



Bharatiya Vidya Bhavan's
SARDAR PATEL COLLEGE OF ENGINEERING

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



END SEM/RE-EXAM EXAMINATION May/June 2026

Program: T.Y. Electrical *Sam VI*

Duration: 3 h

Course Code: PC BTE 601

Maximum Points: 100

Course Name: Electric Drives

Semester: VI

Note:

- Attempt any five questions
- Group sub parts of questions together
- Paper is 3 pages long

19/5/26

Q.No.	Questions	Points	CO	BL	Module No.
Q1(a)	Explain and evaluate the current status of DC and AC drives in modern industrial applications	5	1,2	2,4	1
Q1(b)	Why is load equalization done? Derive the expression for the moment of inertia of a flywheel used for load equalization.	10	1,2	2,3	2
Q1(c)	Classify the components of load torque based on their relationship with angular speed.	5	1,2	2,3	2
Q2(a)	Describe the four-quadrant operation of a motor driving a hoist. Explain each quadrant with respect to direction of motion, torque, and power flow. Illustrate your answer with a neat diagram.	10	1,2	3	2
Q2(b)	Interpret control action and performance Phase Locked Loop (PLL) control. Identify suitable applications of such drives.	10	2	3	4
Q3(a)	A motor has heating constant of 70 min and cooling constant of 90 min. When continuously on full load of 400KW, final temperature rise is 50°C. (i) What load can be delivered by the motor for 10min if the initial temperature is zero. (ii) When used in short time periodic duty cycle consisting of the load period of 10 min followed by no load period long enough for the motor to cool down, what will be the maximum load that motor can carry?	10	2	4	3



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	(iii) Determine the maximum load the motor can deliver when subjected to intermittent periodic load cycle consisting of the load period of 10 min followed by a no-load period of 15 min.				
Q3(b)	A 230 V, 500 rpm, 90 A separately excited dc motor has the armature resistance and inductance of 0.115Ω and 11 mH respectively. The motor is controlled by a class E, four quadrant chopper operating with the source voltage of 230V and a frequency of 400Hz. (i) If the motor operation is required in the second quadrant at the rated torque and 300 rpm. Calculate duty ratio. (ii) What should be the value of the duty ratio if the motor is working in the third quadrant at 400 rpm and half of the rated torque.	10	3	4	5
Q4(a)	Explain with the help of block diagram closed loop operation of a simultaneous dual converter feeding a DC motor and compare its performance with a zero circulating current dual converter.	10	3	4	5
Q4(b)	Explain the operation of a Class D chopper-fed DC motor drive. Illustrate its operation in two -quadrants with appropriate circuit diagram and waveforms.	10	3	2,3	5
Q5(a)	Analyse the operation of a three-phase induction motor during two-lead DC dynamic braking. Derive the equivalent circuit and obtain the expression for braking torque. Also, sketch and explain the speed-torque characteristics of the braking operation.	10	3	4,3	6
Q5(b)	Explain the speed control of a three-phase induction motor using the constant Volts/Hertz (V/f) control method with the help of a suitable schematic block diagram. Discuss the operating principle, performance characteristics, and limitations of the method in practical drive applications.	10	3	4	6
Q6(a)	A 230 V, 500 rpm, 100A separately excited dc motor has an armature resistance of 0.1Ω. The motor is driving under rated conditions, a load whose torque is constant and independent of speed. The speed below the rated speed is obtained with armature voltage control and speed above rated speed are obtained by field control. (i) Calculate terminal voltage when speed is 400 rpm. (ii) By what amount should flux be reduced to get 800 rpm?	10	3	4	5



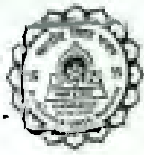
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Q6(b)	What is a slip power recovery scheme? Explain the operating principle of the Kramer drive with the help of a suitable schematic diagram.	10	3	3	6
Q7(a)	Compare Stepper motor, BLDC motor, and Switched Reluctance motor drives based on: • Construction • Control • Efficiency • Applications	10	3	3	7
Q7(b)	Explain the operation of a closed control scheme with inner current control loop. What are various functions of the inner current control loop?	10	1,2	3	4



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END SEMESTER EXAMINATION MAY 2026 / ~~RE-EXAM JULY 2026~~

Program: Electrical Engineering

T.Y. B.Tech CED

Duration: 3 hours

Course Code: PC-BTE602

sem VI

Maximum Points: 100

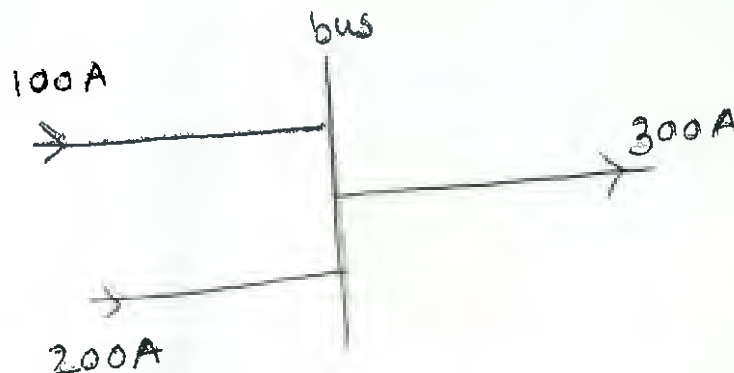
Course Name: Switchgear and protection

Semester: VI

21/5/26

- Question 1 is compulsory
- Solve 4 questions from remaining 6 questions
- Draw neat diagram if necessary
- Assume suitable data if required

