Mid-Term Examination

Programme: B.TECH (Electrical Engg.)
Course Name: CAD of Power Apparatus and System
Maximum Marks: 40

Year/Semester: 2018/5th
Course Code: EEN 304
Time allowed: 1.5 Hours

Notes :

(1) All questions are compulsory.
(2) Unless stated otherwise, the symbols have their usual meanings in context with subject. Assume suitably and state, additional data required, if any.
(3) The candidates, before starting to write the solutions, should please check the question paper for any discrepancy, and also ensure that they have been delivered the question paper of right **course code**.

Q 1 Estimate the main dimensions of the core and yoke, no. of turns and conductor areas of the windings of a 3 phase delta/star core type transformer rated at 300KVA, 6600/440 V, 50 Hz . A cruciform core having a circumscribing circle of 0.25 m diameter and a leg spacing of 0.4m is available. The emf per turn is 8.5 V. Assume a current density of 2.5 A/mm^2
a window space factor of 0.28 and flux density of 1.4 Wb/[redacted]m^2. (10)

Q 2 Calculate the Back pitch, Front pitch and Winding pitch for a 4 pole, 15 slot, 15 coil , double layer simplex wave winding of a d.c generator. Draw the winding table & sequence diagram and indicate the position of brushes on the sequence diagram. (10)

Q3 Justify the following (12)

i. Voltage Regulation of power transformer is worse [redacted] than distribution transformer.
ii. Cores of transformers are stepped.
iii. Tappings are provided on high voltage winding of transformers.
iv. Area of Yoke can be increased by 15-20% when using hot rolled steels for core.

Q4 A) Develop the output equation for a three phase transformer. (5)

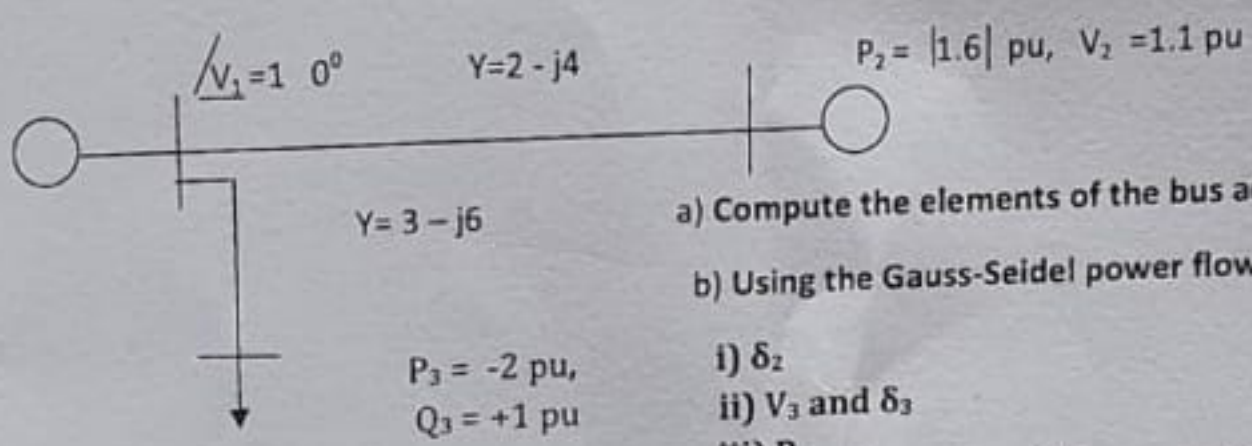
B) A 300 KVA, 6600/400V , 50 Hz ,3 phase delta/star core type transformer has the following data:-
Width of L.V. winding =16mm, Width of H.V. winding =25mm, Width of duct between H.V and L.V. winding =15mm, Height of coils = 0.5m , No. of H..V. winding turns=830, length of mean turn= 0.9m. Estimate the leakage reactance of the transformer referred to H.V side. (3)

PEC (DEEMED TO BE UNIVERSITY)
Mid-Term Examination

Programme: **B.E (ELECTRICAL)**
Course Name: **CAPSA**
Max Marks: **20**

Year/Semester: **2019/5th Sem**
Course Code: **EEN 301**
Time allowed: **1.5 Hours**

1(a) Consider the simple 3-bus power system given below:



a) **Compute the elements of the bus admittance matrix Y_{bus}**

b) **Using the Gauss-Seidel power flows method,calculate :**

i) δ_2
ii) V_3 and δ_3
iii) P_1

Perform the calculations for atleast two iterations.

(b) How the Acceleration factor in G-S method modifies the algorithm for the load flow problem? (8,2)

2(a) Compare the Newton-Raphson and the Fast De-coupled Power methods for power-flow studies, point-wise, detailing the similarities and dissimilarities.

(b) A 11kV/132kV, 50 MVA, three-phase transformer has an inductive reactance of j0.005 Ω referred to the primary (11 kV).Calculate the p.u value of reactance based on the rating. Neglect resistance.

c) List out the four advantages of pu method with proper justification of each point. (5,3,2)

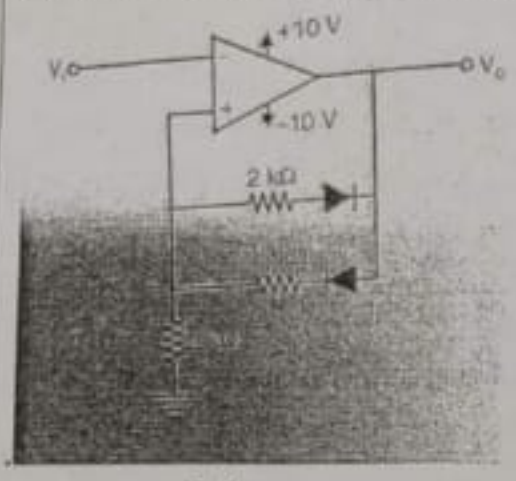
(c) Write a program to add two numbers and store the results at 5000H. 3

(d) Design a circuit with op-amps and LEDs such that 5

voltage	LED1	LED2	LED3
Vi<3V	on	off	off
3V<Vi<6V	off	on	off
Vi>6V	off	off	on

(e) Derive the expression for hysteresis width in Schmitt trigger. Draw the transfer characteristics for the given cicuit in fig(i). 5

(f) What is signal conditioning? Explain the different signal conditioning processes. 5



fig(i)

Mid-Term Examination

Programme: B.TECH (Electrical Engg.)
Course Name: CAD of Power Apparatus and System
Maximum Marks: 40

Year/Semester: 2018/5th
Course Code: EEN 304
Time allowed: 1.5 Hours

Notes :

(1) All questions are compulsory.
(2) Unless stated otherwise, the symbols have their usual meanings in context with subject. Assume suitably and state, additional data required, if any.
(3) The candidates, before starting to write the solutions, should please check the question paper for any discrepancy, and also ensure that they have been delivered the question paper of right **course code**.

