



Bharatiya Vidya Bhavan's

SARDAR PATEL COLLEGE OF ENGINEERING

(Government Aided Autonomous Institute)

Munshi Nagar, Andheri (W) Mumbai – 400058



END-SEMESTER EXAMINATION MAY 2025 / Re-Exam June 25

Program: TY B. Tech (Electrical) *sem VI*

Duration: 3 hr

Course Code: PC-BTE601

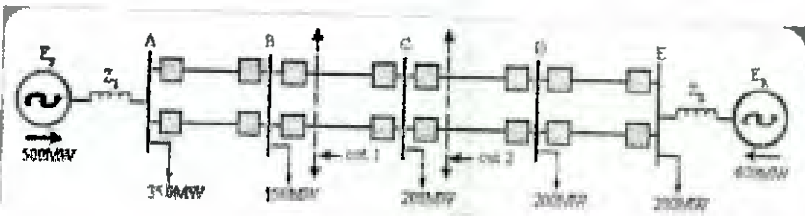
Maximum Points: 100

Course Name: Power System Operation & Control

Semester: VI

Note: Question 1 is compulsory; attempt any 4 from remaining 6.

23/6/25

Q. No.	Question	Points	CO	BL	Module No.
Q.1a	Study the given power system carefully. Assume all distance relays are tripping on a power swing which is resulting in natural separation of the system at cut 2. What is the state of the system at this moment? (Alert/Emergency/Extremis Justify) After the tripping of distance relays, what will happen to the synchronous generators? Which relays are provided for generators under this situation? How will they work? and hence what is the state of the system when they trip? (Alert/Emergency/Extremis Justify) What is to be done to prevent it and how will you achieve that? Clearly mention which relays to be tripped/not tripped for the same and how? Give all relays proper numbering for your convenience. 	10	4	3,4	6
Q.1b	Draw and explain generator capability curve by considering all constraints on a synchronous generator.	10	1	1,2	1
Q.2a	Draw the characteristics and explain the reactive power requirement of transmission line as a function of surge impedance loading.	8	2	2,3	4



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END SEMESTER EXAMINATION MAY 2025



Q.2b	Prove that with mid-point compensation (shunt compensation), active power flow over transmission line increases. Derive the relation for reactive power also. Draw the power angle curve.	12	2	2,3	4
Q.3a	The fuel cost function in Rs./hr for three thermal plants are given by $C_1 = 350 + 7.2P_1 + 0.004P_1^2$ $C_2 = 500 + 7.3P_2 + 0.0025P_2^2$ $C_3 = 600 + 6.74P_3 + 0.003P_3^2$ where, P_1 , P_2 , and P_3 are in MW. Neglecting line losses and generator limits, determine the optimal scheduling of generation, when the total load is 750 MW by using iterative method with initial estimate of $\lambda = 7.5$ Rs/MWh. Find total cost of generation. Also find cost of generation if all generators share the load equally. Compare the results and comment on saving.	10	3	3,4	5
Q.3b	Repeat the problem given in Q.3a, by considering the following generator limits (in MW) $122 \leq P_1 \leq 400$ $260 \leq P_2 \leq 600$ $50 \leq P_3 \leq 445$ Find total cost of generation and compare the result with Q.3a.	10	3	3,4	5
Q.4a	A single area consists of two generating units, rated at 400 and 800 MVA, with speed regulation of 4 percent and 5 percent on their respective ratings. The units are operating in parallel, sharing 800 MW. Unit 1 supplies 300 MW and unit 2 supplies 500 MW at 1.0 per unit (60 Hz) frequency. The load is increased by 130 MW. The load varies 0.804% for every 1% change in frequency. Find the steady-state frequency deviation and the new generation on each unit. How much is the total generation? Why is it less than actual load demand?	10	2	3,4	2
Q.4 b	Define Micro-grid [1m]. List out the components of the Micro-grid [3]. With the help of diagram, show various levels of controls involved in functioning of Micro-grid [4]. What is the objective of tertiary control? [2]	10	4	2,3	7
Q.5a	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	4	1,2,3	6
Q.5b	What is FC-TCR? Discuss the operation and draw the control characteristics of FC-TCR.	10	2	2,3	4



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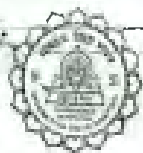
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Q. 6a	The fuel-cost functions in Rs./h for two 800 MW thermal plants are given by $C_1 = 500 + 6P_1 + 0.004P_1^2$ $C_2 = 400 + \beta P_2 + \gamma P_2^2$ where, P_1 and P_2 are in MW. (a) The incremental cost of power λ is Rs.8/MWh when the total power demand is 550 MW. Neglecting losses, determine the optimal generation of each plant. (b) The incremental cost of power λ is Rs.10/MWh when the total power demand is 1300 MW. Neglecting losses, determine the optimal generation of each plant. (c) From the results of (a) and (b) find the fuel-cost coefficients β and γ of the second plant.	10	3	3,4	5
Q.6b	Draw a typical arrangement of Automatic Voltage Regulator and explain control system block for each of the element. Finally draw the complete block diagram of AVR.	10	2	1,2	3
Q.7	Select correct answer[1m] & justify the same[4m] i. For the stability and economic purpose the transmission line is operated with power angle in the range of a) 70° to 90° b) 50° to 60° c) 30° to 45° d) 10° to 25° ii. The steady state error in the frequency at the terminal of a generator can be reduced without increasing settling time by a) Load Frequency Control b) Power System Stabilizer c) Voltage Regulator d) Automatic Generation Control iii. If two synchronous generators are interconnected, loss of synchronism will result in a) stalling/speeding up of generators b) wild fluctuations in currents c) fluctuations in voltages d) all of the above. iv. Optimal dispatch of generation problem is an optimization problem of a) no constraints i.e., unconstrained optimization problem b) constrained optimization with equality constraints only c) constrained optimization with inequality constraints only	20	1 to 4	2,3,4	1,2,5,6



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Program: TY B. Tech (Electrical)

sem VI

Duration: 3 hr

Course Code: PC-BTE601

Maximum Points: 100

Course Name: Power System Operation & Control

Semester: VI

Note: Question 1 is compulsory; attempt any 4 from remaining 6.

12/5/25

Q. No.	Question	Points	CO	BL	Module No.
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END SEMESTER EXAMINATION MAY 2025