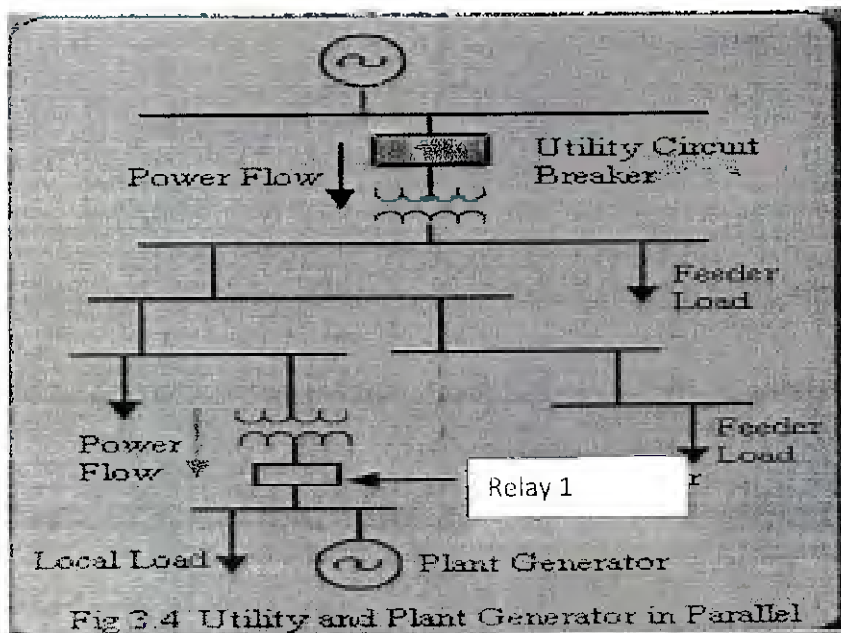
Q.No.	Questions	Points	CO	BL	Module No.
1	a. Three phase transformer is protected from over-voltages by proper transformer oil, bushings, rod gaps and lightning arresters. With reference to BIL, arrange above protective elements from maximum BIL to minimum BIL and justify your answer.	6	1	4	6
	b. In connection with switchgear clearly explain the significance of the term RRRV. In short circuit test on circuit breaker, the following readings were obtained on the single frequency transient i) Time to reach the peak restriking voltage: 50 micro-sec ii) The peak restriking voltage: 110kV Calculate average RRRV and the frequency of oscillations	6	3	3	4
	c. Discuss the protection used for bus bar shown below and precautions to be taken while selecting CT ratio. Find ratings of CTs with polarity.	8	2	3	3,1





END SEMESTER EXAMINATION MAY 2026 / RE-EXAM JULY 2026

- 2 A In given fig. consider that the plant imports at all times a minimum power of 5 MW. Studies indicate that for various faults in utility side, minimum power export from the plant generator is 0.5 MW. Find which relay (shown by Relay 1) will give exact operation? Deduce the setting of selected relay 1. If the plant generator is of 50 MW capacity, what is likelihood of under-frequency or rate of change of frequency relay picking up on such faults?



- 2B A three-phase, 11 kV/132 kV, D-Yg connected power transformer is protected by differential protection. The CT on the LV side have a current ratio of 500/5. What must be the current ratio of the HV side CT there be connected. Draw neat diagram of protection scheme (show polarity marks on CTs, transformer windings, currents through transformer, current through pilot wires and through relay operating coil).
- 3A Calculate required value of neutral resistor for three phase 11 kV alternator so as to protect 70% of winding against earth fault by a relay with pick up current of 1 A. The neutral CT ratio is 250/5.
- 3B Explain with the waveform, current chopping phenomena in case of breaking low magnitude inductive current by the circuit breaker.

**END SEMESTER EXAMINATION MAY 2026 / RE-EXAM JULY 2026**

4A	For a 132 kV system, the reactance and capacitance up to the location of the circuit breaker is 4 ohms and 0.02 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. Suggest the solution to damp the oscillation frequency.	12	3	3	5
4B	Explain the phenomenon of magnetizing inrush. Which harmonics is the most dominant in magnetizing inrush current?	8	2	3	3
5A	p What is meant by infeed effect? How will it affect the performance of a distance relay? Suggest the solution on it.	10	2	3	3
5B	Discuss the range setting of distance relays placed at a particular location. Discuss why the zone-I unit is not set for the protection of 100% of the line.	10	2	3	3
6A	How is backup protection provided in a radial system?	6	2	3	2
6B	What type of a protective scheme is employed for the protection of the field winding of the alternator against ground faults? Explain with suitable diagram	8	2	3	3
6C	Distinguish between PSM and TMS of a relay	6	1	3	1
7A	Compare Air Circuit Breaker (ACB) with Air Blast circuit breaker based on working, voltage rating, applications and limitations.	8	3	3	5
7B	Define Micro-grid. List out the components of the Microgrid.	6	4	3	7
7C	How is selectivity criteria provided in (a) Overcurrent protection scheme (b) Differential protection scheme	6	1	3	2



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End Semester 2026 Examinations



Program: CME

Course Code: MI BT013

Course Name: Financial Management

SET B

Duration: 03 hours

Maximum Points: 100

Semester: VI

Note:

- Question 01 is compulsory
- Attempt any four questions out of remaining 06 questions
- Attempt main question and sub question together
- Draw neat charts wherever required
- Q5 B, 6 and & 7 to be attempted on Excel sheet.