Q 1 Estimate the main dimensions of the core and yoke, no. of turns and conductor areas of the windings of a 3 phase delta/star core type transformer rated at 300KVA, 6600/440 V, 50 Hz . A cruciform core having a circumscribing circle of 0.25 m diameter and a leg spacing of 0.4m is available. The emf per turn is 8.5 V. Assume a current density of 2.5 A/mm^2
a window space factor of 0.28 and flux density of 1.4 Wb/[redacted]m^2. (10)

Q 2 Calculate the Back pitch, Front pitch and Winding pitch for a 4 pole, 15 slot, 15 coil , double layer simplex wave winding of a d.c generator. Draw the winding table & sequence diagram and indicate the position of brushes on the sequence diagram. (10)

Q3 Justify the following (12)

i. Voltage Regulation of power transformer is worse [redacted] than distribution transformer.
ii. Cores of transformers are stepped.
iii. Tappings are provided on high voltage winding of transformers.
iv. Area of Yoke can be increased by 15-20% when using hot rolled steels for core.

Q4 A) Develop the output equation for a three phase transformer. (5)

B) A 300 KVA, 6600/400V , 50 Hz ,3 phase delta/star core type transformer has the following data:-
Width of L.V. winding =16mm, Width of H.V. winding =25mm, Width of duct between H.V and L.V. winding =15mm, Height of coils = 0.5m , No. of H..V. winding turns=830, length of mean turn= 0.9m. Estimate the leakage reactance of the transformer referred to H.V side. (3)

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PUNJAB ENGINEERING COLLEGE, CHANDIGARH

PEC EXPLORE INNOVATE EXCEL

End-Term Examination

B Tech/5th Semester/ EEN313/ 30112019

Programme: B.Tech. (Electrical Engineering)
Course Name: Electric Drives
Maximum Marks: 100

Year/Semester: 3rd/ 5th
Course Code: EEN 313
Time Allowed: 3 Hours

Notes:

(1) All questions are compulsory.
(2) Unless stated otherwise, the symbols have their usual meanings in context with subject. Assume suitably and state, additional data required, if any.
(3) The candidates, before starting to write the solutions, should please check the question paper for any discrepancy, and also ensure that they have been delivered the question paper of right **course code.**
(4) **All parts of a question should be attempted in continuity.**

Q. No		Questions	Marks
1.	(a)	A motor operating with a suitable control system develops a torque given by the relation $T = a\omega_m + b$. The motor drives a load whose torque is given by the expression $T_L = c\omega_m^2 + d$, where a, b, c and d are positive real constants. (i) Find the equilibrium speeds in terms of the constants a, b, c and d. (ii) What relation must exist between the constants for the drive to have two positive real speeds? (iii) Will the drive be stable at the equilibrium points obtained in (i)?	8
	(b)	A 230 V, 500 rpm, 90 A separately excited dc motor has an armature resistance of 0.10 Ω. The motor is controlled by a chopper operating at 400 Hz. If the motor is regenerating, (i) Find the motor speed at the rated current and a duty ratio of 0.5. (ii) Calculate the maximum safe speed if the minimum value of the duty ratio is 0.1.	7
	(c)	Draw a neat circuit diagram of a single-phase PWM rectifier circuit. Also, plot output voltage and source current waveforms for equal pulse width modulated rectifier (assume that the load current is constant).	5
2.		A 3-phase, Y-connected, 50 Hz, 4-pole induction motor has the following parameters: $R_s = R_r' = 0.02\ \Omega$ and $X_s = X_r' = 0.10\ \Omega$. The motor is controlled by the variable frequency control with a constant (V/f) ratio.	8
	(a)	For an operating frequency of 10 Hz, calculate the starting torque and rotor current in terms of their values at the rated frequency.	7
	(b)	For an operating frequency of 10 Hz, calculate the maximum torque as a ratio of its value at the rated frequency for both motoring and braking.	5
	(c)	Comment on the results obtained in 2(a) and 2(b).	

Punjab Engineering College, Chandigarh
Mid-Term Examination

Programme: **B.E. (5th Sem)**
Course Name: Switchgear & Protection
Maximum Marks: 50

Year: Sep 2018
Course Code: **EEN 302**
Time allowed: **1.5 Hours**

Q.No.		Marks
1.	A 50 Hz, 11 kV, 3-phase alternator with earthed neutral has a reactance of 6 Ω/phase and is connected to a bus-bar through a CB. The distributed capacitance up to the location of the circuit breaker is 0.01 μF. Determine the following: a) Peak restriking voltage across the CB b) Frequency of oscillations c) Average RRRV upto the first peak	10
2.	Explain the cut-off characteristics of a fuse. Also explain the operation of a fuse for motor protection.	10
3.	Explain the construction and working of MOCB. Discuss its advantages and limitations. Also discuss the Axial flow and Cross flow of oil during arc interruption using suitable diagrams.	10
4.	Using suitable diagrams, explain the MHO type distance relay. Also derive its torque equation.	10
5.	A circuit breaker equipped with a 1000/5 CT is used to protect a 20 MVA transformer operating at 30% overload and feeding a 11 kV bus-bar. The feeder circuit breaker is also equipped with a 400/5 CT. Both the CTs feeding IDMTL relays have the following characteristics: PSM 2 3 3.4 5 10 15 20 Time (s): 10 6 5.6 4.1 3 2.5 2.2 The relay on the feeder circuit breaker has 125% plug setting and a TMS of 0.3. If a fault current of 5 kA flows from the transformer to the feeder, determine a) Operating time of feeder relay b) Suggest suitable plug setting of the transformer relay between the transformer relay and feeder relay.	10

