Bharatiya Vidya Bhavan's

Sardar Patel College of Engineering

(A Government Aided Autonomous Institute)

Munshi Nagar, Andheri (West), Mumbai – 400058.

End Sem Re-Exam

July 2022

T.Y. B.Tech (ETRX) Sem VI 18/7/22

Max. Marks: **100** Duration: **3hr**

Class: **Third Year** Semester: **VI** Program: **Electrical Engineering**

Name of the Course: **Elective – VLSI** (Circuits) Course Code : **OE-BTE604**

Instructions:

- Question one is Compulsory.
- Solve any four of remaining six questions.
- Illustrate your answers with neat sketches wherever necessary.
- Assume suitable data if required.
- Preferably, write the answers in sequential order.

Question No.		MN	CO	Max. Marks
Q1.				
A)	Consider a diffusion area that has the dimension 0.4μm X 0.2μm and the abrupt junction depth is 32nm. Its n-type impurity doping level is $N_D = 2x10^{20}$ cm^{-3} and the surrounding p-type substrate doping level is $N_A=2x10^{20}$ cm^{-3}. Determine the equivalent capacitance when the diffusion area is biased at 1.2V and substrate is biased at 0V. in this problem, assume that there is no channel stop implant.	1	1	5
B)	Compare the two technology scaling methods, namely, (i) the constant electric-field scaling and (ii) the constant power-supply voltage scaling. In particular, show analytically by using equations how the delay time, power dissipation, and power density are affected in terms of the scaling factor, S.	1	1	5
C)	Explain simplified process sequence for the fabrication of the n-well CMOS integrated circuit with a single polysilicon layer, showing only major fabrication steps.	1	1	5

D)	Consider a simple abrupt pn-junction, which is reverse-biased with a voltage V_{bias}. The doping density of the n-type region is $N_D = 2.2 \times 10^{18}$ cm^{-3}, and the doping density of the p-type region is given as $N_A = 1.8 \times 10^{18}$ cm^{-3} The junction area is A = 10 μm x 10 μm. Find: (i) Built in junction capacitance, (ii) the zero-bias junction capacitance, (iii) the equivalent large-signal junction capacitance assuming that the reverse bias voltage changes from $\boldsymbol{V1=0V\ to\ V2=-1V}$, (iv) the average junction capacitance.	**1**	**1**	**5**
Q2.				
A)	Explain in detail VTC of resistive load inverter, and define noise immunity and noise margins.	**2**	**2**	**5**
B)	Design a resistive-load inverter with R = 2 kΩ, such that V_{OL} = 0.05 V. The nMOS driver transistor has the following parameters: $V_{DD} = 1.1V$ $V_{T0} = 0.52$ V $\gamma = 0$ V$^{1/2}$ $\lambda = 0$ $\mu_n C_{ox} = 216$ μA/V^2 (a) Determine the required aspect ratio, W/L. (b) Determine V_{IL} and V_{IH}. (c) Determine noise margins N_{ML} and N_{MH}.	**2**	**2**	**5**
C)	Consider a CMOS inverter circuit with the following parameters: $V_{DD} = 1.2V$ $V_{T0,n} = 0.48$ V $V_{TO,p} = -0.46$ V $\mu_n C_{ox} = 102$ μA/V^2 $(W/L)_n = 10$ $\mu_p C_{ox} = 51.6$ μA/V^2 $(W/L)_p = 19$ Calculate the noise margins of the circuit.	**2**	**2**	**10**
Q.3				
A)	Sketch the transistor level schematic and layout for CMOS 2-input NAND gate.	2	2	5
B)	Write short note pass transistor logic.	3	3	5
C)	Write short note on JK latch circuit.	3	3	5
D)	Describe AOI and OAI gates.	3	3	5
Q.4				
A)	Give the classification of semiconductor memories. Draw typical random access memory array organization.	**4**	**3**	**5**
B)	Design a 4-bit X 4-bit NOR based ROM array to store following	**4**	**3**	**10**

data stream. Also write its column and rows combination.

Data: 1100

1010

0110

1001

Draw layout for circuit designed.

C)	Discuss the operation of resistive-load SRAM Cell.	4	3	5

Q.5

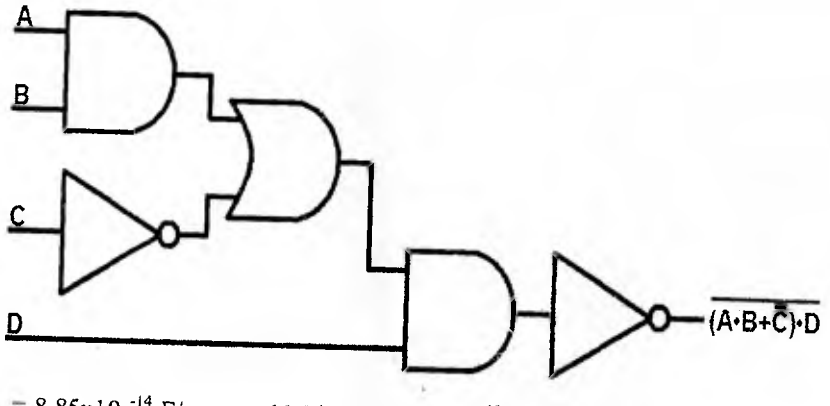
A)	Discuss the operation of three transistors DRAM Cell.	4	3	10
B)	Write an HDL module that computes a 4-input XOR function. The input is A(3:0) and the output is Y.	6	3	5
C)	Describe simulation, synthesis and combinational circuit with example.	6	3	5

Q.6

A)	Write an 8:1 multiplexer module called *mux8* with inputs $S_{2:0}$, *D0, D1, D2, D3, D4, D5, D6, D7*, and output *Y*.	6	4	5
B)	Write a structural module to compute $Y = AB + BC + ABC$ using 8:1 multiplexer logic.	6	4	5
C)	Describe switching power dissipation.	5	4	5
D)	Comment on the advantages and disadvantages of H-trees and clock grids. How does the hybrid tree/grid improve on a standard grid?	7	4	5

Q.7

A)	Sketch a stick diagram for a CMOS gate computing $Z = \overline{(A + B + C).D}$ and estimate the cell width and height.	2	4	10
B)	Draw and explain the operation of CMOS D latch using pass gate.	3	4	5
C)	Realize the transistor level circuit for given logic circuit using Pseudo nMOS gate.	3	4	5



Given Data: $\varepsilon_0 = 8.85\text{x}10^{-14}$ F/cm, $\varepsilon_{si}=11.7*\varepsilon_0$, $q = 1.6\text{x}10^{-19}$C, $k = 1.3\text{x}10^{-23}$ J/K, Intrinsic carrier concentration of silicon (Si) $n_i = 1.45\text{x}10^{10}$ (cm^{-3}) at 300K.

T.Y. B.Tech (Electrical) 28/5/22
Sem VI

Bharatiya Vidya Bhavan's

Sardar Patel College of Engineering

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End Sem Exam

May 2022

Max. Marks: **100** Duration: **3hr**

Class: **Third Year** Semester: **VI** Program: **Electrical Engineering**

Name of the Course: **Elective – VLSI** Circuits Course Code : **OE-BTE604**

Instructions:

- Question one is Compulsory.
- Solve any four of remaining six questions.
- Illustrate your answers with neat sketches wherever necessary.
- Assume suitable data if required.
- Preferably, write the answers in sequential order.

Question No.		M N	C O	Max. Marks
Q1.				
A)	Compare the two technology scaling methods, namely, (i) the constant electric-field scaling and (ii) the constant power-supply voltage scaling. In particular, show analytically by using equations how the delay time, power dissipation, and power density are affected in terms of the scaling factor, S.	**1**	**1**	**5**
B)	For an n-channel MOS transistor with μn = 76.3 $cm2V.s$, Cox = 2.2x10^{-2} F/$m2$, W = 20μm, L = 2μm, and, $VT0$ = 0.48V. Determine drain current for Vgs = 1.0V, and Vds = 0.2V, 0.4V, 0.6V, 0.8V.	**1**	**1**	**5**
C)	What are the steps involved in patterning of silicon dioxide.	**1**	**1**	**5**
D)	Consider a simple abrupt pn-junction, which is reverse-biased with a voltage V_{bias}. The doping density of the n-type region is N_D =2.2x10^{18} cm^{-3}, and the doping density of the p-type region is given as N_A = 1.8x10^{18} cm^{-3} The junction area is A = 10 μm x 10 μm. Find: (i) Built in junction capacitance, (ii) the zero-bias	**1**	**1**	**5**

junction capacitance, (iii) the equivalent large-signal junction capacitance assuming that the reverse bias voltage changes from $V1=0V$ *to* $V2=-1V$, (iv) the average junction capacitance.

Q2.

A)	Give the CMOS inverter voltage transfer characteristics and operating regions.	**2**	**2**	**5**
B)	Design a resistive-load inverter with R = 2 kΩ, such that V_{OL} = 0.05 V. The nMOS driver transistor has the following parameters:	**2**	**2**	**5**

$V_{DD} = 1.1V$

$V_{T0} = 0.52$ V

$\gamma = 0$ $V^{1/2}$

$\lambda = 0$

$\mu_n C_{ox} = 216$ $\mu A/V^2$

(a) Determine the required aspect ratio, W/L.

(b) Determine V_{IL} and V_{IH}.

(c) Determine noise margins N_{ML} and N_{MH}.

C)	Consider a CMOS inverter circuit with the following parameters:	**2**	**2**	**10**

$V_{DD} = 1.2V$

$V_{T0,n} = 0.48$ V

$V_{TO,p} = -0.46$ V

$\mu_n C_{ox} = 102$ $\mu A/V^2$ $(W/L)_n = 10$

$\mu_p C_{ox} = 51.6$ $\mu A/V^2$ $(W/L)_p = 19$

Calculate the noise margins of the circuit.