Q.2a	Define surge impedance loading and write its formula. Draw and explain the voltage profile over the length of a long transmission line in case actual loading is less than, equal to and greater than SIL loading. Consider following circuits- a) Long line connected to source at one end. b) Long line with sources connected at both ends.	8	2	2,3	4
Q.2b	Prove that with mid-point compensation (shunt compensation), active power flow over transmission line increases. Derive the relation for reactive power also. Draw the power angle curve.	12	2	2,3	4
Q.3a	The fuel cost function in Rs./hr for three thermal plants are given by $C_1 = 350 + 7.2P_1 + 0.004P_1^2$ $C_2 = 500 + 7.3P_2 + 0.0025P_2^2$ $C_3 = 600 + 6.74P_3 + 0.003P_3^2$ where, P_1 , P_2 , and P_3 are in MW. Neglecting line losses and generator limits, determine the optimal scheduling of generation, when the total load is 1335 MW by using iterative method with initial estimate of $\lambda = 7.5$ Rs/MWh. Find total cost of generation. Also find cost of generation if all generators share the load equally. Compare the results and comment on saving.	10	3	3,4	5
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Q.4a	A single area consists of two generating units, rated at 400 and 800 MVA, with speed regulation of 4 percent and 5 percent on their respective ratings. The units are operating in parallel, sharing 700 MW. Unit 1 supplies 200 MW and unit 2 supplies 500 MW at 1.0 per unit (60 Hz) frequency. The load is increased by 130 MW. The load varies 0.804% for every 1% change in frequency. Find the steady-state frequency deviation and the new generation on each unit. How much is the total generation? Why is it less than actual load demand?	10	2	3,4	2
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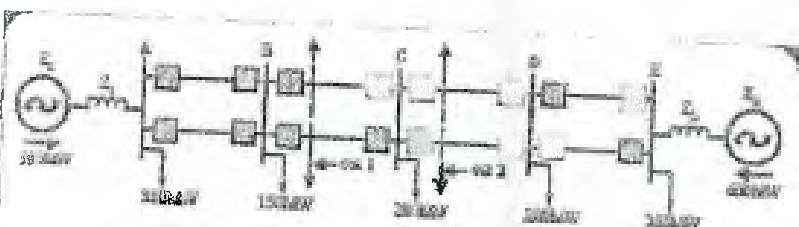
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Q.5b	Study the given power system carefully. Assume all distance relays are tripping on a power swing which is resulting in natural separation of the system at cut 2. What is the state of the system at this moment? (Alert/Emergency/Extremis Justify) After the tripping of distance relays, what will happen to the synchronous generators? Which relays are provided for generators under this situation? How will they work? and hence what is the state of the system when they trip? (Alert/Emergency/Extremis Justify) What is to be done to prevent it and how will you achieve that? Clearly mention which relays to be tripped/not tripped for the same and how? Give all relays proper numbering for your convenience. 	10	4	3,4	6
Q. 6a	The fuel-cost functions in Rs./h for two 800 MW thermal plants are given by $C_1 = 400 + 6P_1 + 0.004P_1^2$ $C_2 = 500 + \beta P_2 + \gamma P_2^2$ Where, P_1 and P_2 are in MW. (a) The incremental cost of power λ is Rs.8/MWh when the total power demand is 550 MW. Neglecting losses, determine the optimal generation of each plant. (b) The incremental cost of power λ is Rs.10/MWh when the total power demand is 1300 MW. Neglecting losses, determine the optimal generation of each plant. (c) From the results of (a) and (b) find the fuel-cost coefficients β and γ of the second plant.	10	3	3,4	5
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~~END SEMESTER~~ / Re-Exam EXAMINATION MAY / JUNE 2025

Program: B. Tech. Electrical

Duration: 3 Hrs.

Course Code: PE-BTE601

Maximum Points: 100

Course Name: Renewable Energy Sources

Semester: VI

Notes:

1. Question number 1 compulsory.
2. Attempt any **four** questions out of remaining six.
3. Draw neat diagrams.
4. Assume suitable data if necessary.

25/6/25

Q. No.	Questions	Points	CO	BL	Module No.																														
01	A residential solar PV system is to be designed to power the following electrical loads: <table><tr><th>Sr. No.</th><th>Load Name</th><th>Power on Load (W)</th><th>No. of Load</th><th>Operating Hrs</th></tr><tr><td>1</td><td>LED Light</td><td>9</td><td>4</td><td>6</td></tr><tr><td>2</td><td>Ceiling Fan</td><td>75</td><td>3</td><td>8</td></tr><tr><td>3</td><td>TV</td><td>100</td><td>1</td><td>4</td></tr><tr><td>4</td><td>Refrigerator</td><td>180</td><td>1</td><td>24</td></tr><tr><td>5</td><td>Miscellaneous</td><td>200</td><td>1</td><td>2</td></tr></table> Consider following data 1. The refrigerator operates with a duty cycle of 0.4 2. Efficiency of battery : 90 % 3. Efficiency of Inverter : 95 % 4. Efficiency of charge controller and cables : 90 % 5. Safety factor of inverter : 1.25 6. Assume suitable rating of PV panels and battery Find out 1. PV Array Sizing 2. Battery Bank Sizing 3. Inverter Sizing 4. Charge Controller Sizing	Sr. No.	Load Name	Power on Load (W)	No. of Load	Operating Hrs	1	LED Light	9	4	6	2	Ceiling Fan	75	3	8	3	TV	100	1	4	4	Refrigerator	180	1	24	5	Miscellaneous	200	1	2	20	2,5	4	03
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2.(a)	Describe how a typical hydropower plant generates electricity, including the diagram of the plant and the roles of the dam, reservoir, penstock, turbine, and generator. Also prove that Actual output power = $\eta \times \rho \times Q \times g \times h$	15	1,2	2	05
2.(b)	Consider a wind turbine with 5m diameter rotor speed of the rotor at 10 m/s, wind velocity is 130 rev./min. and power coefficient at this point is 0.35. Calculate tip speed ratio and torque coefficient of the turbine. What will be the torque available at the rotor shaft? Assume the density of the air to be 1.24 kg/m ³ .	05	2	2	02
3.(a)	The hydro-electric power plant consist of following details a. Capacity of hydroelectric power plant= 100 MW b. Elevation difference, $h = 300$ meter c. Maximum flow rate, $Q_{max} = 250 \text{ m}^3/\text{s}$ d. Minimum flow rate, $Q_{min} = 50 \text{ m}^3/\text{s}$ e. Efficiency of turbine-generator unit = $\eta = 0.7 + 0.001Q$ f. Time period = Sinusoidal rate pattern Calculate : 1. Efficiency 2. Power output at maximum and minimum flow rate 3. How to calculate average power output based on capacity of plant.	10	3	2,3	05
3.(b)	The Central Electricity Authority (CEA) has established specific grid codes for the integration of renewable energy sources with the electricity grid to ensure stability and reliability. Discuss the key requirements outlined by the CEA for renewable energy generators regarding grid connectivity.	10	2,3	2,3	04
4.(a)	Draw the layout of a flash type geothermal power plant and explain the process of how geothermal energy is harnessed and converted into electricity	10	1	1,2	06
4.(b)	What is an MPPT system in a solar PV system? With the help of a flowchart, explain the working principle of the Perturb and Observe (P&O) method and discuss its key advantages and limitations.	10	2,3	3	03
5.(a)	How to calculate hosting capacity for the transmission and distribution system for connecting distributed renewable energy sources?	10	3	3	07
5.(b)	Explain in detail the principles of different renewable energy resources (RES) with emphasis on global and Indian statistics. Include relevant graphs to support your explanation.	10	1	1,2	01



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6.(a)	With the help of neat diagram Explain the different types of tidal energy systems and their working principles.	10	1	1,2	06
6.(b)	A photo voltaic cell has an open circuit voltage of 0.6V and a short circuit current of 350 A/m ² at a cell temperature of 40 ^o C. Calculate the voltage and current density that maximizes the power of the cell. What would be the corresponding maximum power output per unit cell area? What is fill factor of the cell?	10	2,3	2,3	03
7.(a)	Discuss in detail the control strategies used for grid connected residential and industrial solar power plant with the help of following points. 1. Main challenges faced in PV grid integration. 2. Explanation of different control strategies such as Maximum Power Point Tracking (MPPT), voltage control, frequency control and reactive power control.	15	5	3,4	07
7.(b)	Given data consist of Blade Length = 52m Wind Speed = 12 m/s Air density = 1.23 Kg/m ³ Power coefficient = 0.4 Calculate power converted from wind into rotational Energy.	05	1,2	2	05



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Program: B. Tech. Electrical

Duration: 3 Hrs.