3	(a)	A 3-phase, Y-connected, 4-pole, 50 Hz induction motor has the following constants (per phase equivalent circuit referred to the stator): $V_t = 230\ V, R_t = R_r' = 1\ \Omega, \quad X_t = X_r' = 2\ \Omega.$ Calculate the speed and current for an active load torque of 150 N-m if the motor is used for regenerative braking.	8
	(b)	If the motor is used for plugging, determine the braking torque and current for a speed of 1500 rpm.	7
	(c)	Based on the results obtained in 3(a) and 3(b), state which braking method is better and why?	5
4	(a)	Explain with the help of neat block diagram(s) how variable voltage and variable frequency sources are realized practically.	8
	(b)	Draw speed-torque curves of an induction machine operating in four quadrants (motoring, regenerative braking and plugging). Also, draw voltage, torque, power and slip speed curves for a constant stator current as a function of per unit frequency (from 0 to 2.0).	7
	(c)	What is motivation of vector control of an induction machine? Draw a neat block diagram of Direct Vector Control Scheme.	5
5	(a)	Draw properly labeled schematic diagram of the Kron's Primitive Machine. Create its voltage-current relation in matrix form.	8
	(b)	Prove that the electromagnetic torque produced by a separately excited dc machine is given by $T_e = \frac{P}{2} M_d i_a i_f$.	7
	(c)	A 5 kW, 400 V, 3-phase, 50-Hz, 4-pole induction motor is supplied with its rated and balanced voltages. Find the *dq0* axes steady-state stator voltages.	5

PEC UNIVERSITY OF TECHNOLOGY
Mid -Term Examination, September 2019

Programme: B.E (Electrical Engineering)
Course Name: Mechatronics
Maximum Marks: 30
All questions are compulsory.

Year/Semester: 2018-19(1st Sem)
Course Code: EEN-201
Time allowed: 1.50 Hours

Q. No.		Marks
1.	How will you convert an open loop control system for fan operation into a closed loop fan control(operation)system to maintain the desired speed of fan? Draw self-explanatory diagrams including its all elements for both systems.	(3+4)
2.	Why a unique identification is required for mechatronic intelligent system? Justify your each comment(s).	(3+3)
3.	What are capabilities required for an intelligent mechatronics system for its control? Write key words and justify them.	(3+4)
4.	Design an intelligent class room using resistive ,inductive and capacitive sensor(s)/transducer(s) for i,ii and iii, respectively to equip with following features : (i)opening and closing of door(s) (ii)sitting plan (iii)attendance Draw neat and self-explanatory diagrams only.	(3+3+3)

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Punjab Engineering College (Deemed to be University), Chandigarh
End-Term Examination

Programme: B.E. (Electrical Engineering) Year/Semester: 201819/4th
Course Name: Control Systems Course Code: EEN 210
Maximum Marks: 100 Time Allowed: 3 Hours

Notes:

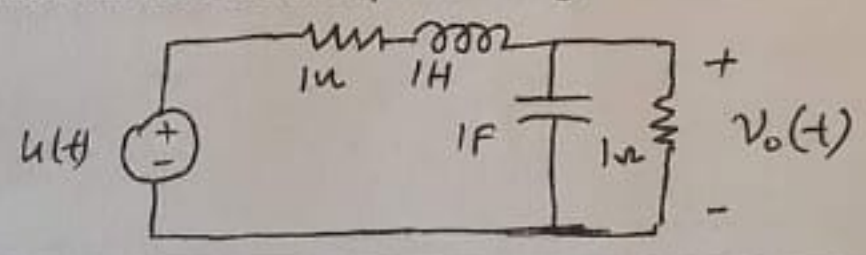
(1) All questions are compulsory.

(2) Unless stated otherwise, the symbols have their usual meanings in context with subject. Assume suitably and state, additional data required, if any.

(3) The candidates, before starting to write the solutions, should please check the question paper for any discrepancy, and also ensure that they have been delivered the question paper of right **course code**.

(4) **All parts of a question should be attempted in continuity.**

(5)

Q. No		Questions	Marks
1.	(a)	Compare open loop and closed loop control systems.	4
	(b)	Define transfer function. Derive transfer function of a circuit given below. Determine initial and final values of the capacitor voltage. 	10
	(c)	What is necessity of compensation? Draw pole-zero plot of lag and lead compensators.	6
2.	(a)	Use the root locus to select K so that the closed-loop poles have 0.707 damping for a unity feedback system having open loop transfer function as $G(s) = K/(s(s+4))$. Find the natural frequency of closed-loop poles. Use your value of K to find the percentage overshoot and rise time for the unit step input.	8
	(b)	Repeat 2 (a) if a compensator ($G_c = (s+8)$) is connected in cascade with G(s).	8
	(c)	Comment on the results obtained in 2 (a) & 2 (b).	4
3	(a)	For a unity feedback system, a forward path transmittance is given as $G(s) = 100(s+20)/(s(s+5)(s+40))$. Draw Bode plot of it.	12
	(b)	From the Bode plot of 3 (a), find the gain and phase margin.	4
	(c)	Comment on the stability of the system given in 3 (a).	4

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PEC UNIVERSITY OF TECHNOLOGY
End-Term Examination, Dec-2018

Programme: **B.E (ELECTRICAL)** Semester: 3rd
Course Name: Mechatronics Course Code: **EEN- 201**
Maximum Marks: 100 Time allowed: **3 Hours**

Note:

- All questions are compulsory.
- The candidates, before starting to write the solutions, should please check the question paper for any discrepancy, and also ensure that they have been delivered the question paper of right **course code**.

Q. No.		Marks
1.	(a)Define system. Explain various types of mechanistic system. (b)What are requirements of intelligent system functioning? Justify your answer in each case. (c)Design a process control intelligent system using PLC for detergent cake. Write down the ladder program for pouring liquid 1 and liquid 2 at level L1 and level L2 followed by a stirrer. A heater is started after delay D. Drain out the mixture to prepare detergent cake after 2hrs of heating. (d)What do you understand by SCADA? Explain in brief with diagram	4 5 10 5
2.	(a)What are various types of possible sensors /transducers available for measurement of temperature? Explain working of any one in detail. (b)Draw and explain working of a LVDT for measurement of linear vertical displacement. Draw and explain its input output characteristics also. (c)What are techniques involved in fault finding in a system?	5 5 5
3.	(a)Draw and explain the circuits of the following: Logarithmic OPAMP, and CB configuration of transistor and characteristics (b)Convert a 2.25V transducer output voltage into equivalent digital value for a 6 bit word length AD converter for a reference voltage is 6 Vd.c.	10 5
4.	(a)What is the importance of transducer to ADC and DAC to actuator circuit interface design? Explain them. (b)What are various types of controllers used in mechatronics compare them. (c)Write the principle, construction, operation of a 3 phase squirrel cage Induction motor as an electrical actuator.	5 5 10
5.	(a) Describe the functions of following pins (i) HOLD (ii) INTA (iii) ALE (iv) RD (v) CLKOUT (b) Differentiate between micro-processor and micro-controller.	5 3