Q.3

A)	Sketch the transistor level schematic and layout for CMOS 2-input NAND gate.	**2**	**2**	**5**
B)	Define: i) Pseudo-nMOS gate, ii) transmission gate. Implement two input multiplexer using CMOS transmission gate.	**3**	**3**	**5**
C)	Write short note on JK latch circuit.	**3**	**3**	**5**
D)	Describe AOI and OAI gates.	**3**	**3**	**5**

Q.4

A)	Give the classification of semiconductor memories. Draw typical random access memory array organization.	**4**	**3**	**5**
B)	Design a 4-bit X 4-bit NOR based ROM array to store following data stream. Also write its column and rows combination.	**4**	**3**	**10**

Data: 1100

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	Draw layout for circuit designed.			
C)	Discuss the operation of resistive-load SRAM Cell.	4	3	5
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B)	Write a structural module to compute $Y = A\bar{B} + \bar{B}\bar{C} + \bar{A}BC$ using 8:1 multiplexer logic.	6	4	5
C)	Describe switching power dissipation.	5	4	5
D)	Comment on the advantages and disadvantages of H-trees and clock grids. How does the hybrid tree/grid improve on a standard grid?	7	4	5
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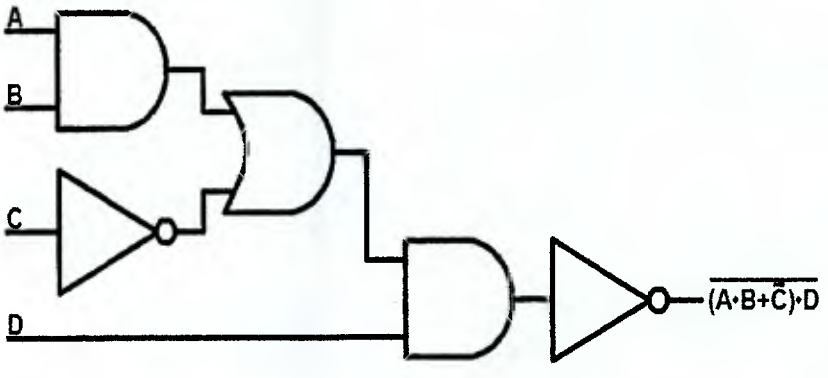
A)	Sketch a stick diagram for a CMOS gate computing $Z = \overline{(A + B + C).D}$ and estimate the cell width and height.	2	4	5
B)		6	4	5
C)	Draw and explain the operation of CMOS D latch using pass gate.	3	4	5
D)	Realize the transistor level circuit for given logic circuit using Pseudo nMOS gate.	3	4	5



Given Data: $\varepsilon_0 = 8.85\text{x}10^{-14}$ F/cm, $\varepsilon_{si} = 11.7 * \varepsilon_0$, $q = 1.6\text{x}10^{-19}$C, $k = 1.3\text{x}10^{-23}$ J/K, Intrinsic carrier concentration of silicon (Si) $n_i = 1.45\text{x}10^{10}$ (cm^{-3}) at 300K.

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RE EXAMINATION

EVEN SEMESTER JULY-2022

T.Y. B.Tech Electrical Sem VI 14/7/22

Program: Electrical Engineering.

Course Code: PE-BTE601

Course Name: ELECTRICAL MACHINE DESIGN-I

Duration: 3Hr

Maximum Points: 100

Semester: VI

Notes: Answer five questions out of seven.

Assume suitable data if required

Sr.No	Questions	Points
Qs-1.	Name and then state the desirable properties of the materials used in electrical machines (power transformers & Induction motors) as **a.** Magnetic materials **b.** Conductor materials **c.** Insulating Materical	 **08** **04** **08**
Qs-2.	**a.** Determine the dimensions of the core and yoke for a 100kVA, 50Hz, single phase, core type transformer. A square core is used with distance between the adjacent limbs equal to 1.6 times the width of the laminations. Assume voltage per turn of 14.0 volts, maximum flux density is 1.1 wb/m², window space factor = 0.32, current density = 3A/mm². Take stacking factor = 0.9. Flux density in the yoke to be 80% of the flux density in core. **b.** A 600kva, 50Hz, 6600V/400V, 3-Ø, delta/star core type transformer has the following data: Width of LV winding = 3.0 cm Width of HV winding = 3.0 cm Width of LV winding = 3.0 cm Width of duct between HV & LV winding = 2.0 cm Height of HV & LV winding = 40.0 cm Length of mean turn = 1.5 m HV winding turns = 220 Estimate the reactance of the transformer winding referred to HV side.	**15** **05**
Qs-3.	**a.** Determine the no-load current of a 5kVA 400/220 volts, 50 Hz, 1-Ø, core type transformer having the following particulars: The length of mean magnetic path 200cm; gross cross section 100cm²; joints equivalent to 0.1mm air gap; maximum flux density 0.7 tesla; specific core loss at 50 Hz and 0.7 tesla is 0.5 watts/kg; ampere turns 2.2 per cm for 0.7 tesla; stacking factor 0.9; density of core material 7.5×10^3 kg/m³.	**10**

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RE EXAMINATION

EVEN SEMESTER JULY-2022

	b. Explain the procedure for design of tank with tubes of a transformer.	**10**
Qs-4.	**a.** A 3.7kW, 400V, 3-phase, 4pole, 50 Hz squirrel cage induction motor with star delta starter is to be designed for maximum power factor. Determine the main dimensions, number of stator slots and the number of turns per phase of the motor if it has to work with an efficiency & power factor of 0.85 & 0.84 respectively at full load. The specific magnetic loading = 0.45 wb/m² and specific electric loading =23000. **b.** A 3-phase, 11kW, 440V, 6pole, 50Hz delta connected squirrel cage induction motor has 54 slots, each containing 28 conductors. Calculate the value of bar and end ring currents. The number of rotor bars is 57. The machine has an efficiency of 0.86 and a power factor of 0.85. the rotor mmf is 80% of stator mmf.	**10** **10**
Qs-5.	**a.** Discuss the factors influencing the choice of flux density and current density in the design of induction motor. **b.** A 3-Φ, 440 V, 750 rpm, 50 Hz st connected, induction motor has a stator with internal diameter of 0.25 m and an axial length of 0.15 m. it has 48 slots with 24 conductors per slot. Calculate the airgap flux per pole. Area of each stator conductor (round conductor) is 5 mm². Calculate the width and depth of the slot to accommodate the stator conductors. The maximum flux density in the teeth is to be 1.7 Wb/m². Conductor insulation is 0.08 mm thick and slot insulation is 0.8 mm thick. Make other suitable assumptions.	**10** **10**
Qs-6.	**a.** A 16 kW, 440 V, 3-phase, 50Hz, 4 pole induction motor has aa diameter of 0.3m and the length of core 0.12m. The number of stator slots is 72 with 20 conductors per slot and a coil span of 11 slots. The stator is delta connected. Calculate the value of magnetizing current per phase if the length of airgap is 0.55mm. The gap contraction factor is 1.2. assume the mmf required for the iron parts to be 35% of the airgap mmf. **b.** Give the layout of lap winding showing allotment of slots to the 3-phases, for the stator of a 3-Φ ac machine having 4poles and 24 slots having 2 coil sides per slot. Also, give the table for each phase groups.	**10** **10**
Qs-7.	**a.** A, 3-phase, 100kW, 600V, 8-pole, 50Hz, induction motor has a star connected stator winding accommodated in 63 slots with 6 conductor per slot. If the slip ring voltage on open circuit is to be	**10**

	about 450V, find a suitable rotor winding, stating: (i) number of slots; (b) number of conductors per slot; (c) coil span; (d) slip ring voltage on open circuit; € approximate per phase full load rotor current. Assume efficiency 90%; power factor 0.86.	
	b. Write notes on the following: (i) Performance checking of induction motor using circle diagram (ii) Types and methods of transformer coolin	**05** **05**

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END SEMESTER EXAMINATION

EVEN SEME MAY 2022

T.Y. B.Tech (Elect.) Sem VI

Program: Electrical Engineering. Duration: 3Hr

Course Code: PE-BTE601 Maximum Points: 100

Course Name: ELECTRICAL MACHINE DESIGN-I Semester: VI

Notes: Answer five questions out of seven.

Assume suitable data if required

Qs. No.	Questions	Points
Qs-1.	a. What are the desirable properties of the materials selected for the following purpose and also state its effect on overall size of the machine (with reference to transformer) :- i) Winding Conductors. ii) Core	10
	b. Obtain a relation between window dimensions and kVA rating of a 3-phase core type transformer.	10
Qs-2.	a. Determine the main dimensions of the 3 limb core (i.e., 3 phase, 3 leg core type transformer), the number of turns and cross-sectional area of the conductors of a 350 kVA, 11000/ 3300 V, star / delta, 3 phase, 50 Hz transformer. Assume: Volt / turn = 11, maximum flux density = 1.25 T. Net cross-section of core = 0.6 d^2 , window space factor = 0.27, window proportion (ht./width) = 3 : 1, current density = 250 A/cm2 , Oil Natural cooled transformer having ± 2.5% and ± 5% tapping on high voltage winding. 'd' represents diameter of circumscribing circle.	10
	b. A 300kva, 50Hz, 6.6kV/400V, 3-Ø, delta/star core type transformer has the following data: Voltage/turn=8Volts, conductor resistivity = 0.21Ω/m/mm^2. Winding height = 0.5 m. **H V winding:-** Outer diameter = 0.36 m; inner diameter = 0.29 m; area of conductor cross section = 5.4 mm^2. **L V winding:-** Outer diameter = 0.26 m; inner diameter = 0.22 m; area of conductor cross section = 170 mm^2. Estimate the resistance and reactance of the transformer winding referred to HV.	10