Course Code: PE-BTE601

Maximum Points: 100

Course Name: Renewable Energy Sources

Semester: VI

Notes:

1. Question number 1 compulsory.
2. Attempt any four questions out of remaining six.
3. Draw neat diagrams.
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Q. No.	Questions	Points	CO	BL	Module No.																														
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2.(a)	The hydro-electric power plant consist of following details - Capacity of hydroelectric power plant= 30 MW - Elevation difference, $h = 300$ meter - Maximum flow rate, $Q_{max} = 150 \text{ m}^3/\text{s}$ - Minimum flow rate, $Q_{min} = 50 \text{ m}^3/\text{s}$ - Efficiency of turbine-generator unit $= \eta = 0.7 + 0.001Q$ - Time period = Sinusoidal rate pattern Calculate : - Efficiency - Power output at maximum and minimum flow rate - How to calculate average power output based on capacity of plant.	10	3	2,3	05
2.(b)	The Central Electricity Authority (CEA) has established specific grid codes for the integration of renewable energy sources with the electricity grid to ensure stability and reliability. Discuss the key requirements outlined by the CEA for renewable energy generators regarding grid connectivity.	10	2,3	2,3	04
3.(a)	With the help of following points describe how a typical hydropower plant generates electricity. - Schematic diagram of hydro power plant - Role of the dam - Role of reservoir - Role of penstock - Role of turbine and generator. Also prove that Actual output power $= \eta \times \rho \times Q \times g \times h$	15	1,2	2	05
3.(b)	Describe the different types of hydropower plants and discuss major advantage and disadvantage of each type. (Don't draw diagram)	05	1,2	2	05
4.(a)	What is an MPPT system in a solar PV system? With the help of a flowchart, explain the working principle of the Perturb and Observe (P&O) method and discuss its key advantages and limitations.	10	2,3	3	03
4.(b)	A photo voltaic cell has an open circuit voltage of 0.6V and a short circuit current of 350 A/m^2 at a cell temperature of 40°C. Calculate the voltage and current density that maximizes the power of the cell. What would be the corresponding maximum power output per unit cell area? What is fill factor of the cell?	10	2,3	2,3	03
5.(a)	How to calculate hosting capacity for the transmission and distribution system for connecting distributed renewable energy sources?	10	3	3	07



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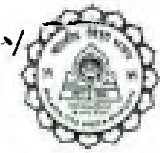
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5.(b)	Explain in detail the principles of different renewable energy resources (RES) with emphasis on global and Indian statistics. Include relevant graphs to support your explanation.	10	1	1,2	01
6.(a)	With the help of neat diagram Explain the different types of tidal energy systems and their working principles.	10	1	1,2	06
6.(b)	Draw the layout of a flash type geothermal power plant and explain the process of how geothermal energy is harnessed and converted into electricity	10	1	1,2	06
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~~END SEMESTER~~ REEXAMINATION ~~MAY~~ JUNE 2025

Program: Electrical Engg.

Course Code: PC-BTE 603

Course Name: Switchgear and protection

Notes: _____

Duration: 3 hours

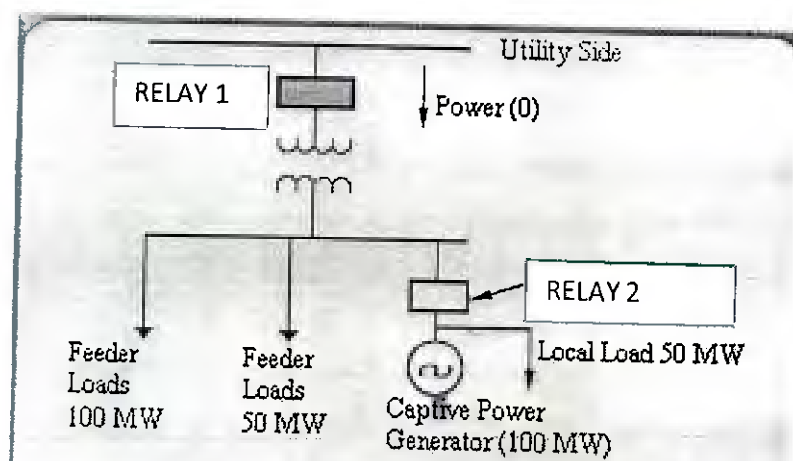
Maximum Points: 100

Semester: VI

- Question 1 is compulsory, Solve any 4 questions from remaining questions

26/6/25

Q.No.	Questions	Points	CO	BL	Module No.
Q.1	A. Explain the phenomenon of magnetizing inrush. Which harmonics is the most dominant in magnetizing inrush current?	6	3	3	3
	B. Discuss the ratings used while selecting a circuit breaker?	8	4	3	4
	C. How transmission lines are protected against lightening?	6	5	3	6
Q.2	A. Explain why MHO characteristic is preferred for the protection of long lines against phase faults, whereas a reactance relay is preferred for ground faults.	10	1,3	3	1,3
	B. What is restricted earth fault relay? Why restricted earth fault protection scheme is used in transformers?	10	1,3	3	3
	A. What is the effect of overlap in zone 2 (Z2) of relay? How can the relay overlap problem in Z2 be solved?	10	3	3	3
	B. Study the power system given below. 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	1,5	3	7



Q.4	A. How CT saturation problem is handled in bus protection schemes?	8	1,3,2	3	1
	B. Compare Air Circuit Breaker (ACB) with Air Blast circuit breaker based on construction, working, voltage rating, applications and limitations	12	4	3	5
Q.5	A. Suggest a suitable protection to be used in case of loss of excitation of Synchronous Generator? Support your answer with justification with help a of capability curve of generator.	10	1,3	3	3
	B. Discuss, how stalling is identified in 3 phase IM. (stalling at starting and running)	10	3	3	3
Q.6	A. For a 132 kV system, the reactance and capacitance up to the location of the circuit breaker is 4 ohms and 0.01 microF, respectively. Calculate the following: (a) The frequency of transient oscillation (b) The maximum value of restriking voltage across the contacts of the circuit breaker (c) The maximum value of RRRV	8	4	3	5
	B. 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?	12	4,5	3	5
Q.7	A. A circuit has a 1200:5 C 400 CT with characteristics as shown in fig 5.7. The maximum symmetrical fault for which the associated relays are to operate is 17,800 Amp. Find out the approximate % error if the secondary burden is: (1) 1 ohm (2) 3 ohm	10	1,2	3	1,2
	B. A three-phase, 11 kV/132 kV, D-Y connected power transformer is protected by differential protection. The CT on the LV side has a current ratio of 500/5. What must be the current ratio of the CT they be connected. Draw neat diagram of protection scheme.	4 6	2,3	3	3



