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SARDAR PATEL COLLEGE OF ENGINEERING

(Government Aided Autonomous Institute)
Munshi Nagar, Andheri (W) Mumbai – 400058

Previous Semester Exam - December 2022 Examinations

Program: T. E (Electrical) Sem VI

Duration: 3h

Course Code: PC-BTE601

Maximum Points: 100

Course Name: Power System-II

Semester: VI

- All questions are compulsory.
- Make suitable assumptions wherever necessary.
- Answer should have 4 digits after decimal.

Q.No	Questions	Points	CO	BL	PI
Q1.(a)	Determine the bus admittance matrix of the system whose data is given below: **Bus code** | **Impedance pu** 1-2 | 0.06+0.18i 1-3 | 0.03+0.09i 2.3 | 0.08+0.24i If each line has a total shunt admittance of -0.5i pu. Determine the modified matrix	12	1	3	2.4.1
Q1.(b)	Solve the following equations using the Gauss elimination method $2x_1+x_2+3x_3=6$ $2x_1+3x_2+4x_3=9$ $3x_1+4x_2+7x_3=14$	8	1	3	2.4.1
Q2.(a)	Write load flow equations in Cartesian form. Name different types of buses and also mention the known and unknown parameters.	8	2		2.1.3
Q2.(b)	Derive the Jacobean matrix for a three-bus system; where bus 2 and 3 are PQ buses.	12	2		2.1.3
Q3.(a)	A double circuit three phase feeder connects a single generator to a large network. The power corresponding to the limits of the steady state stability for each circuit is 100 MW. The line is transmitting 80 MW when one of the circuit is suddenly switched out. Determine with reference to appropriate diagram whether the generator is likely to remain in synchronism.	12	3	3	2.4.1
Q3(b).	Derive the block diagram of the automatic voltage regulator of the synchronous generator.	8	2	4	2.4.1

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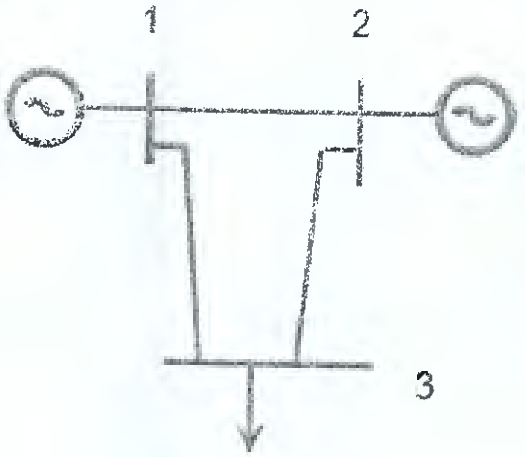
Q4.(a) A three-bus power system is shown below. The system parameters are given in Table1 and the generation and demand data in Table2. The voltage at bus 2 is maintained at 1.04 per unit. The maximum and the minimum reactive power limits of the generation at bus 2 are 35 and 0 MVAR. Assume the bus 1 as slack bus and acceleration factor as 1.6. Determine one iteration of load flow solution using the Gauss Seidel iterative method. 12 3 2.4.1

Table1

Bus Code	Impedance in per unit	Bus code	Line charging admittance ($y_{ij}/2$)
1-2	0.06+j0.18	1	j0.05
1-3	0.02+j0.06	2	j0.06
2-3	0.04+j0.12	3	j0.06

Table 2

Bus No	Bus Voltage	Generation		Demand	
	Per unit	MW	MVAR	MW	MVAR
1	1.06+j0	-	-	0	0
2	1.04+j0	20	-	0	0
3	-	0	0	60	25



Q4.(b)	Explain with the help of a neat diagram different operating states of the power system. Mention conditions for transition from one state to another and also explain the control strategies adopted for each state.	8	3	3	2.4.1
Q5.(a)	What are statis VAR system. Obtain V-I characteristic of SVR and also explain with the help of a neat diagram operation of SVR.	12	5	2	2.2.1
Q5.(b)	Name the method can be used for selective elimination of the nodes from the system. Obtain the equation for the same.	8	1	2	2.2.1
Q6.(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	4	2	2.2.1
Q6.(b)	Explain how series compensation method can be used for the control of power flowing on the transmission line.	8	4	1	1.2.1
Q7.	Attempt any two:	2*10	4	2	2.2.1

(i) Methods of improving transient stability.
(ii) Reactive capability curve of synchronous generators.
(iii) Thyristor control reactors (TCR).