29/5/26

Sr No	Questions	Module	BL	Points
Q 1.A	Critically analyse the difference between profit maximization and wealth maximization as objectives of financial management.	01	L2	10
Q.1.B	Examine the role of ethics in financial management. How do ethical principles contribute to transparency, accountability, and stakeholder trust? Illustrate your answer with suitable examples of ethical and unethical financial practices.	07	L4	10
Q.2.A	Discuss in detail the scope and importance of financial management in modern organizations. Explain the major functions of financial management.	02	L2	10
Q.2.B	Name three types of capital budgeting and explain in detail the function and scope of capital budgeting.	03	L1	10
Q.3. A	Explain various approaches to the measurement of risk in financial management.	03	L5	20
Q.3.B	What do you understand by risk and return? Explain its components and the way it is measured with suitable example.	04	L4	10
Q.4.A	Explain briefly the concept of Time Value of Money and the genesis behind this concept.	02	L2	10
Q.4.B	ABC Ltd. is focusing on increasing profits by cutting costs drastically, including reducing product quality and employee training. In the short term, profits increase significantly, but			

	customer satisfaction declines.																					
	Questions 1. Explain how this decision reflects the profit maximization approach. 2. Analyse why wealth maximization would be a better objective. 3. Suggest financial strategies to balance profitability and long-term value.																					
Q.5. A	Identify how financial management contributes to long-term sustainability of organizations. Explain how financial strategies influence business expansion decisions.	04	L5	10																		
Q.5 B	Mr. Soham is an entrepreneur with a business in Medical Equipment space. He has received a large order from a US company for which he needs to incur a capex of INR 5 CR. He currently plans to fund the capex through a bank loan which is available at 9% pa for a 5-year loan. Please calculate the EMI and share the principal outstanding at the end of 15 th monthly repayment? (5+5)	03	L5	10																		
Q.6.A.	Nishant is a final year graduating student currently interning at a startup. Out of his monthly stipend he invests INR 5000/- every month. He plans to invest this for the next 12 months and expects a return of 12%pa. What would be his corpus at the end of 2 years?	03	L3	10																		
Q.7.A	2. Please calculate the Payback period for the below mentioned projects: (10 Marks) Initial Investment in Project A is 11,00,000/- and Project B 12,50,000/-. <table><tr><th>Year</th><th>Project A Cash Flow</th><th>Project B Cash Flow</th></tr><tr><td>1</td><td>1,00,000/-</td><td>2,25,000/-</td></tr><tr><td>2</td><td>2,50,000/-</td><td>1,00,000/-</td></tr><tr><td>3</td><td>1,00,000/-</td><td>2,00,000/-</td></tr><tr><td>4</td><td>4,50,000/-</td><td>3,25,000/-</td></tr><tr><td>5</td><td>5,00,000/-</td><td>4,00,000/-</td></tr></table> Please calculate the payback period for both the projects.	Year	Project A Cash Flow	Project B Cash Flow	1	1,00,000/-	2,25,000/-	2	2,50,000/-	1,00,000/-	3	1,00,000/-	2,00,000/-	4	4,50,000/-	3,25,000/-	5	5,00,000/-	4,00,000/-	04	L6	10
Year	Project A Cash Flow	Project B Cash Flow																				
1	1,00,000/-	2,25,000/-																				
2	2,50,000/-	1,00,000/-																				
3	1,00,000/-	2,00,000/-																				
4	4,50,000/-	3,25,000/-																				
5	5,00,000/-	4,00,000/-																				

Q.7.B	Mrs. Sheya is an entrepreneur with a business in Medical Equipment space. He has received a large order from a US company for which he needs to incur a capex of INR 7 CR. He currently plans to fund the capex through a bank loan which is available at 11% p.a for a 3-year loan. Please calculate the EMI and share the principal outstanding at the end of 9 th monthly repayment? (5 + 5 Marks)	06	L6	10
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END SEMESTER/ RE-EXAMINATION MAY 2026

Program: T.Y. B.Tech. *CEP Sem VI*
Course Code: MI-BT043
Course Name: Mechanics of Robots

Duration: 3 Hours
Maximum Points: 100
Semester: VI

- Notes:
1. Question No. 1 is compulsory.
 2. Solve any four questions from remaining six.
 3. Draw neat diagrams wherever necessary.
 4. Assume suitable data if necessary.