3	(a)	A 3-phase, Y-connected, 4-pole, 50 Hz induction motor has the following constants (per phase equivalent circuit referred to the stator): $V_t = 230\ V, R_t = R_r' = 1\ \Omega, \quad X_t = X_r' = 2\ \Omega.$ Calculate the speed and current for an active load torque of 150 N-m if the motor is used for regenerative braking.	8
	(b)	If the motor is used for plugging, determine the braking torque and current for a speed of 1500 rpm.	7
	(c)	Based on the results obtained in 3(a) and 3(b), state which braking method is better and why?	5
4	(a)	Explain with the help of neat block diagram(s) how variable voltage and variable frequency sources are realized practically.	8
	(b)	Draw speed-torque curves of an induction machine operating in four quadrants (motoring, regenerative braking and plugging). Also, draw voltage, torque, power and slip speed curves for a constant stator current as a function of per unit frequency (from 0 to 2.0).	7
	(c)	What is motivation of vector control of an induction machine? Draw a neat block diagram of Direct Vector Control Scheme.	5
5	(a)	Draw properly labeled schematic diagram of the Kron's Primitive Machine. Create its voltage-current relation in matrix form.	8
	(b)	Prove that the electromagnetic torque produced by a separately excited dc machine is given by $T_e = \frac{P}{2} M_d i_a i_f$.	7
	(c)	A 5 kW, 400 V, 3-phase, 50-Hz, 4-pole induction motor is supplied with its rated and balanced voltages. Find the *dq0* axes steady-state stator voltages.	5

PEC
EXPLORE INNOVATE EXCEL

Punjab Engineering College, Chandigarh
End-Term Examination

Programme: **B.E (Electrical Engineering)**
Course Name: Switchgear & Protection
Maximum Marks: 75

Year/Semester: 2021/5th
Course Code: **EEN-302**
Time allowed: **2 Hours**

- All questions are compulsory.
- Attempt the questions in sequence only. No marks shall be awarded in case of out of sequence.

Q.No			Ma
1.	a)	Draw the single line diagram of a 33 kV substation. In addition, mention the function of various equipment installed in this.	10
	b)	Derive the Universal relay torque equation. In addition, how can you make a choice while using various distance protection relays?	10
2.	a)	Explain the loss of excitation protection of an alternator. How can you overcome this?	10
	b)	A star connected, 3-phase, 10 MVA, 6.6 kV alternator has a per phase reactance of 10%. It is protected by Merz-price circulating current principle, which is set to operate for fault currents not less than 175 A. Calculate the value of earthing resistance to be provided in order to ensure that only 10% of the winding remains unprotected.	10
3.	a)	Explain the Time Graded protection of feeders along with its different types.	10
	b)	Design a ring feeder having five sections and fed at one point which is to be protected using differential overcurrent relays with suitable time grading of 0.5 sec. The fastest relay needs 5 sec to operate. Explain the working of this feeder along with time of operation of relays.	10
4.	a)	What are the problems arising out of differential protection? How can you overcome these problems?	05
	b)	Find the ratio of a star/delta ICTs to achieve ideal matching of CT secondaries in case of differential protection of a 500 kV/138 kV/13.45 kV, 120 MVA/90 MVA/30 MVA, star/star/delta transformer as shown in the figure below:	1

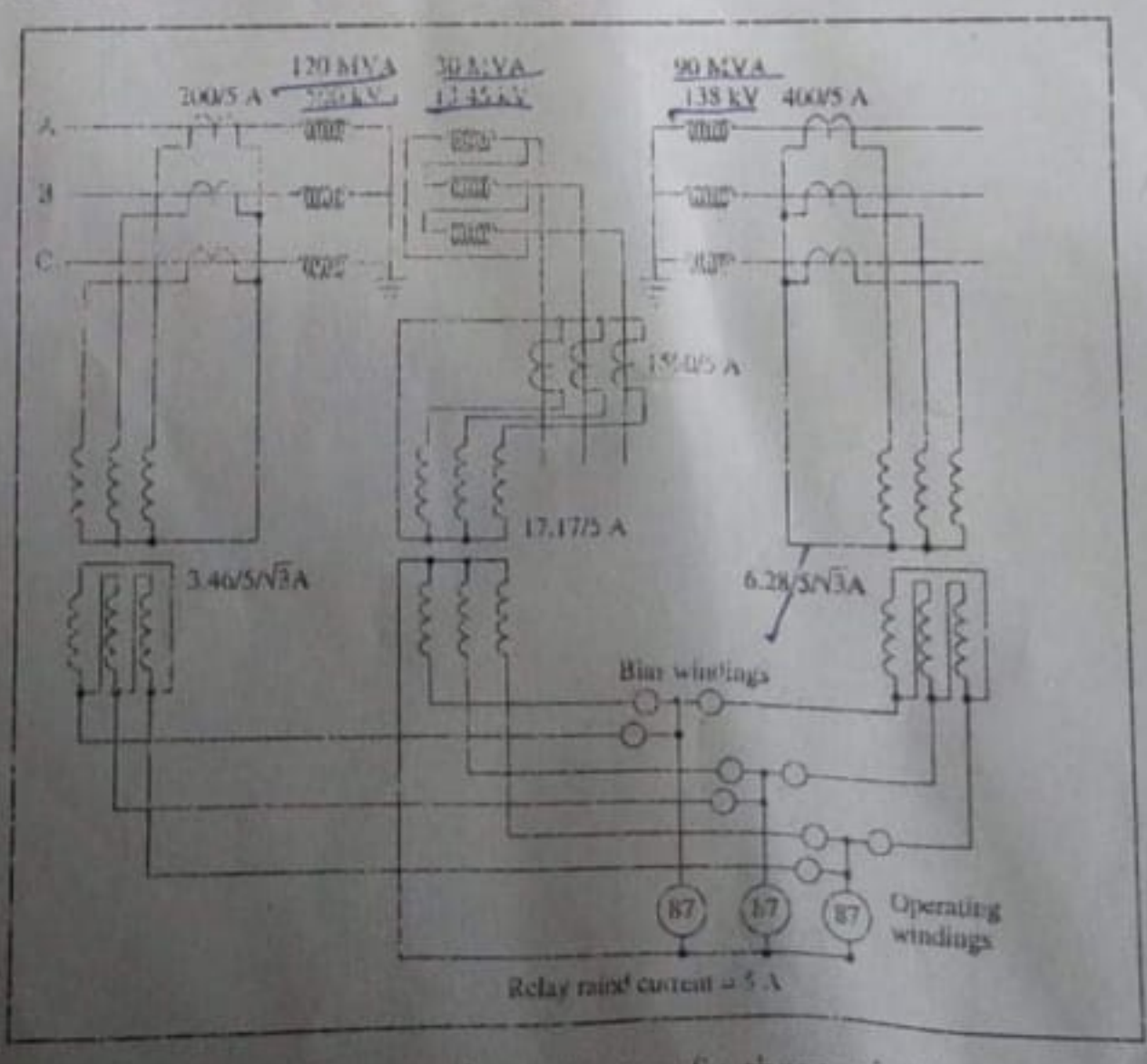

Figure 1: Differential protection scheme of a three winding transformer

Punjab Engineering College, Chandigarh
Mid-Term Examination

Programme: **B.E. (5th Sem)**
Course Name: Switchgear & Protection
Maximum Marks: 50