Sardar Patel College of Engineering

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Previous Year Exam **Date:**

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

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

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

Q. No.	Details	Points	C.O.
Q.1a	Draw and explain current differential protection for a 3-phase transformer.	10	1,3
Q.1b	Where is distance relay used? Explain 3-zone protection using Mho relay	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 working and applications of plain Oil Circuit Breaker.	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	Explain the terms TMS and PSM in case of overcurrent relay.	8	1,4
Q.4b	Explain electromagnetic type Induction disc type relay.	12	1,4
Q.5a	Explain with neat diagram, differential protection for a generator.	10	1,4
Q.5b	Explain parallel feeder protection using directional relays.	10	1,2
Q.6a	Compare HRC Fuse and Circuit Breaker (CB).	10	4
Q.6b	Explain Type-2 co-ordination used in protection of Induction motor.	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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Munshi Nagar Andheri (W) Mumbai 400058

Previous Semester (KT) Examination
Dec 2022

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

28/11/22.

Instructions:
Attempt any five questions from seven 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

		Marks	CO	BL	PI
Q1	**Answer the following Questions**	**20**	CO3	1,2	1.1.2
(i)	Define (a) Productivity (b) Ecology (c) Food chain	6			
(ii)	Explain with a sketch of (i) nitrogen cycle (ii) Carbon cycle (iii) Liebig Law	6		3,2	2.2.3
(iii)	Explain NPP and GPP. A farmer in Ranikhet grows tomatoes in his farmland which is 300 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 60 m^2 for each plot: 600kg, 800kg, 600kg, 500kg, 800kg in Kharif season. Consider yield to be repeated for Rabi season too.	8			
Q2	**Answer the following**	**20**			
(i)	Define air pollution and classify air pollutants. Give possible sources and effects of air pollutants in India	10	CO1 - CO3	1,2	4.1.2
(ii)	Explain Green building. Enumerate various green building certifications at Indian and global level. What are the main criteria considered in these certifications	10	CO1 - CO3	1,2	2.3.2
Q3	**Answer the following**				
(i)	Classify water pollutants. Enumerate sources and effects of water pollutants.	10	CO1 - CO3	3,4	3.2.1
(ii)	Draw a chart showing functional units of solid waste management and enumerate factors affecting generation rate	10	CO1 - CO3	3,4	4.3.1

Q4	**Answer the following questions**		CO1	3,4	3.2.1
(i)	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**	CO3		
(ii)	Explain with figure any one (a) Incineration (b) Composting	**05**			
(iii)	Explain registration process of green building in IGBC	**05**			
Q5	**Answer the following (any TWO)**	**20**	CO3	2,3	2.1.1
(i)	Explain salient features of air (pollution and prevention) act, 1981	**10**			
(ii)	Explain salient features of water (pollution and prevention)act, 1974	**10**			
(iii)	State various conventions and major outcomes of those conventions related to pollution prevention and preventing climate change	**10**			
Q6	**Write short notes on any four**	**20**	CO1	2-4	4.2.1
(i)	Solar water heating	**05**	CO2		
(ii)	Thermal collectors	**05**			
(iii)	Biomass conversion	**05**			
(iv)	Hydroelectricity	**05**			
(v)	Geothermal energy	**05**			
Q7	**Answer the following questions(any four)**	**20**	CO1	2-4	4.2.1
(i)	What is hierarchy of control and explain in short the components	**05**	CO3		
(ii)	Explain Biomass conversion	**05**			
(iii)	What are the various hazards related to occupational health and safety standards? Explain in brief.	**05**			
(iv)	Give the salient features of various acts related to occupational health and safety	**05**			
(v)	Explain occupational hygiene and explain the process for developing occupational health and safety plan	**05**			
(vi)	Explain how to recognize and anticipate a hazard.	**05**			

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Bhavan's Campus, Munshi Nagar, Andheri (West), Mumbai 400 058

Academic Year 2022-23 [Second Half]
Previous Semester Examination – December 2022

29/12/2022

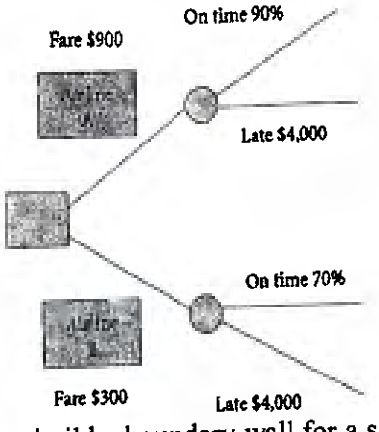
Program: B. Tech. Electrical Engineering T.Y. B. Tech
Course: Open Elective I [Project Management] CO7
Course Code: OE –BTE601 Sem VI