Q.No.	Questions	Points	CO	BL	Module No.
1.	Solve any FOUR from the following.				
a)	Define Direct and Inverse Kinematics Problem.	05	1	1,2	3,4
b)	Define Dot Product, Cross Product, Orthogonality, Norm and Completeness.	05	1,2	1,2	1
c)	Derive Resultant Rotation matrix for Z-Y-Z Euler angle representation.	05 05	1,2	1,2,3	2 5,6
d)	Discuss the velocity of a point due to rotating reference frame..	05	1,3	1,2,3	7
e)	Discuss Principal axes and Principal moments of inertia.		1,4	2,3	
2. a)	Interpret the meaning of each column vector of the below given Homogeneous Transformation Matrix.		1,2	2,3	1
	$T = \begin{bmatrix} n_x & s_x & a_x & p_x \\ n_y & s_y & a_y & p_y \\ n_z & s_z & a_z & p_z \\ 0 & 0 & 0 & 1 \end{bmatrix} = \begin{bmatrix} \mathbf{n} & \mathbf{s} & \mathbf{a} & \mathbf{p} \\ 0 & 0 & 0 & 1 \end{bmatrix}$	10	1	2,3	1
b)	For the given Fig. 1, find 4 X 4 Homogenous Transformation Matrices				
	1. 0T_1 (Frame 1 to 0) and 2. 0T_5 (Frame 5 to 0)	10			
3. a)	Derive rotational matrices for X-Y-Z fixed angle and Z-Y-X Euler angles rotations.	10	1	1,2	2
			1,2	2,3	3,4

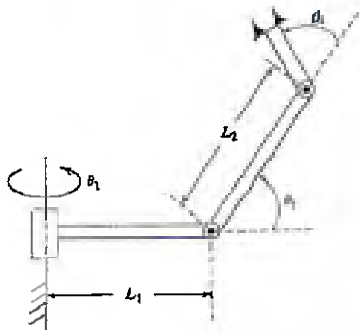


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b)	In the arm with three degrees of freedom shown in Fig. 2 joint 1's axis is not parallel to the other two, instead there is a twist of 90 degrees in magnitude between axes 1 and 2. Derive link parameters and the kinematic equations for ${}^B_W T$ i.e. Transformation matrix between Wrist to Base. Note that no l_3 need be defined.  Fig. 2	10	1,2	2,3	
4. a)	For the two-link manipulator shown in Fig. 3(a), the link-transformation matrices, ${}^0_1 T$ and ${}^1_2 T$, were constructed. Their product is ${}^0_2 T = \begin{bmatrix} c\theta_1 c\theta_2 & -c\theta_1 s\theta_2 & s\theta_1 & l_1 c\theta_1 \\ s\theta_1 c\theta_2 & -s\theta_1 s\theta_2 & -c\theta_1 & l_1 s\theta_1 \\ s\theta_2 & c\theta_2 & 0 & 0 \\ 0 & 0 & 0 & 1 \end{bmatrix}$ The link-frame assignments used are indicated in Fig. 3(b). Note that frame {0} is coincident with frame {1} when $\theta_1 = 0$. The length of the second link is l_2. Find an expression for the vector ${}^0 P_{rip}$ which locates the tip of the arm relative to the {0} frame.	10	1,2	1,2	3
b)	Derive the link transformation matrix for the link shown in Fig. 4 that defines frame {i} relative to frame {i-1}	10	1,2	2,3	3
5. a)	Discuss following terms in the context of Inverse Kinematics 1. Existence of solution, 2. Multiple Solutions	04 04	1,3	1,2,3	4
b)	Solve the Inverse Kinematic problem described below algebraically. Consider the three-link planar manipulator as shown with its link	12	1,3	2,3	4



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parameters in Fig. 5. The kinematic equation of this arm is given below. Assume that the necessary transformations have been performed so that the goal point is a specification of the wrist

$${}^B \bar{T}$$

frame relative to the base frame, that is, ${}^W \bar{T}$.

Goal points can be accomplished most easily by specifying three numbers: x, y, and ϕ where ϕ is the orientation of link 3 in the plane (relative to the +X axis).

$${}^B T = {}^0_3 T = \begin{bmatrix} c_{123} & -s_{123} & 0.0 & l_1 c_1 + l_2 c_{12} \\ s_{123} & c_{123} & 0.0 & l_1 s_1 + l_2 s_{12} \\ 0.0 & 0.0 & 1.0 & 0.0 \\ 0 & 0 & 0 & 1 \end{bmatrix}$$