Year: Sep 2018
Course Code: **EEN 302**
Time allowed: **1.5 Hours**

Q.No.		Marks
1.	A 50 Hz, 11 kV, 3-phase alternator with earthed neutral has a reactance of 6 Ω/phase and is connected to a bus-bar through a CB. The distributed capacitance up to the location of the circuit breaker is 0.01 μF. Determine the following: a) Peak restriking voltage across the CB b) Frequency of oscillations c) Average RRRV upto the first peak	**10**
2.	Explain the cut-off characteristics of a fuse. Also explain the operation of a fuse for motor protection.	**10**
3.	Explain the construction and working of MOCB. Discuss its advantages and limitations. Also discuss the Axial flow and Cross flow of oil during arc interruption using suitable diagrams.	**10**
4.	Using suitable diagrams, explain the MHO type distance relay. Also derive its torque equation.	**10**
5.	A circuit breaker equipped with a 1000/5 CT is used to protect a 20 MVA transformer operating at 30% overload and feeding a 11 kV bus-bar. The feeder circuit breaker is also equipped with a 400/5 CT. Both the CTs feeding IDMTL relays have the following characteristics: PSM 2 3 3.4 5 10 15 20 Time (s): 10 6 5.6 4.1 3 2.5 2.2 The relay on the feeder circuit breaker has 125% plug setting and a TMS of 0.3. If a fault current of 5 kA flows from the transformer to the feeder, determine a) Operating time of feeder relay b) Suggest suitable plug setting of the transformer relay between the transformer relay and feeder relay.	**10**

Shivam Mehta

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PUNJAB ENGINEERING COLLEGE, CHANDIGARH

Mid-Term Examination
B Tech/5th Sem/EEN313/25092019

Programme: B.Tech. (Electrical Engineering) Year/Semester: 201920/5th
Course Name: Electric Drives Course Code: EEN 313
Maximum Marks: 50 Time Allowed: 1.5 Hours

Notes:

(1) All questions are compulsory.
(2) Unless stated otherwise, the symbols have their usual meanings in context with subject.

Q. No	Questions	Marks
1.	A 220V, 1500rpm, 11.6A, $R_a = 1\Omega$, separately excited motor is controlled (continuous conduction) by a 1-phase fully-controlled rectifier with an ac source voltage of 230V, 50Hz. Calculate (i) firing angle to get rated torque at 1000rpm, (ii) firing angle for the rated braking torque at -1500rpm and (iii) the motor speed at the rated torque and $\alpha = 160°$ for the regenerative braking in the II quadrant.	12
2.	Draw properly labeled circuit diagram and waveforms of load voltage, load & source currents with respect to source voltage separately for each case of Q. No. 1 (load current is cont. but not constant).	9
3.	Draw waveforms of load voltage and source current (phase B only) for a constant load current. Draw ~~separate~~ waveforms for Q. No. 1 for (ii) part only if it is operated by 3-phase fully controlled converter supplied with 3-phase, 230V, 50Hz ac. Use waveform given below.	6
4	A separately excited dc motor is employed for electric traction and is being controlled by a dc chopper for motoring and regenerative braking operations. Draw a suitable chopper circuit and relevant waveforms (load voltage, load current and source current) when operating in CCM.	12
5	Show that the limiting value of duty cycle for a continuous conduction is given by following expression for a step-down dc chopper circuit for R_a-L_a-E load. $\delta_c = \frac{\tau_a}{T} \ln\left[1 + \frac{E}{V_s}\left(e^{T/\tau_a} - 1\right)\right]$	11

.....Cut from here and put in your answer book

PEC UNIVERSITY OF TECHNOLOGY
Mid-TermExamination (2017)

Programme: B.E (ELECTRICAL)
Course Name:Electrical Machines
Course Code: CAD of EEN- 304
Maximum Marks: 30

Year/Semester:5th Semester

Time allowed: 1 Hour 30 minutes

Notes :

- All questions are compulsory.
- Unless stated otherwise, the symbols have their usual meanings in context with subject. Assume suitably and state, additional data required, if any.
- The candidates, before starting to write the solutions, should please check the question paper for any discrepancy, and also ensure that they have been delivered the question paper of right course code.

Q. No		Marks
1.	Differentiate the following from a designers point of view a) Distribution transformers and Power transformers b) Hemitropic winding and Whole coil winding c) Sqaure core and Cruciform core d) Major insulation and Minor Insulation in transformers e) OFAN and OFAF type of cooling	10
2.	Design the core(limbs and yoke) and estimate the number of turns and cross section area of conductors of a single phase shell type transformer rated at 100 kVA ,2000/400V , 50 Hz. The emf per turn is 10 V. Assume a current density of 2.0A/mm^2 'flux density equal to 1.1Wb/m^2 , a window space factor of 0.33 and stacking factor of 0.9.	8
3.	Draw the sequence diagram and show the position of brushes for a 4 pole simplex wave wound armature of a d.c. generator having 12slots and 12 commutator segments.Suggest suitable pitches required for designing the windings.	6
4.	A three phase 4 pole induction machine with 36 slots is to be wound with mush winding. Show the slot distribution.Draw the winding diagram for Blue phase for a phase sequence of RBY . The yellow phase starts from slot no. 1.	6

SID.....