Semester: VI
Date: 29th Dec 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.* Explain meaning of OPAs and EEFs briefly. *b.* Explain various economic models of project selection with proper examples. *c.* Explain following terms, with reference to Quality Management on a project: (*i*) Gold Plating (*ii*) Kaizen (*iii*) JIT (*iv*) Marginal Analysis (*v*) TQM *d.* According to Tuckman ladder model, which are the different stages of team formation and development.	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 in detail, the different estimation techniques that may be used on a project	10	2	2	1.7.1
3.	*a.* Write the advantages and disadvantages of: (*i*) Fixed Price Contract *(ii)* Time and Material Contract *(iii)* Cost Reimbursable Contract	10	1	2	1.2.2
	b. Describe various methods used to collect requirements of a project to prepare *Requirement Management Plan.*	10	1	2	1.2.2
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. What a Project Manager should do before Validate Scope Process and what will she have when she is done with this process? How is this process different from Close Project or Phase Process? How is this process related to the Control Quality Process?	10	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?  	**10**	**3**	**3**	**2.6.3**
	b. Jeet is on a project to build a boundary wall for a square shaped MIDC plot. Each of the four sides of this wall is to take one day to build, and $1000 has been budgeted per side. The sides were planned to be completed one after the other, but circumstances changed on the project and the work on the sides was able to proceed in parallel. Now the sides have a Finish-to-Finish relationship instead of a Finish-to-Start relationship, so more than one side can be worked on at the same time. 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---F--PF			Complete, spent $900
Side 3		S--	PS-------PF		50% done, spent $600
Side 4			S--	PS------PF	75% done, spent $600

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

6.	*a.* M/s. Mittal Biocare Ltd. (MBL) is a multinational pharmaceutical company, operating in 7 countries across globe. M/s. MBL is looking for upgrading their existing payroll system, which is currently managing payroll and other HR functions for its 25,000 odd employees. This current payroll system is geographically focused, not flexible and integrated and needs substantial manual clerical time. Administering this system currently costs around US $ 2.4 million annually. For proposed payroll system company has allocated a budget of US $ 12,00,000 and wants to get the project functional by May 2020. For this project, Ms. Ashwini will be a Project Manager. Ms. Janhavi, Vice President, Human Resources (Global Operations) alongiwht Ms. Saiprabha, MD M/s. MBL, will be the sponsors. Ms. Ashwini is collecting the requirements for this project. Which different methods she can use to prepare a Requirements Management Plan for this project? Explain the method of 'Context Diagram' in detail with a proper diagram to collect requirements for this project.	**10**	**3**	**4**	**2.8.2**

	b. 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?	**10**	**3**	**3**	**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 bollers, 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, whicb 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.

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PREVIOUS SEMESTER EXAMINATION DECEMBER 2022

Program: Electrical Engineering
Course Code: OE-BTE604
Course Name: VLSI Circuits

Duration: 3 hr
Maximum Points:
Semester: VI

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.

Q.No.	Questions	Points	CO	BL	Module No.
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.	5	1	2	1
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 $\gamma = 0\ V^{1/2}$ $\lambda = 0$ $\mu_n C_{ox} = 216\ \mu A/V^2$ (a) Determine the required aspect ratio, W/L. (b) Determine V_{IL} and V_{IH}. (c) Determine noise margins N_{ML} and N_{MH}.	5	2	3	2
C)	Write an 8:1 multiplexer module called *mux8* with inputs $S_{2:0}$, *D0, D1, D2, D3, D4, D5, D6, D7*, and output *Y*.	5	4	3	6

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PREVIOUS SEMESTER EXAMINATION DECEMBER 2022

D)	Describe AOI and OAI gates.	5	3	3	3
Q2. A)	Give the CMOS inverter voltage transfer characteristics and operating regions.	5	2	2	2
B)	For an n-channel MOS transistor with $\mu n = 76.3\ cm2V.s$, $Cox = 2.2x10{-}2\ F/m2$, 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.	5	1	2	1
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 $\mu_n C_{ox} = 102\ \mu A/V^2$ $(W/L)_n = 10$ $\mu_p C_{ox} = 51.6\ \mu A/V^2$ $(W/L)_p = 19$ Calculate the noise margins of the circuit.	10	2	3	2
Q.3 A)	Sketch the transistor level schematic and layout for CMOS 2-input NAND gate.	5	2	3	2
B)	Define: i) Pseudo-nMOS gate, ii) transmission gate. Implement two input multiplexer using CMOS transmission gate.	5	3	2	3
C)	Write short note on JK latch circuit.	5	3	2	3
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 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.	5	1	2	1
Q.4 A)	Give the classification of semiconductor memories. Draw typical random access memory array organization.	5	3	2	4