Qs-3.	a. Estimate the no-load current of a 5kva, 400/220 volts, 50 Hz, 1-Ø, distribution transformer having its core built from laminations having a relative permeability of 1000. The length of the flux path is 2.5 m, the area of cross-section of the core is 0.0025m² and low voltage winding has 800 turns. The iron loss at the working flux density is 2.6 W/kg. Iron weighs 0.0058 kg/m³. Stacking factor is 0.9.	**08**
	b. Design an adequate cooling arrangement for a 250kva, 6600/400v,50Hz,3- phase, delta/star, core type oil immersed natural cooled transformer with the following particulars : (i) (ii) winding temperature rise not to exceed 50 C (iii) total losses = 5.0 kw (iv) tank dimension: height × length × width (depth) = 125 × 100 × 50 **(all in cm)** oil level = 115 cm Neglect the top & bottom surface area of tank . The specific heat dissipation due to radiation and convection is respectively 6 & 6.5 watts/m² - °C. Assume that convection is improved by 35% due to provision of tubes. Sketch diagram to show the arrangement	**12**
Qs-4.	**a.** A 3.7kW, 400V, 3-phase, 4pole, 50 Hz squirrel cage induction motor with star delta starter is to be designed for minimum cost. Determine the main dimensions, number of stator slots and the number of turns per phase of the motor if it has to work with an efficiency & power factor of 0.85 & 0.84 respectively at full load. The specific magnetic loading = 0.45 wb/m² and specific electric loading =23000.	**10**
	b. State the steps involved in designing a squirrel cage induction motor rotor bar conductor and end ring size.	**10**
	a. A 3-Φ, 440 V, 750 rpm, 50 Hz st connected, induction motor has a stator with internal diameter of 0.25 m and an axial length of 0.15 m. it has 48 slots with 24 conductors per slot. Calculate the airgap flux per pole. Area of each stator conductor (round conductor) is 5 mm². Calculate the width and depth of the slot to accommodate the stator conductors. The maximum flux density	**10**

	in the teeth is to be 1.7 Wb/m². Conductor insulation is 0.08 mm thick and slot insulation is 0.8 mm thick. Make other suitable assumptions. b. Obtain the winding arrangement for 3-phase 2 pole ac machine designed to have double layer winding that is accommodated in 18 slots. Coil span = 8 slots. Draw a neat developed diagram.	**10**
Qs-5.	a. State the factors and guide lines to be considered while selecting number of slots in the design of stator of a squirrel cage induction motor. b. Define the following terms with reference to ac windings: i) Coil span factor & Distribution factor ii) Chorded winding and its effect on machine performance	**10** **10**
Qs-6.	a. A 15 kW, 400 V, 3-phase, 50Hz, 6 pole induction motor has aa diameter of 0.3m and the length of core 0.12m. The number of stator slots is 72 with 20 conductors per slot and a coil span of 11 slots. The stator is delta connected. Calculate the value of magnetizing current per phase if the length of airgap is 0.55mm. The gap contraction factor is 1.2. assume the mmf required for the iron parts to be 35% of the airgap mmf. b. A, 3-phase, star connected, 6-pole, 50Hz, 220V, 11kW, induction motor has 54 slots, each containing 9 conductors. Calculate the values ofd bar and end ring currents. The number of rotor bars is 64. The machine has an efficiency and power factor 86% and 0.85 respectively. Assume rotor mmf to be 85% of stator mmf.	**10** **10**
Qs-7.	a. A, 3-phase, 90kW, 500V, 8-pole, 50Hz, induction motor has a star connected stator winding accommodated in 63 slots with 6 conductor per slot. If the slip ring voltage on open circuit is to be about 400V, find a suitable rotor winding, stating: (i) number of slots; (b) number of conductors per slot; (c) coil span; (d) slip ring voltage on open circuit; Є approximate per phase full load rotor current. Assume efficiency 90%; power factor 0.86. b. Write notes on the following: (i) Effect of Shape & size of stator and rotor slots on machine performance	**10** **5**

	(ii)	Effect of selection of specific magnetic loading and specific electric loading	**05**

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T.Y. B.Tech (ETRX) Sem VI 14/7/22

Reexamination

Program: Electrical Engineering **Date: July 2022**

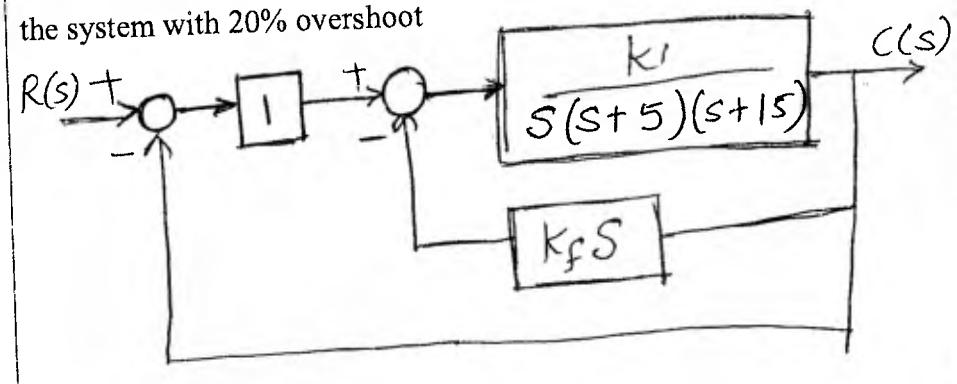
Duration: 3 hrs. **Course code: PE-BTE602**

Maximum Marks: 100 **Semester: VI**

Course Name: Control System Design

Note: Q1 is compulsory. Solve any four questions from the remaining six.

Q. No.	Questions	Max Points	CO No	BL
1 a	Discuss separation principle in a system with controller and observer	05	03	04
b	With an example explain how phase plane analysis is used to comment on stability of the system	05	04	04
c	What are the time domain design specifications? Explain the effect of gain on transient and steady state response.	05	01	02
d	Describe the physical meaning of observability? How is the observability determined mathematically?	05	03	02
2 a	A unity feedback system with forward transfer function $G(s) = \frac{K}{s(s+5)}$ is operating with closed loop step response that has 15% overshoot. Evaluate settling time Design compensator to decrease the settling time by three times.	10	02	06
b	The unity feedback system with forward transfer function $G(s) = \frac{K}{(s+1)(s+3)(s+5)}$ Compensate the system to improve the steady state error of step input response by a factor of 10 if the system is operating with damping ratio 0.4.	10	02	06
3.a	Design lag compensator for the unity feedback system with $G(s) = \frac{k(s+4)}{(s+2)(s+6)(s+8)}$	10	02	06

	Such that static error constant is 100 and operates at 45° phase margin.			
b	Design PID controller (get the values of Kp, Kd, Ki) for unity feedback system with $$G(s) = \frac{K(s+6)}{(s+1)(s+4)(s+8)}$$ so that the system can operate with 20%OS and peak time that is two third that of the uncompensated system with zero steady state error.	10	02	06
4 a	Design the observer for the plant $$G(s) = \frac{10}{(s+2)(s+6)(s+12)}$$ operating with 10% overshoot and 2 sec peak time. Design the observer to respond 10 times faster than the plant. Place the observer's third pole 20 times farther from the imaginary axis than the observer dominant poles. Assume the plant is represented in observer canonical form.	10	03	06
b	For the plant $$G(s) = \frac{100(s+10)}{s(s+3)(s+12)}$$ represented in phase variable form. Design phase variable feedback gains to yield 5% overshoot and peak time of 0.3 sec.	10	03	06
5 a	Consider the system $\dot{x} = \begin{bmatrix} 0 & 1 \\ -1 & -2 \end{bmatrix} x + \begin{bmatrix} 1 \\ -1 \end{bmatrix} u$; $y = [1 \quad 0]x$ and $x(0) = \begin{bmatrix} 0 \\ 1 \end{bmatrix}$ Determine the solution of state equation to unit step input	10	03	04
b	A unity feed back system with forward path function $G(s) = \frac{K1}{s(s+5)(s+15)}$. Design the rate feedback compensation as shown below to reduce settling time by factor of 4 while continuing to operate the system with 20% overshoot 	10	01	06

6 a	Design set point tracker if State Matrix $A = \begin{bmatrix} 0 & 1 \\ -9 & -1 \end{bmatrix}$, input matrix B=$\begin{bmatrix} 0 \\ 1 \end{bmatrix}$, C=[1 0] Desired poles are at -2 and -3	10	03	06
b	A system is given by $$\dot{x} = \begin{bmatrix} 0 & 1 & 0 \\ 0 & 0 & 1 \\ -1 & -5 & -6 \end{bmatrix} x + \begin{bmatrix} 0 \\ 0 \\ 1 \end{bmatrix} u$$ The system uses state feedback controller –kx. Find the state feedback gain matrix which places the closed loop poles at $s = -10$ and $s = -2 \pm j4$	10	03	06
7 a	Why does lag lead compensator is used? Write design procedure of Lag Lead Compensator in frequency domain	10	03	04
b	With an example explain different types of non-linearity observed in various systems	05	04	02
c	Describe the physical meaning of Controllability? How is the Controllability determined mathematically?	05	03	02

25/5/22

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T.Y. B. Tech **End Semester** Retest Sem VI

Program: Electrical Engineering **Date: May 2022**

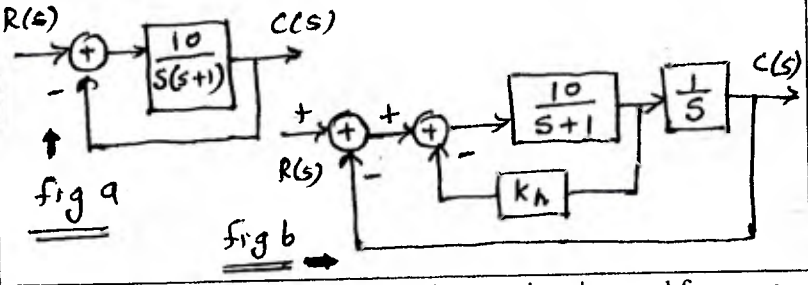
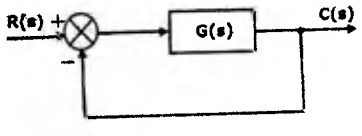
Duration: 3 hrs. **Course code: PE-BTE602**

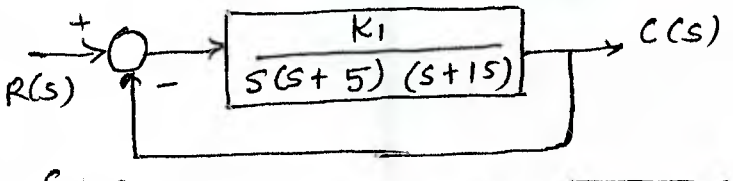
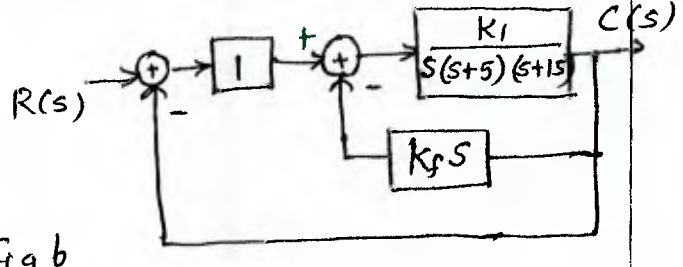
Maximum Marks: 100 **Semester: VI**

Course Name: Control System Design

Note: Q1 is compulsory. Solve any four questions from the remaining six.

