100MVA alternator is provided with differential protection. The percentage of winding to be protected against phase to ground fault is 85%. 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 connection. (5)

b) With the help of a neat diagram explain the working of a surge diverter. (5)

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Reg No.:_____ Name:_____

APJ ABDUL KALAM TECHNOLOGICAL UNIVERSITY

B.Tech S5 (S) Examination September 2020

Course Code: EE301
Course Name: POWER GENERATION, TRANSMISSION AND PROTECTION

Max. Marks: 100 Duration: 3 Hours

PART A

Answer all questions, each carries5 marks. Marks

1		Explain the general arrangement and operation of a hydro electric power plant.	(5)
2		The receiving end voltage of an unloaded long line may be more than the sending end voltage. Explain this phenomenon with the help of a phasor diagram.	(5)
3		Explain Kelvin's law. What are its limitations?	(5)
4		Describe the phenomenon of corona. Explain any three factors which affect corona loss.	(5)
5		Explain the arc quenching theorems in a circuit breaker.	(5)
6		Explain the fundamental requirements of protective relaying.	(5)
7		Differentiate between surge diverter and surge absorber. What are the characteristics of an ideal surge diverter.	(5)
8		Explain briefly various systems of primary distribution in the case of ac.	(5)

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PART B

Answer any two full questions, each carries 10 marks.

9	a)	Define the term Diversity factor and prove that the load factor of a supply system is improved by an increase in diversity of load.	(5)
	b)	Find the sending end voltage and voltage regulation of a 250 km, 3 phase, 50 Hz transmission line delivering 25 MVA at 0.8 pf lag to a balanced load at 132 kV. The inductance of the line is 1.25mH/km/ph and the shunt capacitance is 0.0095 μF/km/ph. Use nominal π method.	(5)
10	a)	From first principles, derive the equation for the loop inductance of a single phase over head line.	(5)
	b)	A synchronous motor improves the power factor of a load of 250 kW from 0.75	(5)

to 0.9 lagging. Simultaneously the motor carries a load of 100 kW. Find (1) the leading KVAR taken by the motor (2) KVA rating of the motor and pf at which the motor operates.

11 a) With the help of block diagrams explain the working of a solar power plant and a wind power plant. (5)

b) Derive the capacitance of a single phase transmission line, considering the effect of earth. (5)

PART C

Answer any two full questions, each carries 10 marks.

12 a) Explain the configuration of FC+ TCR. (5)

b) A single core cable has a conductor radius 2 cm and inside sheath radius 4 cm. It is provided with one inter heath so that limits of maximum and minimum electric stresses is the same in the two layers of dielectric. The system voltage is 66kV, 3 phase. (5)

Find (a) the radius of inter sheath and its voltage (b) the ratio of maximum electric stress with and without inter sheath.

13 a) Explain the power transfer equations in ac transmission and dc transmission. (5)

b) A string of 5 suspension insulators is to be graded for obtaining uniform voltage distribution across the string. If the pin to earth capacitance are all equal to C and the mutual capacitance of the top insulator is 10 C, find the mutual capacitance of each unit in terms of C. (5)

14 a) Classify the types of HVDC links and explain the construction and working of each type with the help of necessary diagrams. (5)

b) Assuming that the shape of an over head line can be approximated by a parabola, derive the expression for sag. How the effect of wind and ice loadings can be taken into account. (5)

PART D

Answer any two full questions, each carries 10 marks.

15 a) Compare the arc rupture in oil and air blast circuit breakers and summarize the relative advantages and disadvantages of these types of switch gears. (5)

b) With the help of a neat diagram explain the Buchholz's protection for transformers. (5)

16 a) Explain how an amplitude comparator can be converted to a phase comparator and vice versa. (5)

	b)	What are the causes of over voltages arising on a power system?	(3)
	c)	Explain the term insulation co ordination.	(2)
17	a)	Draw a neat sketch of an induction disc relay and explain its construction and operation.	(5)
	b)	A dc two wire distributor AB of 300m long is fed at both ends A and B. It supplies uniformly distributed load of 0.15A/m and concentrated loads of 50A, 60A and 40A at distances of 75m, 175m and 225m respectively from the end A. The potentials of feeding points A and B are 206 V and 200 V respectively. The resistance of each wire is 0.00015 ohm/m. Find the currents fed at points A and B.	(5)

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