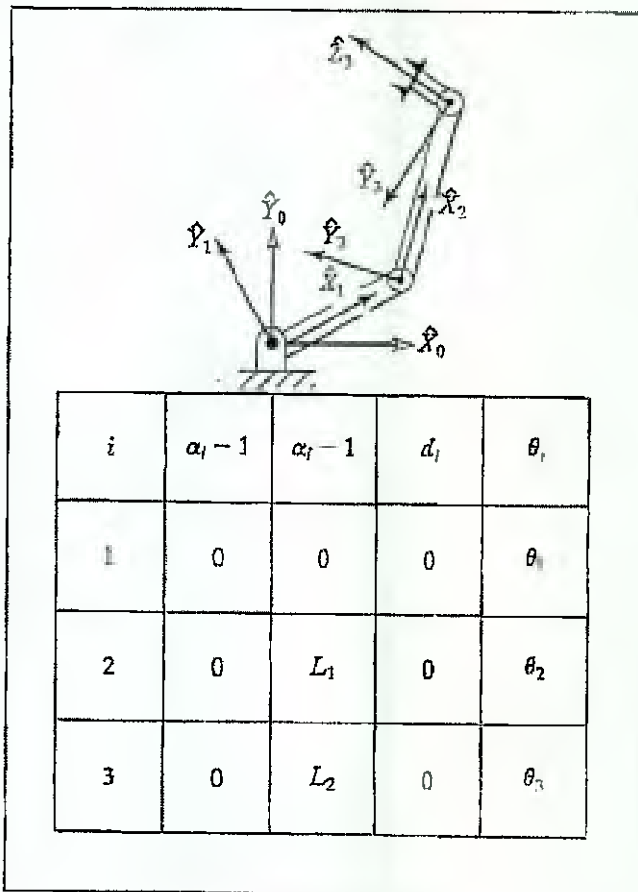
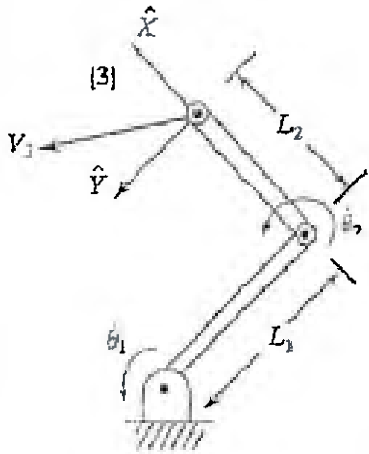
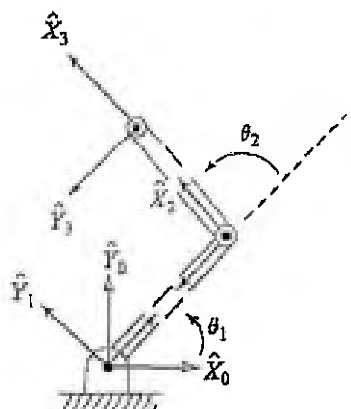
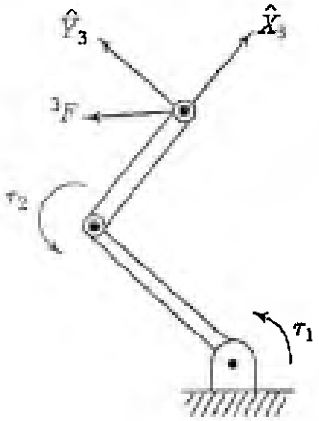


Fig. 5

6. a)	Derive the equations for Linear Velocity, Rotational Velocity and Simultaneous linear and rotational velocity.	10	1,4	2,3,4	5
b)	The two-link manipulator as shown below in Fig. 6 is applying a				6



END SEMESTER/RE- EXAMINATION MAY 2026

	force vector $3F$ with its end-effector. (Consider this force to be acting at the origin of $\{3\}$.) Find the required joint torques as a function of configuration and of the applied force. (See Fig. 7)   Fig. 6  Fig. 7	10	1,4	2,3,4	
7. a)	Consider the case in which $\{B\}$ is rotating relative to $\{A\}$ with ${}^A\Omega_B$ and $\{C\}$ is rotating relative to $\{B\}$ with ${}^B\Omega_C$. Calculate ${}^A\Omega_C$.	05	1,4	2,3,4	7
b)	Derive the closed form dynamic equations for the two-link planar manipulator shown in Fig. 8. For simplicity, assume that the				7

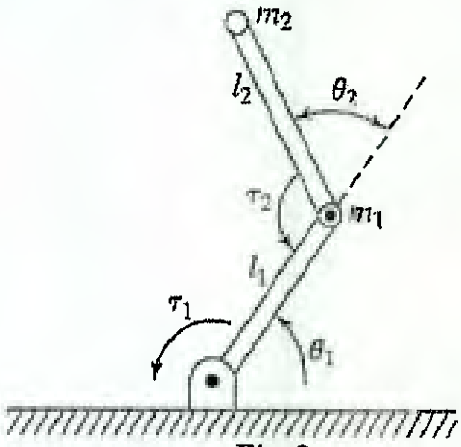


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	mass distribution is extremely simple: All mass exists as a point mass at the distal end of each link. These masses are m_1 and m_2.  Fig. 8	15	1,4	2,3,4	
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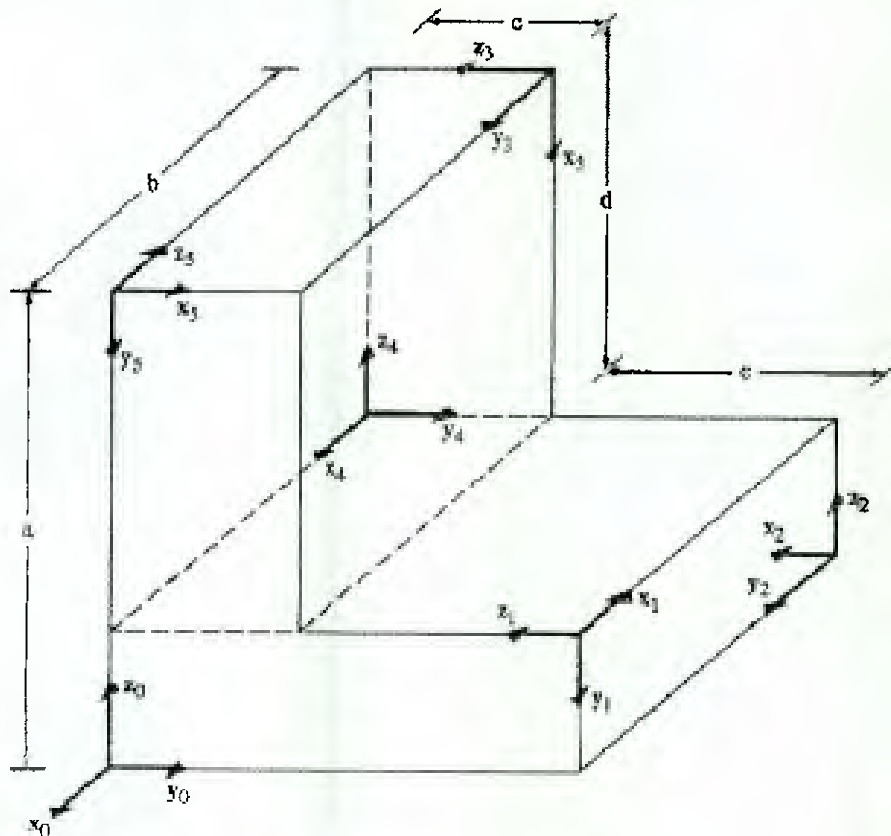