Q. No.	Questions	Max Points	CO No	BL	PI
1 a	Why is the correction factor added to the phase margin required to meet the transient response while designing compensator using Bode plot?	04	02	04	1.3.1
b	Why is there more improvement in steady state error if a PI controller is used instead of a lag network?	04	01	04	1.3.1
c	Briefly describe the configuration of an observer.	04	03	02	1.3.1
d	Explain various types of system non-linearity and their effect on system performance.	04	04	02	1.3.1
e	Describe the physical meaning of controllability? How is the controllability determined mathematically?	04	03	02	1.3.1
2 a	For the unity feedback system with feed forward function $$G(s) = \frac{K}{(s+1)(s+3)}$$ The system operates with 20% overshoot. Design PI controller (find Kp and Ki) to have zero steady state error. Compare uncompensated system and the system with PI controller.	08	01	06	3.1.6
b	Consider the system shown in fig a. Find damping ratio and undamped natural frequency. The feedback as shown in fig. b is used to improve relative stability. Find k_h so that the damping ratio is 0.5.	12	01	05	2.1.2

	Compare settling time and % overshoot in each case. Find steady state error to step input in each case.  				
3.a	Compare compensator design techniques using time and frequency domain methods.	05			
b	Design lag lead compensator for unity feedback system with forward path transfer function $G(s)\frac{k}{s(s+1)(s+4)}$ to meet the following specifications: % overshoot 14%, peak time 2 sec and k_v=12. Use frequency response method.	15	02	06	3.1.6
4 a	With an example explain how phase plane analysis is used to comment on stability of the system	05	04	04	1.3.1
b	A unity feedback system shown below, $G(s)=\frac{k}{s(s+5)(s+11)}$,  Find the gain K for uncompensated system to operate with 30% overshoot Find peak time and k_v for uncompensated system Design Lag-lead compensator to decrease the peak time by a factor of 2, decrease the % overshoot by a factor of 2 and improve the steady state error by factor of 30	15	02	06	3.1.6
5 a	The state space model for the system is $\dot{x}=\begin{bmatrix} -2 & 1 & 0 & 0 \\ 1 & -2 & 1 & 0 \\ 0 & 1 & -2 & 1 \\ 0 & 0 & 1 & -1 \end{bmatrix}x+\begin{bmatrix}1\\0\\0\\0\end{bmatrix}u$ $y=[0\ 0\ 0\ 1]x$	10	03	06	3.1.6

	Design reduced order observer to estimate states x1, x2, x3. The observer poles are at -4, -5, -6.				
b	Design a full order observer for the plant with transfer function $$G(s) = \frac{1}{(s+1)(s+2)(s+5)}$$ The closed loop performance of the observer is given by the characteristic polynomial as $$s^3 + 120s^2 + 2500s + 50000.$$	10	03	06	3.1.6
6 a	Design set point tracker if State Matrix $A = \begin{bmatrix} 0 & 1 \\ -9 & -1 \end{bmatrix}$, input matrix B=$\begin{bmatrix} 0 \\ 1 \end{bmatrix}$, C=[1 0] Desired poles are at -1 and -2	10	03	06	3.1.6
b	For the plant $$G(s) = \frac{100(s+8)}{s(s+2)(s+10)}$$ represented in phase variable form. Design phase variable feedback gains to yield 5% overshoot and peak time of 0.3 sec.	10	03	06	3.1.6
7 a	Discuss separation principle in a system with controller and observer	05	03	04	1.3.1
b	What id singular point. With an example explain how it's use	05	04	04	1.3.1
c	For the system in fig. a, design rate feedback compensation as shown in fig b to reduce settling time by a factor of 3 while continuing to operate the system with 20% overshoot.  fig a  fig b	10	02	06	3.1.6

Bharatiya Vidya Bhavan's

Sardar Patel College of Engineering

(Govt. Aided Autonomous Institute Affiliated to University of Mumbai)

Academic Year 2021-22 [Second Half]

Re-Examination – July 2022

T.Y. B.Tech (ETCE) Sem VI 13/7/22

Program: B. Tech. Electrical Engineering
Course: Open Elective I [Project Management]
Course Code: OE –BTE601

Semester: VI
Date: 13th July 2022
Total Points: 100

Note: Solve any **FIVE** questions of the following.

CO: Course Outcomes **BL:** Bloom's Taxonomy Level **PI:** Performance Indicator

Q. No.	Question	Points	CO	BL	PI
1.	**Answer any FOUR questions of the following. All questions carry equal points.** *a.* What is role of PMO in any organization? Explain different types of PMOs. *b.* Which are the different leadership and Management styles? *c.* Describe the two major plans that are part of scope management plan. *d.* Explain the terms corrective action, preventive action and defect repair in relation to monitoring and controlling project work. *e.* Which are the important points to be considered on a project while preparing time and cost estimates?	**20**	**1**	**2**	**1.2.2**
2.	*a.* How the PM should *manage stakeholder engagement* throughout the project?	**10**	**2**	**2**	**1.7.1**
	b. Explain the different types of communications used on a project? Of these types, which is the most suitable type of communication in following situations?	**10**	**2**	**2**	**1.7.1**

Sr. No.	Situation	Communication Type
1.	Sending an e-mail to ask for clarification of an issue	
2.	Holding a milestone party	
3.	Conducting a bidder conference	
4.	Making changes to a contract	
5.	Requesting additional resources	

3.	*a.* SPCE has decided to renovate its Central Library. With over 100 locations in 20+ countries, Syncreon is the leading Third Party Logistics (3PL) and Supply Chain Solutions provider; delivering customized end-to-end, best-in-class logistics and supply chain solutions. Syncreon has got a new project to design, build and provide strategic value-added contract logistics from one of its client M/s. Volkswagen Group. Ms. Manasi is a Sponsor and Ms. Ruhaab is a Project Manager for this Project. Ms. Ruhaab has figured out following dependencies in this project.	**10**	**1**	**2**	**1.2.2**

Activity	Preceding Activity	Estimate in Months
Start		0
D	Start	4
A	Start	6
F	D, A	7
E	D	8
G	F, E	5
B	F	5
H	G	7
C	H	8
End	C, B	0

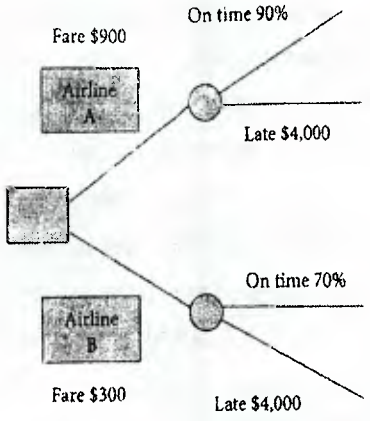
(i) Help Ms. Ruhaab to draw a Network Diagram and determine duration of the critical path.

(ii) Calculate float for activity B, E and D.

(iii) After some discussion with the Ms. Manasi, Ms. Ruhaab realizes that the project duration needs to be shortened by 3 months. To shorten the duration of the project, Ms. Manasi has offered to remove the work of Activity E from the project, making activity D the predecessor to activities G and F. Will this option help Ruhaab to shorten the length of the project?

(iv) Which Schedule Compression techniques Ms. Ruhaab can use to shorten the duration of the project? Which activities she can fast track to shorten the project length?

		10	**1**	**2**	**1.2.2**
	b. Explain the detailed procedure for making changes on a project.				
4.	*a.* What are the reasons for conflicts on any project? Why a Project Manager should possess the skill of Conflict Management? How is the modern view of conflict management different from traditional view? Which are the different conflict resolution techniques a PM use?	**10**	**2**	**2**	**1.2.1**
	b. Explain organizational structure, types and advantages / disadvantages of different types of organization.	**05**	**2**	**1**	**1.2.2**
	c. What does the project charter do for the Project Manager?	**05**	**2**	**1**	**1.2.2**

5.	*a.* Solve following questions: *(i)* How does a *Decision Tree* help in risk analysis? *(ii)* Tejas is planning India Tour of Justin Beiber and his troop from Toranto to Mumbai. He is considering two airlines A and B. Considering the data provided in following decision tree, which airline he should book for the travel of the troop. What is Expected Monetary Value (EMV) of his decision?  *b.* Which are the different types of contracts? Explain each type in detail.	**10** **10**	**3** **2**	**3** **1**	**2.6.3** **1.6.1**
6.	*a.* What is a WBS? Why is it called as The Foundation of the Project? Why WBS is better than other techniques such as lists in the Project Management? Which are rules to be followed while preparing a WBS? What are the benefits of using WBS in a project? *b.* Define following terms: (*a*) Price (*b*) Profit (c) Cost (*d*) Target price (*e*) Sharing ratio (*f*) Ceiling price (*g*) Point of total assumption (*h*) Incentive (*i*) Force majeure (*j*) Arbitration	**10** **10**	**3** **3**	**4** **3**	**2.8.2** **2.6.2**
7.	With reference to the case of 'Coal Fired Boilers Project', develop a detailed Project Charter for this Project. [The case text is given on next page.]	**20**	**3**	**3**	**2.6.2**

Coal Fired Boilers Project

The whole world is a unified place and the events occurring in once country echo loudly in some distant lands. Altaf Hussein worked as an engineering and maintenance manager in National Mills, an old textile mill in the hinterlands of India. He led a routine work life and hardly ever anything exciting new happened. All this changed suddenly in March 1973, when in an OPEC meeting held in distant Riyadh, the decision was taken to raise the crude prices. The crude oil price was indeed observed to fluctuate or even gradually creep upwards over the years. But the price revision this time was an abrupt upward leap – from US $2.73 a barrel to US $ 9.82 a barrel.