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PREVIOUS SEMESTER EXAMINATION DECEMBER 2022

B)	Design a 4-bit X 4-bit NOR based ROM array to store following data stream. Also write its column and rows combination. Data: 1100 1010 0110 1001 Draw layout for circuit designed.	10	3	3	4
C)	Discuss the operation of resistive-load SRAM Cell.	5	3	1	4
Q.5 A)	Discuss the operation of three transistors DRAM Cell.	10	3	1	4
B)	Write an HDL module that computes a 4-input XOR function. The input is A(3:0) and the output is Y.	5	3	3	6
C)	Describe simulation, synthesis and combinational circuit with example.	5	3	2	6
Q.6 A)	What are the steps involved in patterning of silicon dioxide.	5	1	2	6
B)	Write a structural module to compute $Y = AB + BC + ABC$ using 8:1 multiplexer logic.	5	4	3	6
C)	Describe switching power dissipation.	5	4	2	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?	5	4	2	7
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.	10	4	3	2
C)	Draw and explain the operation of CMOS D latch using pass gate.	5	4	2	3
D)	Realize the transistor level circuit for given logic equation using Pseudo nMOS gate. $Y = \overline{(A.B + \bar{C}).D}$	5	4	3	3

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PREVIOUS SEMESTER EXAMINATION DECEMBER 2022

Program: UG B. Tech Elec Engg Sem VI **Duration: 03 Hours**

Course Code: PE-BTE601 **Maximum Points: 100**

Course Name: Electrical Machines Design I **Semester: VI**

Note: Answer five questions out of seven.
Assume suitable data if required

Q.No.	Questions	Points	Module No.
Q. 1 (a)	State the desirable properties of the magnetic materials used in electrical machines.	08	01
Q. 1 (b)	Discuss the required properties of insulating material used in power transformers.	08	01
Q. 1 (c)	What is the effect of flux density on the size of magnetic material? What is the range of flux density in power transformer?	02+ 02	01
Q. 2 (a)	State the advantages of direct cooling method and discuss the coolants used for direct cooling.	10	02
Q. 2 (b)	The losses of a 60 MW hydrogen cooled alternator on full load amount to 750kW. The flow of hydrogen from the coolers is 10 m/s at 2000 mm of mercury gauge pressure above atmosphere, which is 760 mm of mercury. The temperature of hydrogen leaving the coolers is 25°C. Determine the temperature rise of hydrogen assuming specific heat of hydrogen at constant pressure to be 12540 J/kg °C and weight of 11.2 m^3 of hydrogen at 0 °C and 760 mm of mercury to be 1 kg.	10	02
Q. 3 (a)	Derive the expression for determining the rating of 1-phase transformer.	10	03
Q. 3 (b)	Determine the dimensions of core and yoke for a 200 kVA, 50 Hz single phase core type transformer. A cruciform core is used with distance between adjacent limbs equal to 1.6 times the width of core laminations. Assume voltage per turn 14 V, maximum flux density 1.1 Wb/m^2, window space factor 0.32, current density 3 A/mm^2, and stacking factor = 0.9. The net iron area is 0.56 d^2 in a cruciform core where d is the diameter of circumscribing circle. Also the width of largest stamping is 0.85 d.	10	03

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PREVIOUS SEMESTER EXAMINATION DECEMBER 2022