Fig. 1



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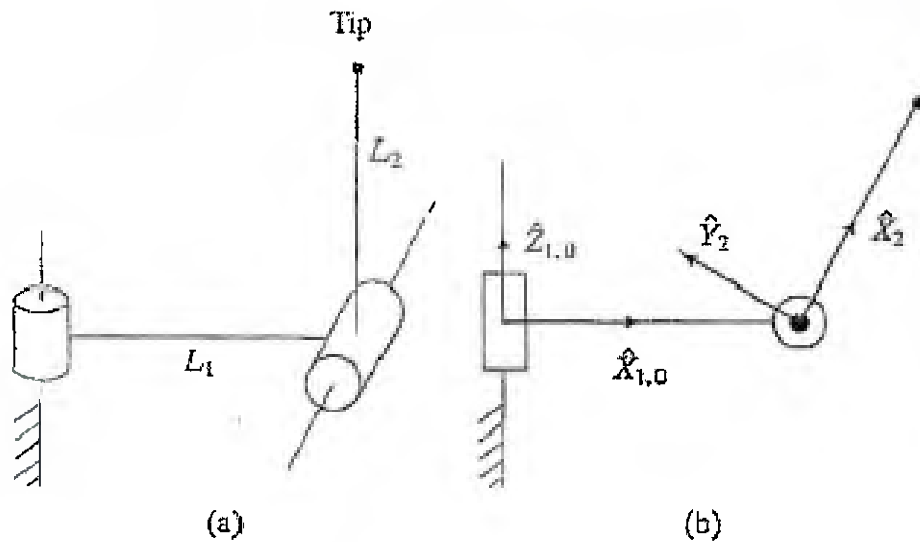


Fig. 3

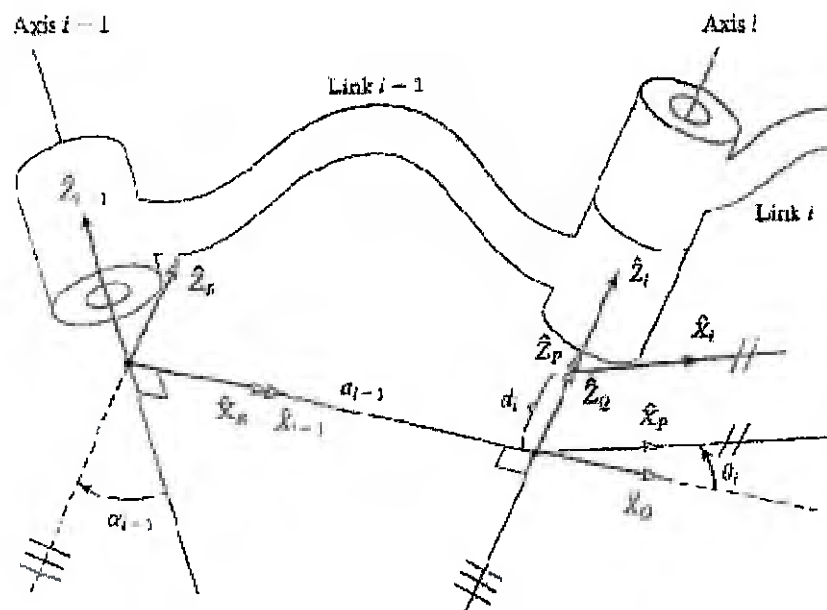


Fig. 4



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Academic Year 2025 – 26 [First Half]

Regulation - 2022

End Semester Examination / Re-examination [May-June 2026]

Program: B. Tech. Electrical Engineering

Course: Digital Signal Processing

Course Code: PE-BTE605

Semester: VI

Total Points: 100

Time: 3 hrs

Note: Solve any FIVE questions of the following. Write answers of all sub-questions together.