The textile mills are heavy user of low pressure steam for their processing departments – dyeing, bleaching and finishing and the cost of steam accounts for a substantial portion of their processing costs. Use of coal as a fuel for raising low-pressure steam would reduce steam costs, but coal is a much unclean and inconvenient fuel compared to oil and so switching over to coal-fired boilers was strongly resisted by the plant management all along. Some textile mills located near the metropolis areas and well-connected by rails had switched over to coal for steam generation, but the procurement and transportation of coal to the hinterland being cumbersome, National Mills had continued to depend on steam generated from oil fired boilers till now. However, with this fourfold increase in the price of oil derived from costly crude, the mill faced dire future. It had to do something about the steam cost or face closure of the entire mill.

Altaf had all along a dislike for use of the old oil-fired boilers with frequent breakdowns and causing unexpected emergencies and workloads on him and his staff, but his proposals for replacing the old boilers with new ones had been rejected twice in the last four years with the argument, "New boilers and the trouble-free continuity in the processing departments is fine, but the investment won't pay for itself." Projection of economic benefits is sometimes difficult to cast into hard cash numbers and Altaf had ultimately lost out on earlier occasions.

Altaf saw in the new situation one more opportunity to push his favourite boiler replacement project - this time with an added twist- new **coal-fired boilers,** which can be justified for economic benefits now hands down. He prepared a brief 3-pages proposal for the new coal fired boilers and sent it to Kamal Nayan Bajaj, Executive Vice-President Friday morning. The proposal was so attractive that Mr.Bajaj summoned Altaf for further discussion that very afternoon. Altaf had projected ₹35 million as the project cost for 80 tonnes/hr capacity boilers and the cost of generated steam to drop from ₹135 per tonne to ₹105 per tonne.

Mr. Bajaj shot a number of questions: "Altaf, the idea is good, but unfortunately, may be, we are late for it. How fast can we execute the project? How sure are you of the viability of the project-the cost of project, saving in operating cost by its generation with coal as fuel? Of course, the most crucial question would be: can we get the boiler on line by February 1974, say latest by March 1974; If your answer to the last question is yes, we can announce in the next annual general meeting in May that the operation cost situation is under control. That would save the day."

"Sir, I am pretty sure of my cost of project and operational cost savings numbers. The project has become now not only just viable but a very attractive investment." enthused Altaf.

"Well, if that is the case, I would be ready to authorize the project right away. You would be the Project Manager and if you deliver the goods, the next promotion to Assistant Vice President is yours! But, remember, you will have to prove your projections first to Mr. Patel, and as the Company Financial Controller, he is as hardnosed as seasoned accountants are. We don't have much time. For a starter, why don't you give me the first thing Monday morning an executive summary of your project proposal, which should include brief project overview?"

Altaf had done his homework well before; so he prepared the executive summary, which could reassure Mr. Bajaj on all issues raised by him. At Mr. Bajaj's suggestion, Altaf prepared the detailed project proposal. After a close scrutiny, Mr. Patel confirmed as realistic the projections in Altaf's proposal and the new **Coal-based Steam Generation Project** was soon authorized.

23/5/22

Bharatiya Vidya Bhavan's

Sardar Patel College of Engineering

(Govt. Aided Autonomous Institute Affiliated to University of Mumbai)

Academic Year 2021 – 22 [Second Half]

End – Semester Examination – May 2022

T.Y. B.Tech (Electrical) Sem VI

Program: B. Tech. Electrical Engineering
Semester: VI
Course: Open Elective I [Project Management]
Date: 23rd May 2022
Course Code: OE –BTE601
Total Points: 100

Note: Answer any **FIVE** questions of the following.

CO: Course Outcomes **BL:** Bloom's Taxonomy Level **PI:** Performance Indicator

Q. No.	Question	Points	CO	BL	PI
1.	**Answer any FOUR questions of the following. All questions carry equal points.**	**20**	**1**	**2**	**1.2.2**
	a. Explain organizational structure, types and advantages / disadvantages of different types of organization.				
	b. Which are the different economic models for project selection? Explain in detail with proper examples.				
	c. Which are the different types of risks that may occur on a project?				
	d. What is role of PMO in any organization? Explain different types of PMOs.				
	e. Explain the difference between a *contract* and an *agreement*?				
2.	*a.* Discuss the place of projects as a vehicle for change-implementing the strategic plans of the organization?	**10**	**2**	**2**	**1.7.1**
	b. Discuss various factors in an organization influencing project management and project life cycle.	**10**	**2**	**2**	**1.7.1**
3.	*a.* What are the reasons for conflicts on any project? Why a Project Manager should possess the skill of Conflict Management? How is the modern view of conflict management different from traditional view? Which are the different conflict resolution techniques a PM use?	**10**	**2**	**2**	**1.2.1**
	b. Which are the three important communication methods used on projects?	**05**	**2**	**1**	**1.2.2**
	c. Which are the different negotiation tactics?	**05**	**2**	**1**	**1.2.2**

4.	*a.* Mr. Sourabh is a Project Manager at M/s. Mehetre Enterprises Ltd. (MEL), an Electrical & Electronics Accessories Distributor Company. His organization is starting a new project to design and build end-to-end distribution network of Anchor Electrical domestic and industry products in the Thane district. He has figured out following dependencies in this project. • Activity 1 can start immediately and has an estimated duration of 3 weeks. • Activity 2 can start after activity 1 is completed and has an estimated duration of 3 weeks. • Activity 3 can start after activity 1 is completed and has an estimated duration of 6 weeks. • Activity 4 can start after activity 2 is completed and has an estimated duration of 8 weeks. • Activity 5 can start after activity 4 is completed and after activity 3 is completed. This activity takes 4 weeks. *a.* Help Mr. Sourabh to draw a Network Diagram and determine duration of the critical path. *b.* Calculate float for activity 2 and 3. *c.* What is the float of the path with the longest float? *d.* In the middle of the project an Engineer working on activity 3 leaves the organization and Mr. Sourabh has to recruit a new Engineer who is less experienced. This activity will now take 10 weeks. How will this affect the project? *e.* After discussion with his team, Sourabh realizes that a new activity 6 needs to be added to the project. This activity will take 11 weeks to complete and must be completed before activity 5 and after activity 3. Ms. Aparna, MD of M/s. MEL is concerned that adding the activity will add 11 weeks to the project. An experienced member, Mr. Harsh from his team suggests that the time will be less than 11 weeks. Who is correct? *f.* With this change to project, how much longer will the project take?	10	3	3	2.6.3
	b. Ms. Manasi has a project to build new fence to a square shaped plot. Each of the four sides of this fence is to take one day to build, and $1000 has been budgeted per side. The sides are planned to be completed one after the other. Today is end of day 3. Using the following project status chart, calculate PV, EV, AC, BAC, CV, CPI, SV, SPI, EAC, ETC, VAC. Also write what does these terms indicate on a project.	10	2	1	1.6.1

Activity	Day 1	Day 2	Day 3	Day 4	Status End of Day 3
Side 1	S---------F				Complete, spent $1,000
Side 2		S--------PF	----F		Complete, spent $1,200
Side 3			PS--S---PF		50% done, spent $600
Side 4				PS--------PF	Not yet started

Key S = Actual Start, F = Actual Finish, PS = Planned Start, and PF = Planned Finish

5.	*a.* Ms. Sneha is managing a project to create an interactive and content rich website that supports students in their efforts to visualize their future by using the neuroscience concept of Time Traveler. The Time Traveler guides students in seeing and planning for the future. In the latest earned value report of her project, she finds that CPI for the project is 1.2, the SPI is 0.8, the PV is $600,000 and the SV is - $120000. She can't find CV in the report. Help her to calculate CV of the project.	**05**	**3**	**4**	**2.8.2**
	b. Mr. Ayush is managing a project to develop a cloud based Business Intelligence Solutions for the Health Care industry. In the latest earned value report of his project, he finds that CV of his project is $10,000, SV is –$ 3000 and PV is $100,000. What are SPI and AC of his project?	**05**	**3**	**4**	**2.8.2**
	c. Ms. Vaibhavi is nominated as a Project Manager for *Construction of New Hostel* Project at SPCE, Mumbai. What she should do to have positive involvement of the all stakeholders throughout this project?	**10**	**2**	**1**	**2.8.2**
6.	*a.* Which are the three important types of contracts? Explain each type in detail.	**10**	**2**	**1**	**1.2.2**
	b. SPCE is in the process of installation of air source heat pump with solar water heater at SPCE Hostel. Mr. Jayant is nominated as a Procurement Manager for this project. Which documents / processes / inputs Mr. Jayant should refer to *plan the procurement management process* effectively.	**10**	**1**	**2**	**2.6.2**
7.	With reference to the case of 'Coal Fired Boilers Project', develop a detailed Project Charter for this Project. [The case text is given on next page.]	**20**	**3**	**3**	**2.6.2**

* * * * *

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Bharatiya Vidya Bhavan's
SARDAR PATEL COLLEGE OF ENGINEERING
(An Autonomous Institution Affiliated to University of Mumbai)

Munshi Nagar Andheri (W) Mumbai 400058

Reexamination
July 2022

T.Y. B.Tech (Elect) Sem VI 12/7/22

Max. Marks: 100 Duration: 3 Hrs
Class: T.Y. B. Tech Semester: VI
Name of the Course: Environmental Science Program: BTech Electrical
Course Code: MCBTE003

Instructions:

Question one is compulsory. Attempt any four of remaining six questions
Draw neat sketches/diagrams wherever required
Assume suitable data if necessary and state them clearly
Figure on right indicate maximum points for the given question, course outcomes attained, Bloom's Level and Performance Indicators

Q1	**Answer the following Questions**	(20)	CO	BL	PI
A	**Fill in the blanks**	(10)	CO1 - CO2	1,2	1.1.2
	1) _____ and _____ are emitted by vehicles 2) _____ and _____ organisations can give certifications for green buildings 3) _____ and _____ are two ecosystems 4) Ecological pyramid is made up of _____. 5) _____ is the global effect caused majorly by excess of methane and carbon di oxide. 6) _____ and _____ are two methods to reduce soil pollution 7) _____ indicates global warming in present scenario 8) Ozone depletion is caused by_____ 9) _____is the place in Mumbai where metro shed building is controversial 10) _____ and _____ are renewable energies.				
B	**State true or false with reasoning (give reasoning for true also)**	(10)	CO1 - CO2	3,2	2.2.3
(i)	In hierarchy of control, administrative control is the last option.				
(ii)	Solar energy is renewable source of energy.				
(iii)	Organic matter is water pollutant.				