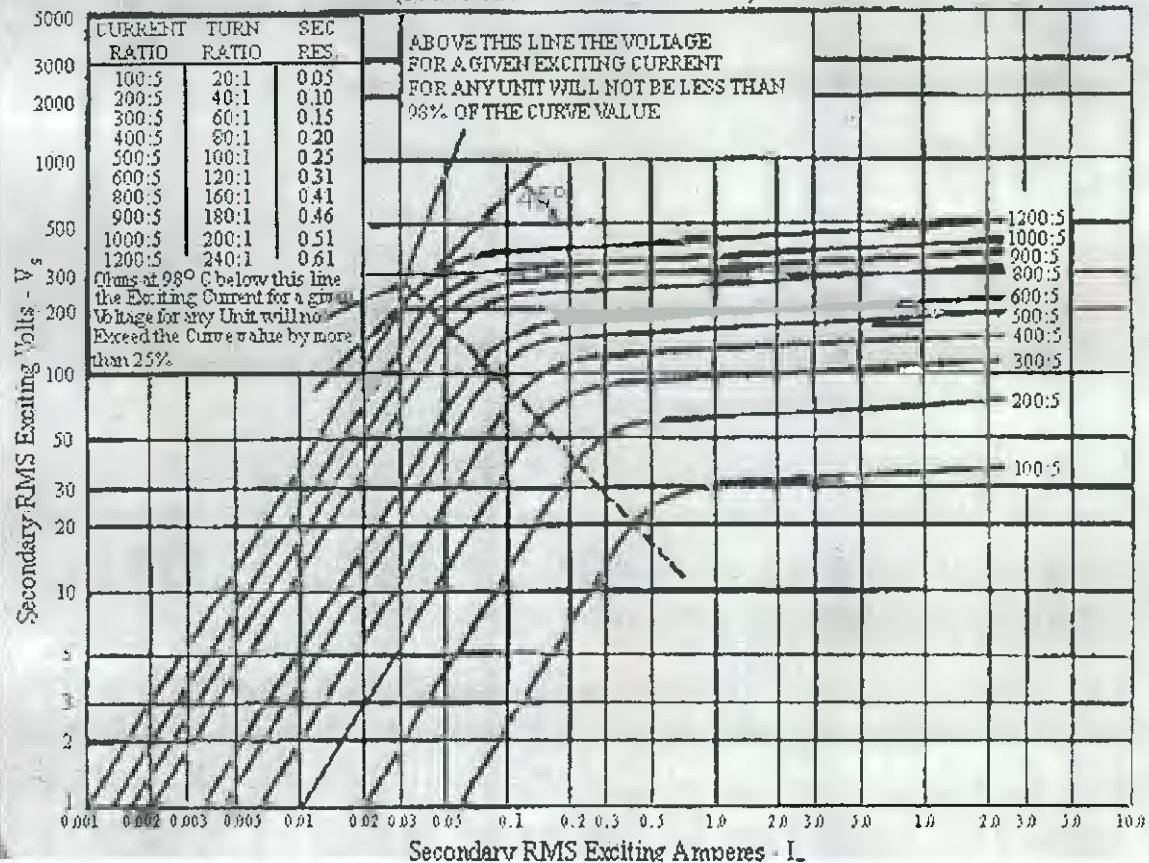
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~~END SEMESTER~~ REEXAMINATION ~~MAY~~/JUNE 2025

Fig 5.7 Typical Excitation Curves for Multi-Ratio C class Current Transformers
(Source: IEEE std C37-110 1996)





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END SEMESTER/ RE-EXAMINATION MAY/ JUNE 2025

Program: Electrical Engg.

Course Code: PC-BTE 603

Course Name: Switchgear and protection

Duration: 3 hours

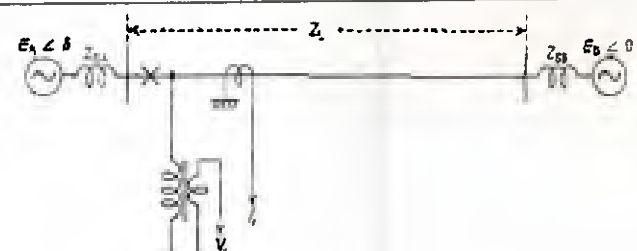
Maximum Points: 100

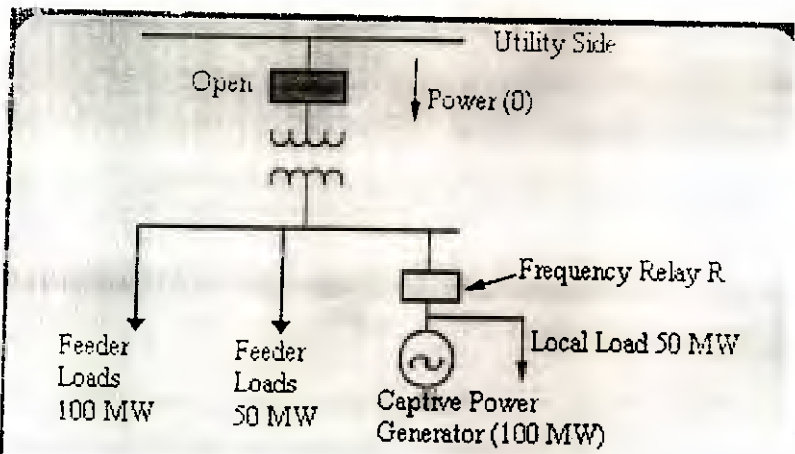
Semester: VI

Notes:

- Question 1 is compulsory, Solve any 4 questions from remaining question

19/5/25

Q. No.	Questions	Points	CO	BL	Module No.
Q.1	Suggest suitable protective device from the basket of relays for following various situations. Justify your answer in brief. [Impedance Relay, Differential Relay, Over-current Relay, Reverse Power Relay, Frequency Relay, Over-voltage Relay, Negative Sequence Relay, Ground wire, Mho Relay, Buchholz relay, Harmonic restrain relay, Earth Fault Relay, HRC Fuse, Restricted Earth Fault Relay] 1) Unbalance load on Generator 3) Lightning stroke on line 4) Transmission line 3 phase fault with heavy arc resistance. 6) Synchronous Generator has lost its prime mover. 7) Stator winding fault occurred in Induction Motor. 8) Line to ground fault on EHV Transmission line 9) Incipient faults in transformer 10) Line to ground fault on transformer	20	1,2,3 4,5	3	3,2,6,7, 1,4,5
Q.2	A. 	10	3	3	3

	Generators A and B are connected through a transmission line. Generator A is exporting power; hence its rotor angle δ is positive. Generator B is importing power, its rotor angle is taken as the reference zero. Derive impedance seen by relay (shown by cross in diagram) as a function of rotor angle. B. Explain the phenomenon of magnetizing inrush. Which harmonics is the most dominant in magnetizing inrush current?	10	3	3	4
Q.3	A. Explain with the waveform, capacitor bank switching by the circuit breaker. Suggest the solution.	10	4	3	3
	B. Discuss the ratings used while selecting a circuit breaker?	10	4	3	4
Q.4	A. Discuss briefly about phasor measuring unit, using block diagram.	10	5	3	7
	B. Study the power system given below. 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	5	3	7
Q.5	A. Suggest a suitable protection to be used in case of loss of excitation of Synchronous Generator.	10	3	3	3
	B. Discuss, how stalling is identified in 3 phase IM. (stalling at starting and running)	10	3	3	3