Q. No.	Question	Points	CO	Module No.
1 A	Design a Butterworth digital IIR highpass filter using bilinear transformation by taking $T = 0.5$ sec, to satisfy following specifications: $0.707 \leq H(e^{j\omega}) \leq 1.0 \quad ; 0.65\pi \leq \omega \leq \pi$ $ H(e^{j\omega}) \leq 0.2 \quad ; 0 \leq \omega \leq 0.45\pi$	10	4	5
B	Design a Chebyshev digital IIR lowpass filter using bilinear transformation by taking $T = 1$ sec, to satisfy following specifications: $0.8 \leq H(e^{j\omega}) \leq 1.0 \quad ; 0 \leq \omega \leq 0.2\pi$ $ H(e^{j\omega}) \leq 0.2 \quad ; 0.32\pi \leq \omega \leq \pi$	10	4	5
2 A	Using frequency sampling method design a linear-phase FIR filter for the specifications given below: $H_d(e^{j\omega}) = \begin{cases} e^{-j3\omega} & 0 \leq \omega \leq \frac{\pi}{2} \\ 0 & \frac{\pi}{2} < \omega \leq \pi \end{cases}$	10	4	6
B	Design a 4 th order FIR filter, using rectangular window function, to approximate an ideal low-pass filter with passband gain of unity, cut-off frequency of 850 Hz and working at a sampling frequency of 5000 Hz.	10	4	6
3 A	Determine and sketch the magnitude and phase response of the sequence given below: $y(n) = x(n) + 0.9x(n-2) - 0.4y(n-2)$. [Note: Plot the magnitude and phase response on a graph paper.]	10	2	2

	B	For the system described by the difference equation, $y(n) - \frac{1}{2}y(n-1) + \frac{1}{4}y(n-2) = x(n),$ Determine, i. transfer function and ii. response of the system to the input $x(n) = \left(\frac{1}{3}\right)^n u(n)$.	10	2	2
4	A	An analog circuit has following normalized, s-plane transfer function: $H(s) = \frac{5s+1}{s^2+0.4s+1}$ Determine the transfer function of an equivalent digital circuit using bilinear transformation with resonant frequency of 10 Hz and sampling frequency of 60 Hz.	10	4	5
	B	Convert the analog filter with system function, $H(s) = \frac{1}{(s+0.5)(s^2+0.5s+2)}$ into a digital IIR filter using impulse invariance method, with $T_s = 1$ sec.	10	4	5
5	A	(i) State and prove symmetry properties of DFT. (ii) The first 8 samples of a 14-point DFT $X(k)$ of a real valued sequence $x(n)$ are: $X(0)=12, X(1)=-1+j3, X(2)=3+j4, X(3)=1-j5,$ $X(4)=-2+j2, X(5)=6+j3, X(6)=-2-j3, X(7)=10$ Determine remaining samples of DFT $X(k)$.	10	3	3
	B	For the sequences $x_1(n) = \{1, 1, 2, 2\}$ and $x_2(n) = \{1, 2, 3, 4\}$, determine: i. linear convolution ii. circular periodic convolution using DFT / IDFT.	10	3	3
6	A	Determine response $y(n)$ for $n \geq 0$ of a system having impulse response $h(n) = \cos \pi n u(n)$ to the input $x(n) = (0.5)^n u(n)$.	05	2	2
	B	Classify following system as static/dynamic, linear/non-linear, time-variant/invariant, causal/non-causal and stable/unstable, $y(n) = x(n) + nx(n+1)$.	05	1	1

	C	Determine the transfer function and sketch poles and zeros of an LTI system described by the equation, $y(n) = x(n) + 0.8x(n-1) + 0.8x(n-2) - 0.40y(n-2)$ Comment on the stability of this system.	10	2	2
7	A	Find the general solution of the following equation: $y(n) - 0.9y(n-1) = 0.5 + 0.9^{n-1} \text{ for } n \geq 0 \text{ with } y(-1) = 5 \text{ and } x(n) = 0.5 + (0.9)^{n-1}$	10	2	1
	B	Explain stationary random processes and their properties.	05	1	7
	C	Compare Wiener filtering with ordinary filtering techniques.	05	1	7

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



~~RE~~
End Semester Examination

~~May/June 2026~~

MAY 2026

Max. Marks: 100

Duration: 03 Hours

Class: **T.Y. B.TECH. (E)** Semester: VI

Program: **B.TECH. (ELECTRICAL)**

Name of the Course: **Basics of Automotive System**

Course Code: **PE-BTE601**

Instructions:

- Question No. 1 is compulsory.
- Solve Any Four questions from remaining 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.

21/6/26

Ques. No	Description of question	Max. Marks	CO
Q.1a)	Discuss the "History of Electric Motors in Traction".	05	01
Q.1b)	In the design/modelling of vehicle, it is required to keep the NVH level within limits. Justify.	05	02
Q.1c)	Draw the power train of EV and discuss its components in brief.	05	03
Q. 1d)	What are the motivations behind the commercial exploitation of EVs?	05	04
Q. 2a.)	Discuss the purpose of transmission system used in automotive system. Enlist the different types of transmission system and compare them.	10	03
Q. 2b)	Draw the block diagram and discuss the energy management in hybrid electric vehicles.	10	02
Q. 3a)	Define the tractive effort required to move the vehicle. Discuss the rolling resistance and aerodynamic drag in detail.	12	02