PUNJAB ENGINEERING COLLEGE, CHANDIGARH

PEC EXPLORE INNOVATE EXCEL

End-Term Examination

B Tech/5th Semester/ EEN313/ 30112019

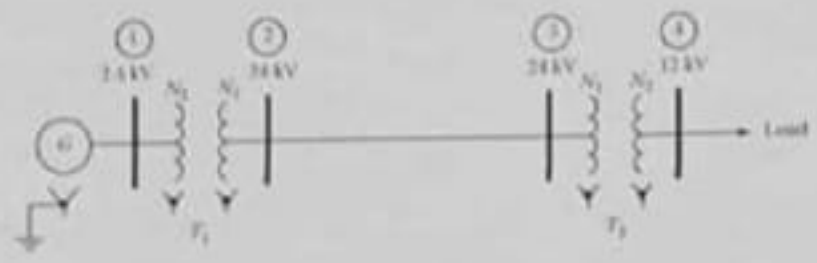
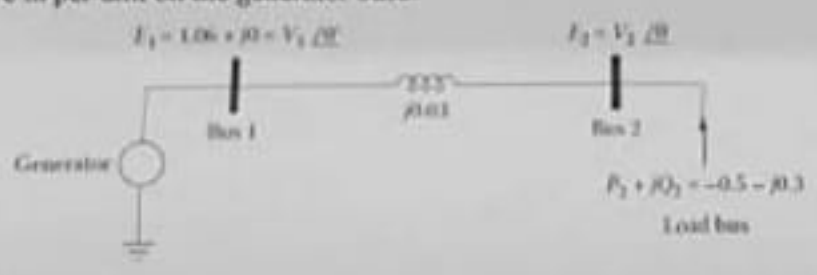
Programme: B.Tech. (Electrical Engineering)
Course Name: Electric Drives
Maximum Marks: 100

Year/Semester: 3rd/ 5th
Course Code: EEN 313
Time Allowed: 3 Hours

Notes:

(1) All questions are compulsory.
(2) Unless stated otherwise, the symbols have their usual meanings in context with subject. Assume suitably and state, additional data required, if any.
(3) The candidates, before starting to write the solutions, should please check the question paper for any discrepancy, and also ensure that they have been delivered the question paper of right course code.
(4) **All parts of a question should be attempted in continuity.**

Q. No		Questions	Marks
1.	(a)	A motor operating with a suitable control system develops a torque given by the relation $T = a\omega_m + b$. The motor drives a load whose torque is given by the expression $T_L = c\omega_m^2 + d$, where a, b, c and d are positive real constants. (i) Find the equilibrium speeds in terms of the constants a, b, c and d. (ii) What relation must exist between the constants for the drive to have two positive real speeds? (iii) Will the drive be stable at the equilibrium points obtained in (i)?	8
	(b)	A 230 V, 500 rpm, 90 A separately excited dc motor has an armature resistance of 0.10 Ω. The motor is controlled by a chopper operating at 400 Hz. If the motor is regenerating, (i) Find the motor speed at the rated current and a duty ratio of 0.5. (ii) Calculate the maximum safe speed if the minimum value of the duty ratio is 0.1.	7
	(c)	Draw a neat circuit diagram of a single-phase PWM rectifier circuit. Also, plot output voltage and source current waveforms for equal pulse width modulated rectifier (assume that the load current is constant).	5
2.		A 3-phase, Y-connected, 50 Hz, 4-pole induction motor has the following parameters: $R_s = R_r' = 0.02\ \Omega$ and $X_s = X_r' = 0.10\ \Omega$. The motor is controlled by the variable frequency control with a constant (V/f) ratio.	8
	(a)	For an operating frequency of 10 Hz, calculate the starting torque and rotor current in terms of their values at the rated frequency.	7
	(b)	For an operating frequency of 10 Hz, calculate the maximum torque as a ratio of its value at the rated frequency for both motoring and braking.	5
	(c)	Comment on the results obtained in 2(a) and 2(b).	

3.a)	One-line diagram of a three-phase system is given below. Assume that the line length between the two transformers is negligible and the three-phase generator is rated 4160 kVA, 2.4 kV, and 1000 A and that it supplies a purely inductive load of Ipu = $2.08\angle -90^{\circ}$ pu. The three-phase transformer $T1$ is rated 6000 kVA, $2.4Y$–$24Y$ kV, with leakage reactance of 0.04 pu. Transformer $T2$ is made up of three single-phase transformers and is rated 4000 kVA, $24Y$–$12Y$ kV, with leakage reactance of 0.04 pu. Draw impedance diagram in pu values taking suitable base values. 	(12,8)
b)	Derive Swing Equation of a Synchronous Machine. Define Inertia constant.	(10,10)
4.a)	Draw diagrams to illustrate the application of equal area criterion to study transient stability for a switching operation causing the switching out of one of the circuits of a double circuit line feeding an infinite bus.	
b)	Explain latest approaches to improve transient stability studies.	
5.	Apply the Newton-Raphson algorithm to find $V_2 \angle \theta$, the per unit voltage and phase angle (rad) at load bus 2, if its real and reactive power are specified as shown in Fig. below All values are in per unit on the generator base. 	(10)

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PEC UNIVERSITY OF TECHNOLOGY
End-Term Examination

Programme: **B.E (Electrical)**
Course Name: CAPSA
Maximum Marks:100

Year/Semester: 2019/7th
Course Code: EEN 311
Time allowed: **3 Hours**

Notes :

All questions are compulsory.

- Unless stated otherwise, the symbols have their usual meanings in context with subject. Assume suitably and state, additional data required, if any.
- The candidates, before starting to write the solutions, should please check the question paper for any discrepancy, and also ensure that they have been delivered the question paper of right **course code**.

Q. No.		Marks
1. a)	Three plants of a total capacity of 500 MW are scheduled to supply a total system load of 310 MW. Evaluate the optimum load scheduling if the plants have the following cost characteristics and limitations. $C_1 = 0.06P_{G1}^2 + 30\,P_{G1} + 10, \quad 30 \le P_{G1} \le 150$ $C_2 = 0.10P_{G2}^2 + 40\,P_{G2} + 15, \quad 20 \le P_{G2} \le 100$ $C_3 = 0.075P_{G3}^2 + 10\,P_{G3} + 20, \quad 50 \le P_{G3} \le 250$ Determine the generation supplied by each plant with and without limitations. After applying limitations if the transmission line loss is expressed through $P_L = 0.015P_{G1}^2 + 0.030P_{G2}^2 + 0.02\,P_{G1}^2$ p.u. Determine the optimal power generation.	(15,6)
b)	Develop and explain block diagram of two area system network for load frequency control.	(10)
2. (a)	Show that positive and negative sequence currents are equal in magnitude but out of phase by 180^0 in a line to line fault. Draw a diagram showing interconnection of sequence of networks for this type of faults.	(10,15)
2(b)	Consider the system given below and assume that the given impedance values are based on the same megavolt-ampere value. The two three-phase transformer banks are made of three single-phase transformers. Assume that there is an SLG fault, involving phase a, at the middle ofthe transmission line TL23, as shown in the figure. (a) Draw the corresponding positive-, negative-, and zero-sequence networks, without reducing them, and their corresponding interconnections. (b) Determine the sequence currents at fault point F. (c) Determine the sequence currents at the terminals of generator G_1. (d) Determine the phase currents at the terminals of generator G_1.	