Q.6	A. Two relays R 1 and R 2 are connected in two sections for a feeder as shown in fig. Relay R1: CT ratio = 300/5, plug setting = 50%, TMS = 0.3 Relay R 2: CT ratio = 500/5, plug setting = 75%. A fault at F results in a fault current of 3000 A. Find TMS of R2 to give time-grading margin of 0.5 sec between the relays. (use IEC SI characteristic) The diagram shows a horizontal line representing a feeder. On the left, there is a box labeled R₂ with an arrow pointing to a CT symbol labeled 500/5 A. On the right, there is a box labeled R₁ with an arrow pointing to a CT symbol labeled 300/5 A. Between the two relays, there is a fault symbol labeled F with a lightning bolt, and below it, the text 3000 A. B. Compare the time-current characteristics of inverse, very inverse and extremely inverse overcurrent relays. Discuss their area of applications	12	1,2	3	1,2
		8	1,2	3	2
Q.7	A. Compare Air Circuit Breaker (ACB) with Air Blast circuit breaker based on construction, working, voltage rating, applications and limitations B. For a 132 kV system, the reactance and capacitance up to the location of the circuit breaker is 3 ohms and 0.015 micro-F. respectively. Calculate the following: (a) The frequency of transient oscillation (b) The maximum value of restriking voltage across the contacts of the circuit breaker (c) The maximum value of RRRV	10	4	3	5,6
		10	4	3	4,6



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✓
END SEM/RE-EXAM EXAMINATION May/June 2025

✓
Program: B.Tech Electrical

Course Code: PC -BTE 602

Course Name: Electric Drives

Duration: 3 h

Maximum Points: 100

Semester: VI

- Attempt *any five*
- Make suitable assumptions wherever necessary
- Note question paper is 3 pages long

15/5/25

Q.No.	Questions	Points	CO	BL	Module No.
Q1.(a)	Illustrate the operation of a phase locked loop speed control? What are the application of it?	5	1,2	2	4
Q1. (b)	Discuss how a motor of a smaller rating can be used for short time duty?	5	1,2	2	3
Q1. (c)	List down the factors which decide the choice of the electrical drive for a given application?	5	1,2	2	1
Q1. (d)	Examine how the steady state stability of a drive depends on relative characteristic of the motor and load and not just on load characteristic.	5	1,2	2	2
Q2(a)	In pressing machines a large torque is required for a short duration. Explain how using load equalization, fluctuation in speed -torque characteristic of the motor can be reduce? Estimate the moment of inertia of the flywheel?	10	1,2	2,3	2
Q2. (b)	A motor equipped with a flywheel has to supply a load torque of 600 N-m for 10 sec followed by a no- load period long enough for the flywheel to regain its full speed. It is desired to limit the motor torque to 450 N-m. What should be the moment of inertia of the flywheel? The no load speed of the motor is 600 rpm and it has a slip of 8% at torque of 400 N-m. Assume the motor speed torque	10	1,2	5	2



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END SEM/RE-EXAM EXAMINATION May/June 2025

	characteristic to be straight line in the range of operation. Motor has an inertia of 10kg-m^2 .				
Q3.(a)	A motor operates on a periodic duty cycle in which it is clutched to its load for 20 minutes and declutched to run on no load for 10 minutes. Minimum temperature rise is 60°C . Heating and cooling time constants are 50 and 70 minutes respectively. When load is declutched continuously the temperature rise is 10°C . Determine: (i) Maximum temperature during the duty cycle. (ii) Temperature when the load is clutched continuously.	10	1,2	5	3
Q3.(b)	Explain with help of a neat diagram the four quadrants of a motor driving a hoist load.	10	1,2	4	2
Q4.(a)	Illustrate with the help of a neat circuit operation of Class E chopper (using method 3) controlled separately excited dc motor. Motor is being operated in first quadrant. Draw waveform of control signals, armature current, source current and armature voltage.	12	3	3	5
Q4. (b)	A 230V, 500 rpm, 90 A separately excited dc motor has the armature resistance and inductance of 0.115Ω and 11mH respectively. The motor is fed by a 4 quadrant chopper controlled using method 3. The source voltage is 230 V and frequency of operation is 400 Hz. (i) If the motor operation is required in the 2 nd quadrant at the rated torque and 300 rpm. Calculate duty ratio. (ii) What would be the value of duty ratio if the moto is working in 3 rd quadrant at 400 rpm and half rated torque?	8	3	5	5
		10			
Q5.(a)	Explain the closed loop operation of circulating current dual converter with the help of a neat diagram. Articulate the advantages and disadvantages of circulating current dual converter over zero current dual converter.	12	3	3	5



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✓
END SEM/RE-EXAM EXAMINATION ✓
May/June 2025

Q5. (b)	List different methods for speed control of induction motor from stator side. Discriminate stator voltage control method and stator pole changing method for speed control of induction motor.	8	1	1,4	6
Q6.(a)	Describe slip speed control method used for controlling speed of three phase induction machine. Also explain stator current, slip speed, torque, and power for different modes of operation.	10	3	3	6
Q6.(b)	Explain three lead ac dynamic braking of three phase induction motor. Obtain the equivalent circuit of the induction machine and also torque equation for the same. Also draw speed torque characteristic for same.	10	3	4	6
Q7.(a)	What are similarities between a brushless dc motor and conventional dc motor? Why it is known as brushless motor? What are its advantages over a conventional dc motor?	10	3	2,3	7
. (b)	A 440V, 50Hz, 6 pole, Y connected wound rotor motor has the following parameters: $R_s=0.5 \Omega$, $R'_r=0.4 \Omega$, $x_s=x'_r=1.2 \Omega$, $x_m=50 \Omega$. Stator to rotor ratio is 3.5. Motor is controlled by static resistance control. External resistance is chosen such as to breakdown torque is produced at standstill for a duty ratio of zero. (i) Calculate the value of external resistance. (ii) How duty ratio should be varied with speed so that motor accelerates at maximum torque.	10	3	5	6



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**END SEMESTER EXAMINATION MAY 2025 / Re-Exam June 2025**Program: TY B. Tech (Electrical) *Ann VI*

Duration: 3 hr

Course Code: PE-BTE602

Maximum Points: 100

Course Name: Design & Management of Electrical Systems

Semester: VI

Note: 1. Question 1 is compulsory; attempt any 4 from remaining 6.