(iv)	IGBC is only organization giving green rating				
(v)	Active solar water heating is more economical then passive solar design				
Q2	**Answer the questions**	**(20)**	**CO3**	**5**	**5.3.1**
(a)	Define (a) Productivity (b) Food web	(06)			
(b)	Explain with a sketch of (i) water cycle (ii) Liebig Law	(06)			
(c)	Explain NPP and GPP. A farmer in Punjab grows sunflowers in his farmland which is 250 m^2 during Rabi season and in Kharif season. Find NPP for a farmland the farmer harvests crop as given below for area of 50 m^2 for each plot: 200kg, 600kg, =400kg, 400kg, 500kg in Kharif season. Consider yield to be repeated for Rabi season too.	(08)			
Q3	**Answer the following questions**	**(20)**			
(a)	Define air pollution and classify air pollutants. Give possible sources and effects of air pollutants in India	(10)	CO1 ,CO 2	3,4	6.2.1
(b)	Classify water pollutants. Enumerate sources and effects of water pollutants.	(10)	CO1 ,CO 2	3,4	7.3
Q4	**Answer the following questions**		**CO1 - CO3**	**3,4**	**3.2.1**
i	Explain procedure to get the building certified as green building	10			
iii	Explain with figure any two (a) Incineration (b) Composting (d) landfills	10			
Q5	**Answer the following**	**20**	**CO3**	**2,3**	**2.1.1**
(i)	Explain the elements considered for green buildings	05			
(ii)	Explain salient features of water (pollution and prevention)act, 1974	05			
(iii)	Explain an example of green building with details of elements considered	05			
(iv)	Explain Solid waste management	05			
Q6	**Write short notes on any four**	(20)	**CO1 - CO2**	**2-4**	**4.2.1**
(i)	Solar water heating	(05)			
(ii)	Thermal collectors	(05)			
(iii)	Wind Turbines	(05)			
(iv)	Biomass conversion	(05)			
(v)	Hydroelectricity	(05)			
(vi)	Geothermal energy	(05)			

Q7	**Answer the following questions(any four)**	**20**	**CO1 - CO3**	**2-4**	**4.2.1**
Q1	Explain green buildings and the need for them	(05)			
Q2	Give the salient features of various acts related to occupational health and safety	(05)			
Q3	Explain occupational hygiene and explain the process for developing occupational health and safety plan	(05)			
Q4	Explain salient features of Air Act 1981	(05)			
Q5	What is hierarchy of control and explain in short the components	(05)			
	All the Best				

21/5/22

Bharatiya Vidya Bhavan's
SARDAR PATEL COLLEGE OF ENGINEERING
(An Autonomous Institution Affiliated to University of Mumbai)

Munshi Nagar Andheri (W) Mumbai 400058

T.Y. B. Tech (CBTS) Sem VI

End Semester Examination
May 2022

Max. Marks: 100 | Duration: 3 Hrs
Class: T.Y. B. Tech | Semester: VI
Name of the Course: Environmental Science | Program: BTech Electrical
Course Code: MCBTE003

Instructions:
Question one is compulsory. Attempt any four of remaining six questions
Draw neat sketches/diagrams wherever required
Assume suitable data if necessary and state them clearly
Figure on right indicate maximum points for the given question, course outcomes attained, Bloom's Level and Performance Indicators

Q1	**Answer the following Questions**	**(20)**	**CO**	**BL**	**PI**
A	**Fill in the blanks**	**(10)**	**CO1 - CO2**	**1,2**	**1.1.2**
	1) _____ and _____ are responsible for air pollution disasters 2) _____is first in hierarchy of controls in OHSAS. 3) Various air pollutants emitted by vehicles are _____ and _____. 4) _____ is used as indicator of eutrophic lakes. 5) Ecological pyramid is made up of _____. 6) _____ can be used for transit of solid waste to the disposal site 7) Excess of Carbon mono oxide when mixed with blood forms_____. 8) _____ global effect is caused by excess of CFC 9) _____ is the global effect caused majorly by excess of methane and carbon di oxide. 10) _____ and _____ are two methods to reduce soil pollution				
B	**State true or false with reasoning (give reasoning for true also)**	**(10)**	**CO1 - CO2**	**3,2**	**2.2.3**
(i)	In hierarchy of control, Isolation is the last option.				
(ii)	Biomass energy is renewable source of energy.				

(iii)	Detergents are water pollutants.				
(iv)	Food chains indicate transfer of mass.				
(v)	Active solar water heating is more economical then passive solar design				
Q2	**Answer the questions**	**(20)**	**CO3**	**5**	**5.3.1**
(a)	Define (a) Productivity (b) Ecosystem (c) Food chain	(06)			
(b)	Explain with a sketch of (i) nitrogen cycle (ii) ecological pyramid (iii) Liebig Law	(06)			
(c)	Explain NPP and GPP. A farmer in Ranikhet grows tomatoes in his farmland which is 250 m^2 during Rabi season and maize in Kharif season. Find NPP for a farmland the farmer harvests crop as given below for area of 50 m^2 for each plot: 300kg, 800kg, 600kg, 400kg, 500kg in Kharif season. Consider yield to be repeated for Rabi season too.	(08)			
Q3	**Answer the following questions**	**(20)**			
(a)	Times of India of 3rd May 2018 stated "The first 14 of the 15 worst cities in terms of air pollution are in India, according to the World Health Organization (WHO), which monitors 4,300 world cities for air pollution in terms of PM 2.5 levels" Define air pollution and classify air pollutants. Give possible sources and effects of air pollutants in India	(10)	CO1 ,CO 2	3,4	6.2.1
(b)	Classify water pollutants. Enumerate sources and effects of water pollutants. A story in TOI on 6th May stated Notices were sent recently after the civic body observed poor quality of water. The Chief officer of Municipal corporation of Alandi, Pune Sunil Bhumkar said, "Oxygen level in the drinking water drawn from the river has reduced drastically due to the high level of hyacinth in the river. Therefore, we advised people to boil the water to avoid health issues." Is this statement correct as per your knowledge? Explain the actual cause of need to boil the water? (There are several factories in nearby areas in Alandi and residential area too)	(10)	CO1 ,CO 2	3,4	7.3.1
Q4	**Answer the following questions**	**(20)**	**CO1 - CO3**	**3,4**	**3.2.1**
i	Draw a chart showing functional units of solid waste management and enumerate factors affecting generation rate	05			
ii	Explain methods to mitigate noise pollution. The noise levels at various sources are 40db, 68db,40db,61db,63db and 60db respectively. Find out Lavg.	10			
iii	Explain with figure any one (a) Incineration (b) Composting	05			
Q5	**Answer the following**	**(20)**	**CO3**	**2,3**	**2.1.1**
(i)	Explain salient features of air (pollution and prevention) act, 1981	05			

(ii)	Explain salient features of water (pollution and prevention)act, 1974	05			
(iii)	Explain salient features of Solid waste management rules, 2016	05			
(iv)	State various conventions and major outcomes of those conventions related to pollution prevention and preventing climate change	05			
Q6	**Write short notes on any four**	**(20)**	**CO1 - CO2**	**2-4**	**4.2.1**
(i)	Solar water heating	(05)			
(ii)	Thermal collectors	(05)			
(iii)	Wind Turbines	(05)			
(iv)	Biomass conversion	(05)			
(v)	Hydroelectricity	(05)			
(vi)	Geothermal energy	(05)			
Q7	**Answer the following questions(any four)**	**20**	**CO1 - CO3**	**2-4**	**4.2.1**
Q1	What are the various hazards related to occupational health and safety standards? Explain in brief.	(05)			
Q2	Give the salient features of various acts related to occupational health and safety	(05)			
Q3	Explain occupational hygiene and explain the process for developing occupational health and safety plan	(05)			
Q4	Explain how to recognize and anticipate a hazard.	(05)			
Q5	What is hierarchy of control and explain in short the components	(05)			
	All the Best				

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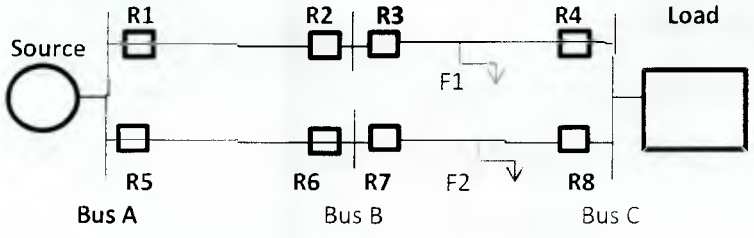
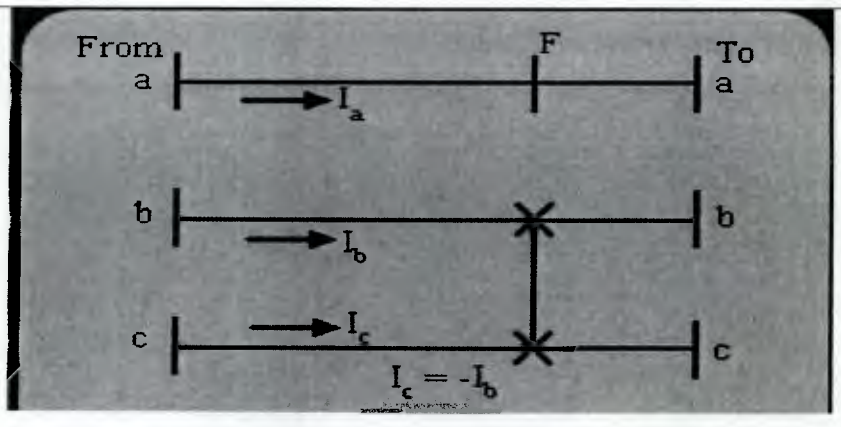
Re- Exam **Date: 11/07/2022**