Q. 4 (a)	What is the voltage regulation in transformer? Derive the expression for per unit voltage regulation for full load rated output and full load current.	10	04
Q. 4 (b)	An 11kW, 3-phase, 6-pole, 50 Hz, 220V, star connected induction motor has 54 stator slots, each containing 9 conductors. Calculate the values of bar and end ring currents. The number of rotor bars is 64. The machine has an efficiency of 0.86 and a power factor of 0.85. The rotor mmf may be assumed as 85% of stator mmf. Also find the bar and the end ring sections if the current density is 5 A/mm^2.	10	05
Q. 5 (a)	Discuss the factors affecting the size of rotating electrical machines.	10	05
Q. 5 (b)	State the steps involved in designing a squirrel cage induction motor rotor bar conductor and end ring size.	10	05
Q. 6 (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.	10	06
Q. 6 (b)	A 15 kW, 440V, 4 pole, 50 Hz, 3 phase induction motor is built with a stator bore 0.25 m and a core length of 0.16. The specific electric loading is 23000 ampere conductors per metre. Using the data of this machine, determine the core dimensions, number of stator slots and number of stator conductors for a 11kW, 460 V, 6 pole, 50 Hz motor. Assume a full load efficiency of 84% and power factor of 0.82 for each machine. The winding factor is 0.955.	10	06
Q. 7 (a)	Define the following terms with reference to ac windings: (i) Coil span factor and distribution factor (ii) Chorded windings and its effect on machine performance	10	07
Q. 7 (b)	Find the main dimensions of a 15 kW, 3-phase, 400 V, 50 Hz, 2810 r.p.m. squirrel cage induction motor having an efficiency of 0.88 and a full load power factor of 0.9. Assume: Specific magnetic loading = 0.5 Wb/m^2; Specific electric loading = 25000 A/m. Take the rotor peripheral speed as approximately 20 m/s at synchronous speed.	10	07

Bharatiya Vidya Bhavan's

Sardar Patel College of Engineering

(A Government Aided Autonomous Institute)
Munshi Nagar, Andheri (West), Mumbai – 400058

Previous Semester Examination

Program: Electrical Engineering
Duration: 3 hrs.
Maximum Marks: 100

Date: December 2022
Course code: PE-BTE602
Semester: VI

Course Name: Control System Design

Note: Q1 is compulsory. Solve any four questions from the remaining six.
Assume suitable data if required

Q. No.	Questions	Max Marks	CO No	BL	Module
1 a	What are the time domain design specifications? Explain the effect of gain on transient and steady state response.	05	01	03	01
b	Why is the correction factor added to the phase margin required to meet the transient response?	05	02	04	03
c	Why is there more improvement in steady state error if a PI controller is used instead of a lag network?	05	01	04	04
d	Briefly describe the configuration of an observer. How is the observability defined mathematically?	05	03	02	06
2 a	A unity feedback system with a forward transfer function $G(s) = \frac{k}{s(s+6)}$ is operating with closed loop response that has 10% overshoot. a> Evaluate the settling time b> Evaluate the steady state error for unit ramp input. c> Design a lag lead compensator to decrease the settling time by two times and decrease the steady state error for a unit ramp input by 10 times. Place the lead zero at -3.	10	01	06	02
b	For a unity feedback system $G(s) = \frac{k}{s(s+4)(s+12)}$ Design rate feedback compensator to reduce settling time by a factor of 4 if %overshoot is 20%.	08	01	06	04

3 a	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	04
b	Describe the relation between closed loop transient and closed loop frequency response. Also, briefly explain how to find static error constant from Bode magnitude plot.	10	02	02, 03	03
4 a	For a unity feedback system with a forward transfer function $$G(s) = \frac{k}{s(s+30)(s+100)}$$ Use frequency response method to find system gain k, to yield closed loop step response with 20% overshoot.	08	02	05	02
b	Design lag lead compensator for unity feedback system with forward path transfer function $$G(s) = \frac{k}{s(s+2)(s+5)}$$ to meet the following specifications: % overshoot 14%, peak time 2 sec and k_v=12. Use frequency response method.	12	02	06	02
5 a	The plant transfer is given by $$\frac{s+4}{s^3+8s^2+17s+10}$$ Design full order observer to have 10 % OS and 0.1 sec settling time	10	03	06	5,6
b	The state space model for the system is $$\dot{x} = \begin{bmatrix} -2 & 1 & 0 & 0 \\ 1 & -2 & 1 & 0 \\ 0 & 1 & -2 & 1 \\ 0 & 0 & 1 & -1 \end{bmatrix} x + \begin{bmatrix} 1 \\ 0 \\ 0 \\ 0 \end{bmatrix} u;$$ $$y = [0\ 0\ 0\ 1]x$$ Design reduced order observer to estimate states x1,x2,x3. The observer poles are at -3, -4, -5.	10	03	06	5,6

6 a	Consider the system $\dot{x} = \begin{bmatrix} 0 & 1 \\ -1 & -2 \end{bmatrix} x + \begin{bmatrix} 1 \\ -1 \end{bmatrix} u ; \quad y = [1 \quad 0]x \quad and\ x(0) = \begin{bmatrix} 0 \\ 1 \end{bmatrix}$ Determine the solution of state equation to unit step input	10	03	04	05
b	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	06
7 a	Explain various types of system non-linearity and their effect on system performance.	10	04	02	07
	With an example explain how phase plane analysis is used to comment on stability of the system	10	04	02	07