2. Use given data hand book for design. In absence of any data assume suitably.

21/5/25

Q. No.	Question	Points	CO	BL	Module No.				
Q.1	A distribution transformer of 300 KVA delta star 11kV/ 415V with 5% impedance is supplying power to an induction motor of 200 HP rating. For the distribution transformer, assuming fault level from utility side to be 600 MVA, find fault levels at the end of HT cable (Relay R3), end of LT cable (Relay R2) and at the 200 HP motor terminal (Relay R1). Refer table No. 1 for selection of cable impedance for fault calculation purpose (without any derating) Select suitable relay from below table and do appropriate settings. Assume length of all cables to be 200 meters. <table border="1"> <thead> <tr> <th>IDMT</th><th>Very Inverse</th></tr> </thead> <tbody> <tr> <td>$t = TMS * \frac{0.14}{PSM^{0.02}} - 1$</td><td>$t = TMS * \frac{13.5}{PSM} - 1$</td></tr> </tbody> </table> Assume HT side cable of 35Sq. mm with impedance of 0.101 ohm/km.	IDMT	Very Inverse	$t = TMS * \frac{0.14}{PSM^{0.02}} - 1$	$t = TMS * \frac{13.5}{PSM} - 1$	20	1,2	3,4,5	2,3
IDMT	Very Inverse								
$t = TMS * \frac{0.14}{PSM^{0.02}} - 1$	$t = TMS * \frac{13.5}{PSM} - 1$								
	What is the difference between I200/5, 5P10 CT and C400 CT? Why two different designs of CTs are required for protection & measurement purpose? [6m] What is meant by rated current, breaking current capacity, making current capacity & rated short time withstand current of a breaker? [4m]	10	1,2	3,4	2,3				
Q.2b	i) What is the difference between a battery of rating 150A-hr with 1C rating & 5C rating? [2m] ii) Which battery is of larger physical size? AAA or AA [2m] iii) From the following batteries which are re-chargeable & which are disposable batteries? [4m] Zinc carbon, Nickel Cadmium, Lithium Manganese Dioxide, Nickel Metal Hydride iv) Why one should go for rechargeable batteries even if they costly? [2]	10	1,2,3	3,4,5	3				



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END SEMESTER EXAMINATION MAY 2025 / Re-Exam June 2025

Q.3a	Discuss in detail various components of overhead equipment mechanism used to collect current in traction system. What is the return path for the current taken by traction system? Which is the best suitable motor for traction system? Justify.	10	1,2	3,4	4
Q.3b	Compare AC & DC traction in terms of components, voltage range, advantages & disadvantages. Which traction systems & voltages are used in Mumbai & Delhi Metro?	10	1,2	3,4	4
Q.4a	Rate the following with respect to their luminous efficacy [2m] – GLS lamp – FTL – CFL – HPSV List the energy savings opportunities in industrial lighting systems. [4m]	6	3	2,3	5
Q.4b	Compare ACB, MCCB & MCB, HRC Fuse based on i) Voltage rating, ii) breaking capacity (roughly) iii) Applications	8	1,2	3,4,5	
Q.4c	What is EPABX communication system? [1m] What are its components? [3m] How is it different than an intercom service? [2m]	6	1,2	2,3,4	6
Q.5	A 650 kVA, delta star 11kV/ 415V transformer with 5% impedance is supplying power to 2 three phase induction motors of 80 HP & 200 HP respectively and a 3 phase heater of 200 kW. Select suitable cable and cable laying method from data hand book for LV side of the transformer and for 200 HP motor. Assume ambient temperature to be 45° and length of 200 meters each for all (transformer & Motor). Assume that with 200 HP motor cable, 80 HP motor cable is also running in parallel. Assume suitable data for motor current calculations. [16m] What are possible locations of capacitor bank placements in the above power system? Mention the benefits separately at each location. [4m]	20	1,2, 3	3,4,5	2,3
Q.6a	Write a tender notice with commercial and technical specifications for the cables used in Q.5 [8m] What is the difference between Earnest Money Deposit & Performance Security Deposit? [2m]	10	1,2	2,3	7
Q.6b	For the power system given in Q. 5, what all types of engineering drawings will be required? Enlist them and discuss the use of the same.	10	1,2	3,4	1
Q.7	For the power system in Q.1, draw SLD showing all loads with metering, protective and switching devices on LT, & HT side of transformer and loads. Write legend and mention ratings on SLD. Give supportive calculations. Assume suitable data for motor current calculations. (Use transformer impedance to approximately select C.B. on HT & LT side of transformer.) Also show capacitor bank at each possible location on SLD with suitable protective device. (without rating is acceptable)	20	1,2, 3	3,4,5	3



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END SEMESTER EXAMINATION MAY 2025 / Re-Exam June 2025

Table to be used for Question 1-

Cable Size, (mm ²)	Current Rating	Reactance
	Ampere	X (Ω/km)
1.5	18	0.168
2.5	25	0.156
4	33	0.143
6	43	0.135
10	59	0.119
16	79	0.112
25	104	0.106
35	129	0.101
50	167	0.101
70	214	0.0965
95	261	0.0975
120	303	0.0939
150	349	0.0928
185	400	0.0908
240	472	0.0902
300	545	0.0895
400	634	0.0864
500	723	0.0812
630	826	0.077



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Academic Year 2024 – 25 [Second Half]

Regulation – 2022

End Semester Examination – May 2025 / ~~Re-Examination – June 2025~~

P.Y. D. T. S. Question Paper Set-II

Program: B. Tech. Electrical Engineering *Sum 4*

Course: Project Management [Open Elective-I]

Course Code: OE -BTE605

Semester: VI

Total Points: 100

Date: *23/5/25*

Note: Question No. 1 is compulsory. Answer any **FOUR** questions of the remaining.

CO: Course Outcomes

BL: Bloom's Taxonomy Level

Q. No.	Question	Points	CO	Module No.
1.	a. What is role of PMO in any organization? Explain different types of PMOs.	05	1	1
	b. Explain the terms <i>corrective action</i> , <i>preventive action</i> and <i>defect repair</i> in relation to monitoring and controlling project work.	05	1	2
	c. Explain the <i>Tuckman Ladder Model</i> of team building.	05	1	4
	d. Explain the difference between <i>quality</i> and <i>grade</i> with an appropriate example. What is <i>quality management</i> ?	05	1	3
2.	Ms. Siddhi is appointed as a Project Manager for <i>Construction of New Hostel Project</i> at SPCE, Mumbai. She is aware that by <i>investing in the overall happiness of her team members, they will experience higher levels of satisfaction</i> which will boost engagement and motivation, and ultimately impact their productivity.			
	a. Which model for <i>human motivation</i> she should refer to understand <i>what the needs of her team members are and how do they impact their motivation</i> ?	10	2	4
	b. Explain the different <i>classification models</i> Ms. Siddhi can use for <i>Analysis of all the Stakeholders</i> on her project?	10	2	6
3.	Ms. Rashmi is appointed as a Project Manager for <i>Installation of Roof-top Solar Panels Project</i> at SPCE, Mumbai.			
	a. While <i>gathering the requirements</i> for this project from various stakeholders, she realizes that <i>one requirement is leading to more refined requirements and clarifications</i> . Therefore, it is becoming difficult to remember <i>where a requirement came from and its significance on the project</i> . Ms. Rashmi apprehends, this may cause losing focus on <i>the reason of the requirement</i> and may result into major project objective not being met.	10	3	2
	Suggest and explain a suitable <i>technique that can be used to link the requirements to the objectives</i> and/or other requirements to ensure the strategic goals of the project are accomplished.			