Program: B. Tech. Electrical, Sem VI **Duration: 3hours** **Marks:100**

Course: PC-BTE 602 **Switchgear & Protection** 11/7/22

Instructions: Attempt any 5 T.Y.B.Tech (Elect) Sem VI

Q. No.	Details	Points	C.O.
Q.1a	 Above circuit shows Ring main system connected to a source and a load at other end. Except R1 and R5 all are directional relays. Decide the directions in which all remaining relays will trip and redraw the diagram. Now, in case of fault F1, list out the relays and their sequence in which they will trip in case R3 and R4 fail to trip. Also for fault F2 list out the relays and their sequence in which they will trip in case R7 and R8 fail to trip.	10	1,3
Q.1b	 For the above transmission line, if Zs is self impedance per unit length, Zm is mutual impedance per unit of length and Z1 is positive sequence impedance per unit length, then prove that the line to line fault which occurred at x distance from sending end bus can be detected by $$\frac{V_b - V_c}{I_b - I_c} = xZ_1$$	10	1,3

Q.2a	Draw the typical Architecture (topology) of a Wide Area Measurement System. What are the functions of PMU and PDC? Compare WAMS with SCADA system.	10	3
Q.2b	Explain different grounding methods.	10	5
Q.3a	Compare Air Blast Circuit Breaker (ABCB) and Minimum Oil Circuit Breaker (MOCB) based on construction (draw the diagrams), working, voltage rating, and applications.	15	4
Q.3b	Explain Lightning phenomena in brief.	5	5
Q.4a	Draw and explain Buchholz relay.	8	1,4
Q.4b	Explain neatly 3 zone protection of transmission line using Impedance relay or Mho relay.	12	1,4
Q.5a	Explain with neat diagram, differential protection for a generator.	10	1,4
Q.5b	Explain Digital relay with the help of block diagram.	10	1,6
Q.6a	Compare HRC Fuse and Circuit Breaker (CB).	10	4
Q.6b	How will you differentiate between switch, isolator, circuit breaker and power contactor based on their capabilities of making, breaking and carrying normal, overload, and short circuit current? (Recall the IEC standard definition)	10	2,4
Q.7a	Explain current chopping phenomena in case of breaking inductive current.	10	4
Q.7b	Explain capacitor bank switching.	10	4

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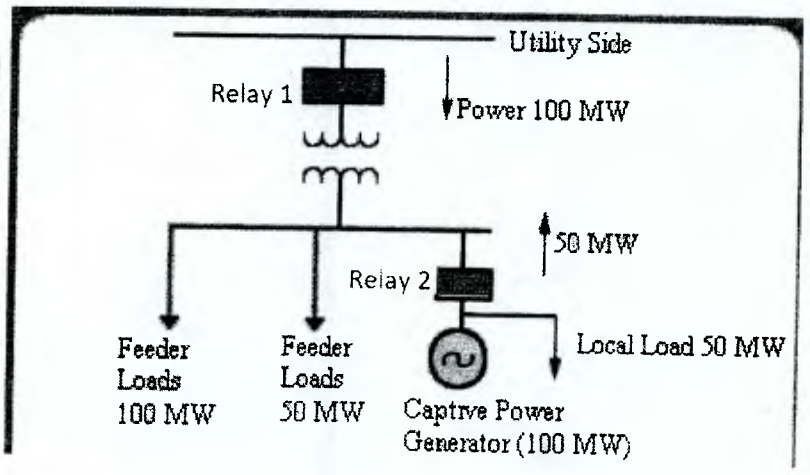
End Semester Exam **Date: 19/05/2022**

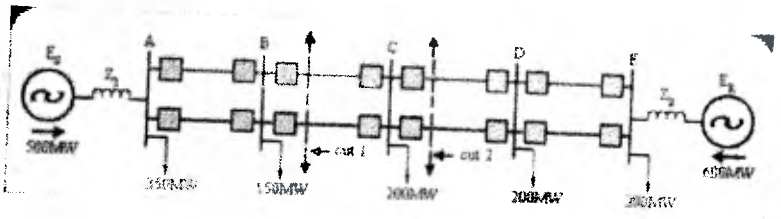
T. Y. B. Tech Electrical Sem VI

Program: B. Tech. Electrical, Sem VI **Duration: 3hours** **Marks:100**

Course: PC-BTE 602 **Switchgear & Protection**

Instructions: Question 1 is compulsory. Attempt any 4 from remaining 6.

Q. No.	Details	Points	C.O.
Q.1a	 Study the power system given above. The utility and Captive power generator both were supplying power of 100 MW each. Note that there is perfect load generation balance in the given system. Now suppose there is a fault in the transformer and Relay 1 disconnects the supply power from utility side. Now, Relay 2 must trip to maintain the supply to local load of 50 MW by adjusting the generation of Captive generator. Suggest, whether you will use directional Overcurrent relay, Reverse Power relay or Frequency relay. Discuss how it will work.	10	1,3
Q.1b	How will you differentiate between switch, isolator, circuit breaker and power contactor based on their capabilities of making, breaking and carrying normal, overload, and short circuit current? (Recall the IEC standard definition)	10	2,4
Q.2a	Explain **in brief** with neat diagram, working of a) Buchholz Relay b) Plain Break Oil Circuit Breaker	12	1,4
Q.2b	Draw and explain with neat diagram differential protection for a Delta-Star (or a Star-Delta) transformer. Show the interconnection of CTs with dot convention.	8	3
Q.3a	Consider the Voltage signal $V(t) = V_m \sin(\omega t + \emptyset)$ Show that using three consecutive samples of voltage signal, we can find the unknown V_m and $\emptyset$ using the least square method.	10	6

Q.3b	Draw and explain functional block diagram of Numerical/Digital Relay Hardware.	10	1,6
Q.4a	Study the given power system carefully. Assume all distance relays are observing a power swing which is resulting in natural separation of the system at cut 2. What will happen to the synchronous generators and overall system if such separation occurs? What is to be done to prevent it and how will you achieve that? Clearly mention which relays to be tripped/not tripped and how? Give all relays proper numbering for your convenience.  Note: Write in brief.	10	3
Q.4b	Draw the typical Architecture (topology) of a Wide Area Measurement System. What are the functions of PMU and PDC? Why does WAMS perform in a better way than SCADA system?	10	3
Q.5a	Explain with neat diagram how a Mho relay is used in case of loss of excitation of a Synchronous Generator? Why is it placed in the 3rd and 4th quadrant of the R-X diagram?	10	6
Q.5b	Explain with proper diagram Type-2 co-ordination used for Induction Motor protection. Why does a HRC fuse is required at first place when an overcurrent relay is already provided for the motor protection? Can't the same relay trip on short circuit?	10	3,4
Q.6a	Consider a L-G fault in an ungrounded system. How does overvoltage appear in healthy phases? How is it overcome in a solidly grounded system? Explain both with phasor diagrams.	12	5
Q.6b	In a system of 132 kV, the line to ground capacitance is 0.01 μF and the inductance is 5 Henries. Determine the voltage appearing across the pole of a C.B. if a magnetizing current of 5 amp (instantaneous value) is interrupted. Determine also the value of resistance to be used across the contacts to eliminate the Re-striking voltage. (Recall current chopping phenomena)	8	4
Q.7a	Compare Air Circuit Breaker (ACB) and Air Blast Circuit Breaker (ABCB) based on construction (draw the diagrams), working, voltage rating, and applications. Why ABCB cannot be used for low voltage applications?	15	4
Q.7b	Explain Lightning phenomena in brief. How does a ground wire protect transmission line against lightning?	5	5

17/5/22

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End Semester - May 2022 Examinations

T.Y. B.Tech (Electrical) Sem VI

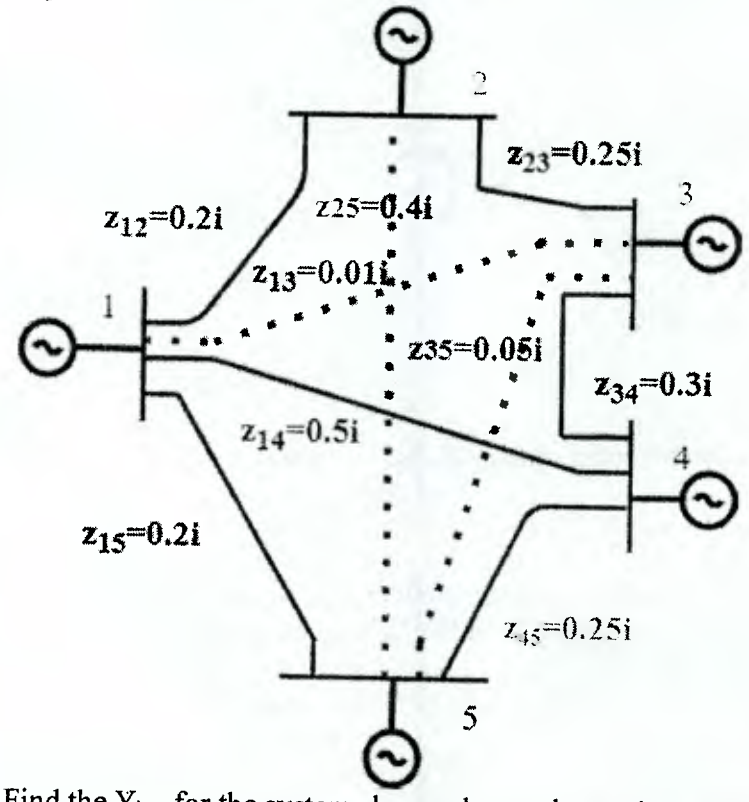
Program: T. E | **Duration:** 3h

Course Code:PC-BTE601 | **Maximum Points:**100

Course Name: Power System-II | **Semester:** VI

- Attempt any 5 questions.
- Make suitable assumptions wherever necessary.
- All sub question should be solved together.
- Answer should have four digits after decimal.

Q.	Questions	Points	CO	BL	PI
Q1.(a)	Describe the different operating states of the power system and the control strategies adopted for each state.	10	3	3	2.4.1
(b)		10	1	2	2.4.1



(i) Find the Y_{bus} for the system shown above when only transmission lines represented by solid lines are connected.