PUNJAB ENGINEERING COLLEGE, CHANDIGARH

(Deemed to be University)

Mid-Term Examination

Programme: B.E. (Electrical Engineering) Year/Semester: 2019/ 5th
Course Name: **CAD of Electrical Machines** Course Code: EEN 304
Maximum Marks: 40 Time allowed: **1.5 Hours**

(1) All questions are compulsory.
(2) Unless stated otherwise, the symbols have their usual meanings in context with subject. Assume suitably and state additional data required, if any.

Q. No		Marks
1. A	Explain why sometimes the high voltage winding is divided into more than one section even in core type transformers.	2
B	Design the core (limbs and yoke) and estimate the number of turns and cross section area of conductors of a single phase core type power transformer rated at 500 kVA, 6600/400V,50 Hz. Assume a cruciform core of CRGO with a flux density of 1.5 Wb/ m^2 Assume a current density of 2.75 A/mm^2 , k =0.8 and stacking factor of 0.9.	8
2. A	Draw the sequence diagram and show the position of brushes for a 4 pole simplex wave wound d.c. machine armature having 13 slots and 13 commutator segments. Suggest suitable pitches required for designing the windings.	8
B	A 3 phase, 4 pole induction machine with 48 slots is to be wound with mush winding. Calculate the coil span and show the slot distribution for each phase. For a phase sequence of RYB indicate the start of each of the three phases. Assume that yellow phase starts from slot No. 1	4
3. A	Compare the performance of Copper and Aluminium material as a conductor. Show that using aluminium instead of copper reduces the overall rating of the machine.	4
B.	During a temperature rise test on a 100 kVA transformer, the temperature recorded were 50 ^{0}C after 1 hour and 62^0 C after 2 hours. Calculate the time for which the transformer can be safely loaded to 200kVA.Ambient temperature is 30 ^{0}C and the full load copper loss at 100kVA is twice the iron loss.	6
4. A	What type of materials are used for manufacturing of cores of electrical machines? What are the factors which govern the choice of these materials?	4
B	Explain the significance of using hydrogen cooling for the large alternators.	4

Shivam Mehta

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PUNJAB ENGINEERING COLLEGE, CHANDIGARH

Mid-Term Examination
B Tech/5th Sem/EEN313/25092019

Programme: B.Tech. (Electrical Engineering) Year/Semester: 201920/5th
Course Name: Electric Drives Course Code: EEN 313
Maximum Marks: 50 Time Allowed: 1.5 Hours

Notes:

(1) All questions are compulsory.
(2) Unless stated otherwise, the symbols have their usual meanings in context with subject.

Q. No	Questions	Marks
1.	A 220V, 1500rpm, 11.6A, $R_a = 1\Omega$, separately excited motor is controlled (continuous conduction) by a 1-phase fully-controlled rectifier with an ac source voltage of 230V, 50Hz. Calculate (i) firing angle to get rated torque at 1000rpm, (ii) firing angle for the rated braking torque at -1500rpm and (iii) the motor speed at the rated torque and $\alpha = 160°$ for the regenerative braking in the II quadrant.	12
2.	Draw properly labeled circuit diagram and waveforms of load voltage, load & source currents with respect to source voltage separately for each case of Q. No. 1 (load current is cont. but not constant).	9
3.	Draw waveforms of load voltage and source current (phase B only) for a constant load current. Draw ~~separate~~ waveforms for Q. No. 1 for (ii) part only if it is operated by 3-phase fully controlled converter supplied with 3-phase, 230V, 50Hz ac. Use waveform given below.	6
4	A separately excited dc motor is employed for electric traction and is being controlled by a dc chopper for motoring and regenerative braking operations. Draw a suitable chopper circuit and relevant waveforms (load voltage, load current and source current) when operating in CCM.	12
5	Show that the limiting value of duty cycle for a continuous conduction is given by following expression for a step-down dc chopper circuit for R_a-L_a-E load. $\delta_c = \frac{\tau_a}{T} \ln\left[1 + \frac{E}{V_s}\left(e^{T/\tau_a} - 1\right)\right]$	11

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PUNJAB ENGINEERING COLLEGE, CHANDIGARH

Mid-Term Examination

Sept, 2018 QUESTION PAPER-28/09/18

Programme: B.E (Electrical Engg.)
Course Name: **Electric Drives**
Maximum Marks: 40

Year/Semester: 2018/5th
Course Code: **EEN 303**
Time allowed: **1.5 Hours**

Notes :

(1) All questions are compulsory.
(2) Unless stated otherwise, the symbols have their usual meanings in context with subject. Assume suitably and state, additional data required, if any.
(3) The candidates, before starting to write the solutions, should please check the question paper for any discrepancy, and also ensure that they have been delivered the question paper of right **course code**.

Q. No			Marks
1.	a)	Explain statically induced emf and rotationally induced emf.	(04)
	b)	How the sign of the rotationally induced emf is determined ?	(03)
	c)	Explain the [speed-torque], [torque-armature current], [speed-armature current]characteristics? (for seperately excited & DC series motor)	(03)
	d)	A 160 V, 10.5 A, 1000 rpm shunt motor has the armature and field resistance of 300 ohm each. It drives a load whose torque is constant at rated motor torque. Calculate the motor speed if the voltage drops to 100V.	(05)
2.	a)	Derive the generalized torque expression of Kron's Primitive machine model using Kron's primitive machine model diagram.	(09)
	b)	Use the above Kron's primitive machine model to model a separately excited DC machine and derive the expression of torque for this machine.	(04)
3.	a)	What are the steady state characteristics with armature and field control? Explain methods briefly?	(07)
	b)	Explain the mechanical modelling of dc motor and draw model?	(05)

PUNJAB ENGINEERING COLLEGE, CHANDIGARH

(Deemed to be University)

Mid-Term Examination

Programme: B.E. (Electrical Engineering) Year/Semester: 2019/ 5th
Course Name: **CAD of Electrical Machines** Course Code: EEN 304
Maximum Marks: 40 Time allowed: **1.5 Hours**

(1) All questions are compulsory.
(2) Unless stated otherwise, the symbols have their usual meanings in context with subject. Assume suitably and state additional data required, if any.