	b. While she is <i>planning communications</i> on her projects, which <i>methods</i> should she consider? c. When she is in the <i>Manage Communications</i> process, which reports should she consider for the <i>performance reporting</i> of her project?	05	1	4																																	
		05	1	4																																	
4.	a. 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. Mr. Mitreya is a Sponsor and Ms. Simran is a Project Manager for this Project. Ms. Simran has figured out the following dependencies in this project: <table><thead><tr><th>Activity</th><th>Preceding Activity</th><th>Estimate in Months</th></tr></thead><tbody><tr><td>Start</td><td></td><td>0</td></tr><tr><td>D</td><td>Start</td><td>4</td></tr><tr><td>A</td><td>Start</td><td>6</td></tr><tr><td>F</td><td>D, A</td><td>7</td></tr><tr><td>E</td><td>D</td><td>8</td></tr><tr><td>G</td><td>F, E</td><td>5</td></tr><tr><td>B</td><td>F</td><td>5</td></tr><tr><td>H</td><td>G</td><td>7</td></tr><tr><td>C</td><td>H</td><td>8</td></tr><tr><td>End</td><td>C, B</td><td>0</td></tr></tbody></table> (i) Help Ms. Simran 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 Mr. Maitreya, Ms. Simran realizes that the project duration needs to be shortened by 3 months. To shorten the duration of the project, Mr. Maitreya 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 Ms. Simran to shorten the length of the project? (iv) Which Schedule Compression techniques Ms. Simran can use to shorten the duration of the project? Which activities she can fast track to shorten the project length? b. In <i>Estimate Costs Process</i>, which costs should a Project Manager consider? c. Enlist and define important <i>types of costs</i> that may incur on a project?	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	10	3	3
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																																			
		05	1	3																																	
		05	1	3																																	
5.	Aditya is assigned a project of landscaping of Bhavan's Andheri Campus. a. Which different strategies he can use to respond to the <i>risks, opportunities</i> and <i>threats</i> on a project? b. He is considering the following inputs while performing risk management on his project. Explain why each of the following inputs are needed to adequately perform the risk management process: i. OPAs and EEFs ii. Project Charter iii. Project Management Plan iv. Scope Baseline v. Network Diagram	10	2	5																																	
		10	2	5																																	

	vi. Stakeholder register vii. Quality Management Plan viii. HR Management Plan ix. Procurement Documents x. Time and Cost estimates			
6	a. Mr. Ishaan 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, he finds that CPI for the project is 1.2, the SPI is 0.8, the PV is \$600,000 and the SV is – \$120000. He can't find CV in the report. Help him to calculate CV of the project. b. Mr. Bhomesh 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? c. What are the advantages and disadvantages of <i>centralized contracting</i> and <i>decentralized contracting</i>?	05 05 10	1 1 1	3 5
7.	It is proposed to install Roof-top Solar Panels at SPCE Hostels. Prof. P. G. Gaikwad is a sponsor for this project and Mr. Ayush is appointed as a Project Manager of this project. The project will be implemented with the help of M/s. Suraj Solar Technologies Pvt. Ltd. (SSTPL). Mr. Sachin, Mr. Yash and Mr. Darsh are the Technical Expert, Procurement Manager and Quality Control Engineer working on this project on behalf of SSTPL. This project aims to reduce the SPCE Hostel's electricity expenses by 10% and contribute to its sustainability goals. Currently over 90% of its electricity is sourced from non-renewable sources of energy which have negative impacts to the environment. This electricity expenses are not affordable for SPCE Hostel which offers accommodation to SPCE students at very subsidized rates. It is now proposed to source at least 30% of its electricity from renewable sources of energy, such as solar panels, which will also contribute to lower electricity expenses. The money saved on electricity expenses can be utilized to provide better sports facilities for the students staying in SPCE Hostel The project scope includes the design, installation, and commissioning of 25kW solar panel system. The project team will be responsible for all aspects of the project, from initial design to final commissioning. The project is estimated to cost approximately Rs. 30 lakh and will be completed within 6 months. The project team will address potential risks, such as weather delays and material shortages, by implementing contingency plans and alternative sourcing strategies. SSTPL has informed that all the steps towards installing solar panels including the measurements, blueprints, accruing contractors, installing solar panels and 5 years warranty on installed solar panels, are included in their scope. However, regular cleaning of solar panels during warranty period and repairs & maintenance of entire system after warranty period is not included in their scope. The risk of sudden black-	20	3	2

out in the Hostels during the installation period is not the liability of the vendor			
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During the initial meetings of the project the team uncovers that to get maximum output from the solar panels, it is expected that the solar panels should be able to function for 24 hours by storing the energy during day time and then utilizing it at night. A backup generator may be needed in case the panels malfunction or if the weather is cloudy during the monsoon season. If the power generated is not fed properly to the grid then there are chances of electricity wastage or system malfunction. The control room shall be easily accessible in times of emergency. During cloudy seasons, the electricity needs to be used from the main utility grid. If the war-like situation arises then the costs of solar panels may go above the initial estimates and the availability of the same from an international supplier may also be a challenge. Therefore, it is better to have an alternate supplier available in India.

Prepare a detailed *project charter* for this project.





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ES/EE Exam - May/June 2025 Examinations



Program: Electrical

Course Code: OE-BTE604

Course Name: Computer Architecture

Duration: 3 hours

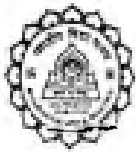
Maximum Points: 100

Semester: VI

- Attempt any 5 questions from the given 7 questions.
- Make suitable assumptions wherever necessary.

23/9/25

Q.No.	Questions	Points	CO	BL
1a.	What is dynamic branch prediction? Explain how 1 bit and 2 bit predictor methods are used for dynamic branch prediction.	10	1	2
1b.	Discuss the architecture and function of a general computer system.	10	4	2
2a.	Solve $(10011)_2 / (11)_2$ using the restoration division algorithm.	10	2	3
2b.	What is Direct Memory Access (DMA)? Compare programmed I/O, interrupt-driven I/O, and DMA in terms of efficiency and CPU involvement.	10	3	2
3a.	Discuss the different timing considerations of magnetic hard disk	10	1	2
3b.	Discuss the register model of 80386 in the Real mode.	10	4	2
4a.	Differentiate between serial bus and parallel bus used for I/O interface w.r.t. advantages and disadvantages of each of them. (Take suitable example to explain the difference).	10	1	3
4b.	Give the mechanism along with diagram for segment address translation from virtual address to its physical address.	10	1	2
5a.	A program requires execution of 1000 complex instructions in a CISC system, each taking 4 cycles. The equivalent RISC system executes 3000 simple instructions, each taking 1.2 cycles. Calculate and compare the total number of cycles in both systems. Which is faster? Comment on the result.	04	3	3



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ES/EE Exam - May/June 2025 Examinations



5b.	Consider a 4 stage pipeline processor. The number of cycles needed by the four instructions I1, I2, I3 and I4 in the stages S1, S2, S3 and S4 is shown below: <table><tr><th></th><th>S1</th><th>S2</th><th>S3</th><th>S4</th></tr><tr><td>I1</td><td>1</td><td>3</td><td>2</td><td>1</td></tr><tr><td>I2</td><td>2</td><td>2</td><td>3</td><td>1</td></tr><tr><td>I3</td><td>1</td><td>1</td><td>1</td><td>1</td></tr><tr><td>I4</td><td>2</td><td>1</td><td>1</td><td>2</td></tr></table> What is the number of cycles needed to execute the following loop? for(i=1 to 2) {I1.I2.I3.I4}		S1	S2	S3	S4	I1	1	3	2	1	I2	2	2	3	1	I3	1	1	1	1	I4	2	1	1	2	10	1	4
	S1	S2	S3	S4																									
I1	1	3	2	1																									
I2	2	2	3	1																									
I3	1	1	1	1																									
I4	2	1	1	2																									
5c.	A hard disk with a transfer rate of 10MB/sec is constantly transferring data to memory using DMA. The processor runs at 600MHz and takes 300 and 900 clock cycles to initiate and complete DMA transfer resp. If the size of the transfer is 20KB, what is the total time consumed for the transfer? Also calculate the percentage of time consumed for the preparation of transfer operation	06	1	3																									
6a.	Explain Fetch and Indirect cycle with respect to the micro operations performed during the respective cycles.	10	3	2																									
6b.	$X = 0.3478 * 10^4$, $Y = 0.140 * 10^2$ Perform addition, subtraction, multiplication and division on the above two floating point numbers.	10	2	3																									
7.	Discuss the following architectures i. MIPS ii. VLIW	20	4	2																									