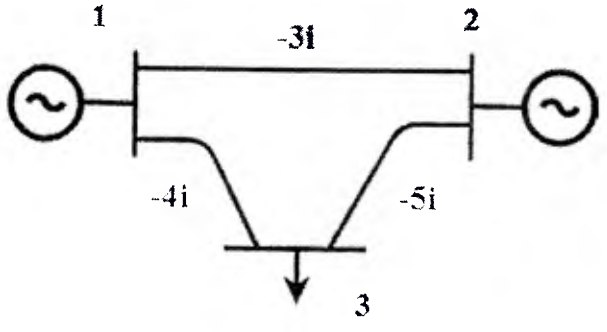
(ii) What changes should be made in Y_{bus}, when the transmission lines represented by doted lines also get connected in the system.

Q2.(a)	Explain with the help of a neat diagram single area automatic load frequency controller and obtain the connected block diagram for the same.	12	1	5	2.2.1

(b)	Obtain the dynamic response of the automatic load frequency controller for single area system. Also suggest a method for improving the dynamic response of load frequency controller.	8	5		2.2.1

Q3.(a)	The three-bus power system shown below. The relevant pu line admittance on 100 MVA base are indicated on the diagram and the bus data are given. Form Y_{bus} and determine voltage at bus 2 and 3 after first iteration Gauss Seidel. Take acceleration factor α=1.6.	12	3,2	2	2.4.1

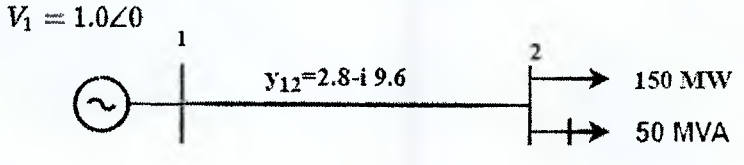
Bus	Type	Generation		Load		Voltage	δ
		P_G(MW)	Q_G(MVAR)	P_L(MW)	Q_L(MVAR)	pu	
1		?	?	0	0	1.02	0°
2		25	15	50	25	?	?
3		0	0	60	30	?	?



(b)	Explain the working of the thyristor control series reactor (TCSC) and also obtain its operating regions.	8	4	4	2.2.1

Q4. (a)	A generator operating at 50 Hz delivers 1 pu power to an infinite bus when a fault occurs which reduces the maximum power transferable to 0.4 pu whereas the maximum power transferable before the fault was 1.75 pu and is 1.25 pu after the fault is cleared. Determine the critical clearing angle. If the inertia constant (H) of the generator is 4 pu.	10	5	4	2.4.1
(b)	Explain how series compensation method can be used for the control of power flowing on the transmission line.	10	4	2	2.2.1

Q5. (a)	A synchronous generator having H=8 MJ/MVA is connected to an infinite bus and supplying power of 1 pu with initial angle (δ_o) as 25°. Assume as 3φ fault occurring at t=0; cleared at t=0.15 s. The power equations expressed in pu are as under: Power transfer in pre fault condition=2.5sin δ Power transfer in fault condition=0.6 sin δ Power transfer in post fault condition=1.5sin δ The system frequency is 50 Hz. Use modified Euler's method to solve the swing equation with step size 0.05.	12	5	4	2.4.1
(b)	Obtain the reactive power capability curves of the synchronous machine. Also comment how the operating region under reactive capability curve can be improve.	8	4	2	2.2.1
Q6. (a)	In the two bus system shown below, bus 1 is a slack bus with $V_1=1.0< 0\ pu$. A load of 150 MW and 50 MVAR is taken from bus 2 .The line impedance is $y_{12}=10< -73.74°$ pu on the base of 100 MVA. The expression of real and reactive power at bus 2 is given by $P_2=10\|V_2\|\|V_1\|\cos(106.26°-\delta_2+\delta_1)+10\|V_2\|^2\cos(-73.74°)$ $Q2=-10\|V_2\|\|V_1\|\sin(106.26°-\delta_2+\delta_1)+10\|V_2\|^2\sin(-73.74°)$ Using the Newton Raphson Method obtain the voltage magnitude and phase angle at bus 2. Start with an initial estimate of $\|V_2\|=1.0$ pu and $\delta_2°=0$.Perform two iterations.	12	4	4	2.4.1



(b)	A synchronous motor is drawing 30% of the maximum steady state power from an infinite bus bar. If the load on motor is suddenly increased by 100% would the synchronism be lost? If not, what is the maximum excursion of torque angle the new steady state rotor position.	8	5	5	2.4.1

Q7.	Write short notes on any two:	2*10	4	2	2.2.1
	(i) Static VAR Systems					
	(ii) Automatic voltage regulators for synchronous generator					
	(iii) Equal angle criteria					

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RE-Exam - July 2022 Examinations

T. Y. B. Tech (Electrical Engg) Sem VI

Program: T. E

Course Code: PC-BTE601

Course Name: Power System-II

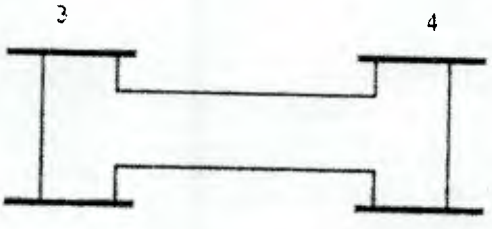
Duration: 3 h

Maximum Points: 100

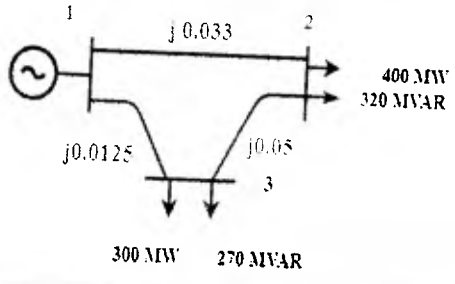
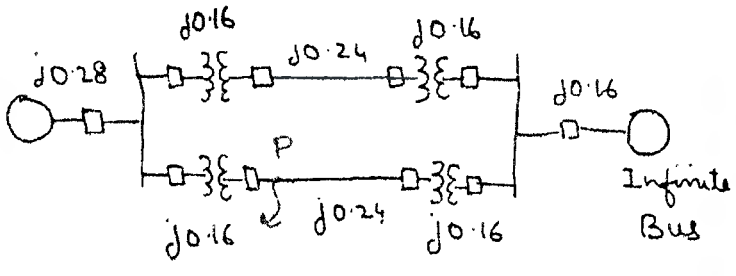
Semester: VI

8/7/22

- Attempt any five questions.
- Make suitable assumptions wherever necessary.
- Answer should have at least four digits after decimal.

Q.No	Questions	Points	CO	BL	PI
Q1(a).	Form the Ybus using singular trans formation method for the system shown below. The impedance data (in pu) is given in Table below. 	8	1	3	2.4.1
Q1.(b).	Write expression for power flow equation. How are buses classified and what are the known and unknown variables at each bus?	6	1	4	2.4.1
Q1.(c)	Use classical Runga Kutta method of 4th order at x=1.1 ; given y(0)=1 and h=0.05.	6	1	4	2.4.1
Q2.	The one-line diagram of a simple three bus system with generation at bus1. The voltage at bus 1 is V_1=1.0 pu. The schedule load on buses 2 and 3 are marked on the diagram. Line impedance in pu on a 100MVA base. The line charging susceptance are neglected. Using Gauss Seidel and initial estimate $V_2^{(0)}=V_3^{(0)}=1+0i$, determine	15	3	4	2.4.1

Element No	Bus code	Impedance
1	1-2	0.5
2	1-3	0.6
3	3-4	0.4
4	2-4	0.3

	V_2 and V_3 after first iteration.  				
Q2.(b)	Solve the following initial value problem by modified Euler's method. Find y at x=1.1 and 1.2.	5	1	3	2.4.1
Q3.(a)	The single line diagram given below shows a generator connected through parallel high voltage transmission lines to a large metropolitan system considered as an infinite bus. Numbers on the diagram indicate the values of the reactance in per unit. The transient reactance of the generator is included in the values marked. Breaker adjacent to a fault on both sides are arranged to clear simultaneously. Specify in electrical degrees the critical clearing angle for the generator for a three-phase fault at the point P when the generator is delivering 1.0 per unit power. Assume that the voltage behind transient reactance is 1.25 per unit for the generator and that the voltage at the infinite bus is 1.0 per unit.  	15	4	3	2.4.1
Q3(b)	Compare the Gauss Seidel method and Newton Raphson method used for solving load flow problems	5	3		
Q.4.(a)	The dynamics of the synchronous generator is obtained using swing equation. Derive the swing equation for the synchronous	10	4		

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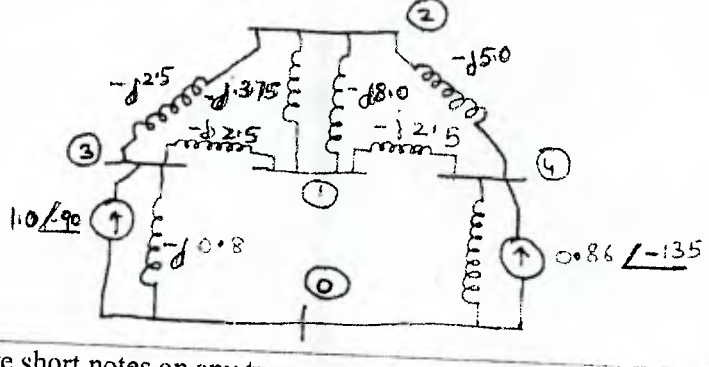
RE-Exam - July 2022 Examinations

	generator.				
Q4.(b)	Explain with the help of a neat diagram the working of the thyristor control reactor (TCR) and also obtain the expression of admittance.	10	5		
Q5.(a)	Explain with the help of a neat diagram the speed governor system and also highlight the role of hydraulic amplifier. Derive the transfer function of the speed governor.	10	5	4	2.4.1
Q 5.(b)	Determine the steady state response of the single area frequency controller for free governor operation.	10	5		
Q6.(a)	A power deficient area received 50 MW over a tie line from another area. The maximum steady state capacity of the line is 100MW. Find the allowable sudden load that can be on without loss of stability.	10	4		
Q6 (b)	The nodal admittance network is shown below. Eliminate node 1 and the corresponding voltage from the network using Kron's elimination. Also draw the one-line diagram of the reduced network 	10	1		
Q7.	Write short notes on any two: (i) V-I characteristic of SVS (ii) Automatic voltage regulator (iii) Operating states of power systems (iv) Reactive power capability curve	2*10	4	4	2.4.1