Q. No		Marks
1. A	Explain why sometimes the high voltage winding is divided into more than one section even in core type transformers.	2
B	Design the core (limbs and yoke) and estimate the number of turns and cross section area of conductors of a single phase core type power transformer rated at 500 kVA, 6600/400V,50 Hz. Assume a cruciform core of CRGO with a flux density of 1.5 Wb/ m^2 Assume a current density of 2.75 A/mm^2 , k =0.8 and stacking factor of 0.9.	8
2. A	Draw the sequence diagram and show the position of brushes for a 4 pole simplex wave wound d.c. machine armature having 13 slots and 13 commutator segments. Suggest suitable pitches required for designing the windings.	8
B	A 3 phase, 4 pole induction machine with 48 slots is to be wound with mush winding. Calculate the coil span and show the slot distribution for each phase. For a phase sequence of RYB indicate the start of each of the three phases. Assume that yellow phase starts from slot No. 1	4
3. A	Compare the performance of Copper and Aluminium material as a conductor. Show that using aluminium instead of copper reduces the overall rating of the machine.	4
B.	During a temperature rise test on a 100 kVA transformer, the temperature recorded were 50 ^{0}C after 1 hour and 62^0 C after 2 hours. Calculate the time for which the transformer can be safely loaded to 200kVA.Ambient temperature is 30 ^{0}C and the full load copper loss at 100kVA is twice the iron loss.	6
4. A	What type of materials are used for manufacturing of cores of electrical machines? What are the factors which govern the choice of these materials?	4
B	Explain the significance of using hydrogen cooling for the large alternators.	4

Punjab Engineering College, Chandigarh
End-Term Examination

Programme: **B.E (Electrical Engineering)** Year/Semester: 2021/5th
Course Name: Switchgear & Protection Course Code: **EEN-302**
Maximum Marks: 75 Time allowed: **2 Hours**

- All questions are compulsory.
- Attempt the questions in sequence only. No marks shall be awarded in case of out of sequence.

Q.No			Ma
1.	a)	Draw the single line diagram of a 33 kV substation. In addition, mention the function of various equipment installed in this.	10
	b)	Derive the Universal relay torque equation. In addition, how can you make a choice while using various distance protection relays?	10
2.	a)	Explain the loss of excitation protection of an alternator. How can you overcome this?	10
	b)	A star connected, 3-phase, 10 MVA, 6.6 kV alternator has a per phase reactance of 10%. It is protected by Merz-price circulating current principle, which is set to operate for fault currents not less than 175 A. Calculate the value of earthing resistance to be provided in order to ensure that only 10% of the winding remains unprotected.	10
3.	a)	Explain the Time Graded protection of feeders along with its different types.	10
	b)	Design a ring feeder having five sections and fed at one point which is to be protected using differential overcurrent relays with suitable time grading of 0.5 sec. The fastest relay needs 5 sec to operate. Explain the working of this feeder along with time of operation of relays.	10
4.	a)	What are the problems arising out of differential protection? How can you overcome these problems?	05
	b)	Find the ratio of a star/delta ICTs to achieve ideal matching of CT secondaries in case of differential protection of a 500 kV/138 kV/13.45 kV, 120 MVA/90 MVA/30 MVA, star/star/delta transformer as shown in the figure below:	1

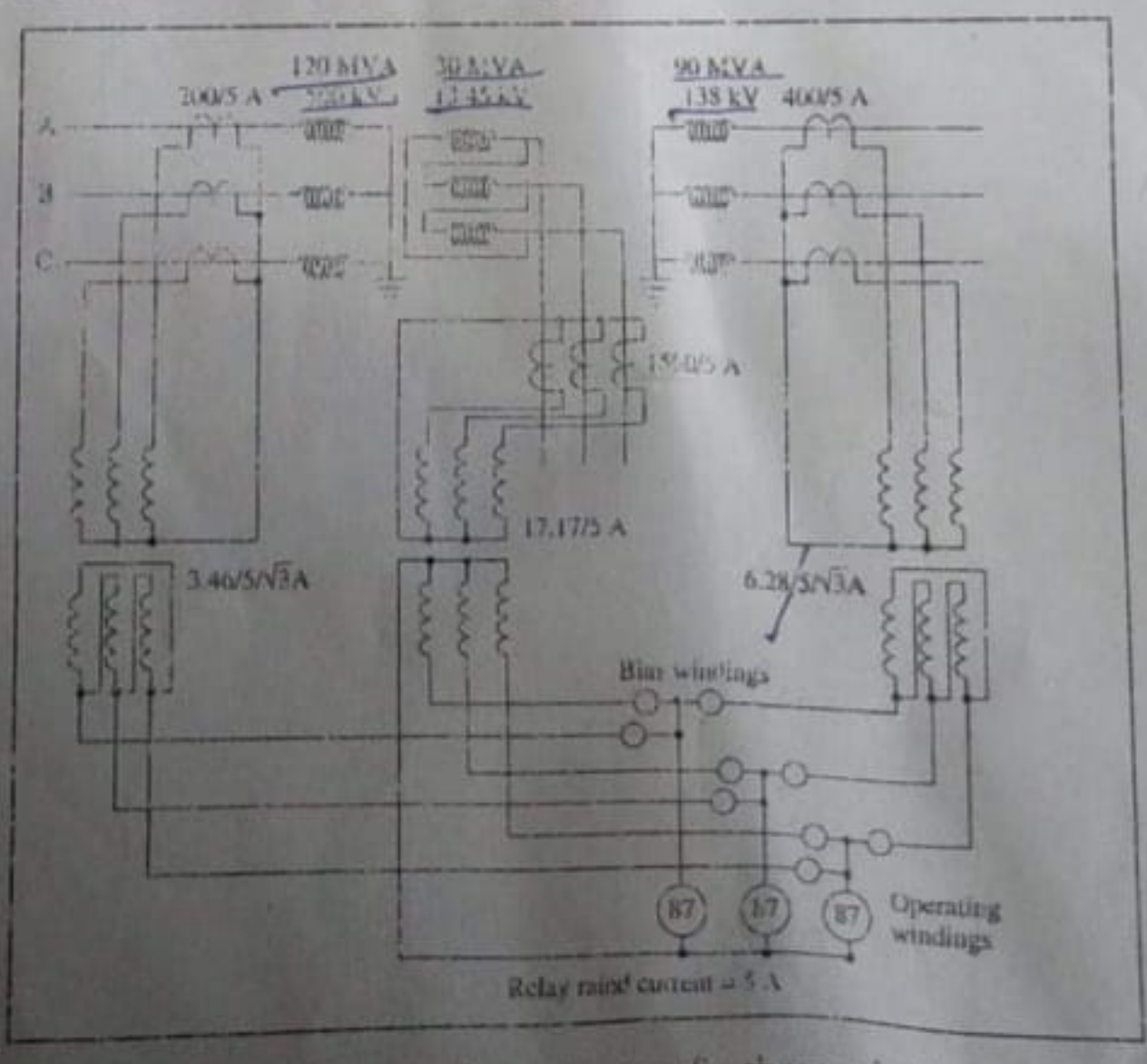

Figure 1: Differential protection scheme of a three winding transformer