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END SEM/RE-EXAMINATION MAY/JUNE 2025

Program: T. Y. B. Tech Electrical *Sum VI*
Course Code: PE-BTE 612
Course Name: Micro-grid and Distributed Generation

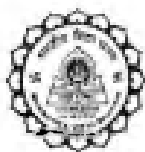
Duration: 03 Hour
Maximum Points: 100
Semester: VI

Instructions:

1. Attempt any FIVE questions.
2. Draw neat diagrams wherever possible.

26/5/25

Q.No.	Questions	Points	CO	BL	Module No.
Q. 1(a)	Outline and discuss the regulatory standards and frameworks that govern the interconnection of distributed resources to electric power systems particularly focusing on IEEE 1547.	10	01	L-1	01
Q. 1(b)	What security issues are associated with the implementation of distributed generation and how can it be mitigated? Hence, discuss the parameters need to be considered while selecting the distributed energy resources.	05+ 05	01	L-1	01
Q. 2 (a)	What are the limits on operational parameters such as voltage, frequency, and Total Harmonic Distortion (THD) for integrating Non-Conventional Energy (NCE) sources into the grid? Hence, how should renewable energy systems respond to abnormal grid operating conditions such as voltage sags, frequency deviations, and faults?	04+ 06	01	L-1	02
Q. 2 (b)	What is the concept of islanding in grid-connected renewable energy systems, and what are the challenges associated with its detection and prevention?	04+ 06	02	L-1	02
Q. 3 (a)	What is the concept and definition of micro grid? What are the primary drivers & benefits of micro-grid?	02+ 04+ 04	02	L-1	03



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END SEM/RE-EXAMINATION MAY/JUNE 2025

Q. 3 (b)	Draw and explain the typical structure/configuration of AC-DC Hybrid micro-grid. Hence discuss the benefits of hybrid micro-grid over the independent AC and DC micro-grids.	06+ 04	02	L-1	03
Q. 4 (a)	How does active and reactive power control maintain the balance between generation and demand in a micro grid? Describe a method commonly used for active power control in micro grid?	05+ 05	03	L-1	04
Q. 4 (b)	How does the protection system in a micro grid differentiate between faults in grid-connected and islanded modes? What strategies are used to ensure reliable protection?	05+ 05	03	L-1	04
Q. 5 (a)	Identify and describe the main types of power quality issues caused by distributed generation? Hence, discuss the challenges of maintaining power quality in islanded microgrid operation, especially under varying load and generation conditions?	06+ 06	03	L-1	05
Q. 5 (b)	Explain the positive and negative impacts of distributed energy resources on power system.	04+ 04	03	L-1	05
Q. 6 (a)	Explain the working and role of Phase Locked Loops (PLLs) in grid synchronization of DG inverters with diagram.	10	04	L-1	06
Q. 6 (b)	Describe the current control method used in DG inverters. How does it ensure system stability during transient events?	10	04	L-1	06
Q. 7 (a)	What factors affect the cost of energy in Distributed Generation systems?	05	04	L-1	07
Q. 7 (b)	A university plans to install a grid-connected solar PV system to reduce its electricity bills. The system has the following specifications: Rated Capacity: 60 kW; Capital Cost: ₹40,00,000; Operating Hours per Year: 1,500 hours; O&M Cost: ₹25,000 per year; System Life: 25 years; Electricity Tariff (Saving): ₹8 per kWh; Discount Rate: 6%; Residual Value at End of Life: ₹3,00,000. Calculate annual energy generation, annual gross savings; net annual savings; present value of net annual savings; present value of residual value; net present value (NPV); the payback period; LCOE and interpret the financial viability.	15	04	L-1	07



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End Semester Examination / ~~RE-EXAMINATION~~
May/~~June~~-2025

Max. Marks: 100

Class: T.Y. B.TECH.

Semester: VI

Duration: 03 Hours

Program: B.TECH. (ELECTRICAL)

Name of the Course: Basics of Automotive System

Course Code: PE-BTE611

Instructions:

- Solve Any Five Questions
- Answers to all sub questions should be grouped together
- Figures to the right indicates full mark
- Assume suitable data if required and justify the same.

26/5/25

Ques. No	Description of question	Max. Marks	CO
Q.1a)	What are the advantages and disadvantages of ICE based vehicles, EVs and HEVs?	10	1
Q.1b)	What is parallel HEVs architecture? Explain its different operating modes. Comment on the sizing of power components of these HEVs.	10	1
Q. 2a)	Define the tractive effort and discuss the different components of total tractive effort required to move the vehicle?	10	2
Q. 2b)	An electric vehicle has the following parameter values: $m=800$ kg, $C_D=0.2$, $A_F=2.2$ m², $C_0=0.008$, $C_1=1.6 \times 10^{-6}$ s²/m². Also, take density of air $\rho=1.18$ kg/m³, and acceleration due to gravity $g=9.81$ m/s². The vehicle is on level road. It accelerates from 0 to 65 mph in 10 s, such that its velocity profile is given by $v(t) = 0.29055t^2$ for $0 \leq t \leq 10$ s (a) Calculate $F_{TR}(t)$ for $0 \leq t \leq 10$ s. (b) Calculate $P_{TR}(t)$ for $0 \leq t \leq 10$ s. (c) Calculate the energy loss due to non-conservative forces E_{loss}.	10	2

Q. 3a)	Draw the torque-speed characteristics of ICE as a power source and compare it with EM as a power source for vehicle type of load.	10	03
Q. 3b)	Draw the torque speed characteristics of vehicular load and explain the vehicle performance.	10	03
Q. 4a)	Discuss the classification of chargers used for EVs. What are the issues with fast chargers?	10	02
Q. 4b)	Discuss the requirements and design considerations of EV motors. Discuss the advantages of PM motors.	10	03
Q. 5a)	Compare PMSM with BLDC motor. Draw the block diagram and discuss the control of PMSM.	10	03
Q. 5b)	Explain the basic principle of ultra-capacitors. Compare ultra-capacitor with battery in terms of following parameters: (i) Cycle life (ii) Efficiency (iii) Specific Energy (iv) Specific Power	10	02
Q. 6a)	Explain the operating principles of fuel cell and discuss its use in Fuel cell powered Electrical vehicles.	10	03
Q. 6b)	Discuss the purpose of transmission system used in automotive system. Enlist the different types of transmission system and compare them.	10	02
Q. 7a)	What is suspension system in vehicles? Discuss the mechanical suspension system.	07	02
Q. 7b)	Discuss the Noise, Vibration and Harshness (NVH) in vehicles.	07	01
Q. 7c)	Discuss the steering systems used in vehicles.	06	01