Q. 3b)	Find the torque needed at the wheels to move a vehicle if the total tractive force required is 6000 N and the wheel radius is 0.35 m. Calculate the power rating of motor if the base speed is: (neglect the losses) (i) 3000 rpm (ii) 6000 rpm (iii) 8000 rpm (Assume suitable data if required and justify the same)	08	02
Q. 4a)	The electrical motor is a suitable power source for vehicular type of load. Justify the statement with suitable characteristics of electrical motor and load.	10	03
Q. 4b)	A three phase induction motor is used as the power source in EV. Explain how the regenerative brakes applied to the EV and discuss in detail the torque reversal and power reversal with suitable phasor diagram.	10	03
Q. 5a)	Compare on board charger and off board charger.	06	02
Q. 5b)	What are the advantages of PM motors? Compare the BLDC motor and PMSM.	07	02
Q. 5c)	Explain the possible EV configurations of the drivetrain.	07	
Q. 6a)	Explain the parallel HEV architecture and its operation modes. Comment on the sizing of power components.	12	03
Q. 6b)	A car is having following specification: $M = 2000 \text{ kg}$ $C_d = 0.19$ $\text{Area} = 2.5 \text{ m}^2$ $\mu_{rr} = 0.005$ $G = 10:1$ $r = 0.3 \text{ m}$ The base speed of the motor is 6000 rpm. The maximum torque is 2000 N. Find: (i) Power rating of the motor (ii) Maximum acceleration	08	02
Q. 7a)	Discuss the EV with single gear system and dual gear system.	07	03
Q. 7b)	Discuss the cooling systems in electrical vehicles.	07	01
Q. 7c)	Discuss the antilock braking system used in vehicles.	06	01



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END SEMESTER EXAMINATION MAY 2026 / ~~RE-EXAM JULY 2026~~

Program: B. Tech. Electrical

Course Code: PE-BTE604

Course Name: Renewable Energy Sources & Grid integration

Duration: 3 Hrs.

Maximum Points: 100

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.

Q. No.	Questions	Points	CO	BL	Mod. No.
1.	With a suitable diagram, explain the complete control architecture of a grid-connected solar PV system. Elaborate the role of: 1. MPPT for maximum energy extraction 2. DC-DC converter for voltage regulation 3. VSC for grid interfacing 4. PLL for synchronization with the grid 5. Current controller and PWM for inverter switching	20	3,4	3	07
2.(a)	A wind turbine has a rotor radius of 40 m and operates at a wind speed of 10 m/s. The air density is 1.225 kg/m ³ . The power coefficient $C_p = 0.42$ and thrust coefficient $C_T = 0.8$ 1. Calculate the actual power extracted by the turbine. 2. Determine the thrust force acting on the turbine. 3. If the rotor speed is 20 rpm, calculate the tip speed ratio (λ).	10	3	3	02
2.(b)	Briefly discuss the key requirements of the grid code for integrating renewable energy sources into the power system.	10	1,2	2	04
3.(a)	With the help of following points describe how a typical hydropower plant generates electricity. 1. Schematic diagram of hydro power plant 2. Role of the dam 3. Role of reservoir 4. Role of penstock 5. Role of turbine and generator.	10	1,2	2	05



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END SEMESTER EXAMINATION MAY 2026 / ~~RE - EXAM JULY 2026~~

3.(b)	A 2.5 MW, 6-pole Doubly Fed Induction Generator (DFIG) is connected to a 50 Hz grid. The wind turbine drives the generator at a speed of 920 rpm. The stator delivers 2 MW power to the grid. Calculate 1. Calculate the synchronous speed, slip, and rotor current frequency of the generator. 2. Identify the mode of operation (sub-synchronous or super-synchronous). Justify your answer. 3. Calculate the power handled by the rotor-side converter. Also state the direction of power flow in the rotor circuit.	10	3	2,3	02																														
4.	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>6</td><td>6</td></tr><tr><td>2</td><td>Ceiling Fan</td><td>75</td><td>3</td><td>12</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>3</td></tr></table> Consider following data 1. The refrigerator operates with a duty cycle of 0.5 2. Efficiency of battery : 90 % 3. Efficiency of Inverter : 95 % 4. Efficiency of charge controller and cables : 85 % 5. Safety factor of charge controller : 1.25 6. Surge factor of inverter : 2 7. 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	6	6	2	Ceiling Fan	75	3	12	3	TV	100	1	4	4	Refrigerator	180	1	24	5	Miscellaneous	200	1	3	20	2,5	4	03
Sr. No.	Load Name	Power on Load (W)	No. of Load	Operating Hrs																															
1	LED Light	9	6	6																															
2	Ceiling Fan	75	3	12																															
3	TV	100	1	4																															
4	Refrigerator	180	1	24																															
5	Miscellaneous	200	1	3																															



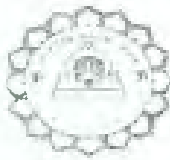
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END SEMESTER EXAMINATION MAY 2026 / ~~RE-EXAM JULY 2026~~

5.(a)	With the help of neat diagram Explain the different types of tidal energy systems and their working principles.	10	1	1,2	06
5.(b)	How to calculate hosting capacity for the transmission and distribution system for connecting distributed renewable energy sources?	10	3	3	07
6.(a)	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.(b)	Explain the role of FRT in maintaining grid stability of the power system	10	2	2	04
7.(a)	A hydroelectric power plant operates under a head of 120 m. The rate of water discharge is $90 \text{ m}^3/\text{s}$. The overall efficiency of the turbine-generator system is 88%. 1. Calculate the power generated by the plant. 2. If the plant operates for 8 hours per day, determine the annual energy generated.	05	2,3	2,3	5
7.(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
7.(c)	Draw the layout of a dry 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 Examination/ ~~Practical Examination~~, May /June 2026



Max. Marks: 100

Class: TY CE

Semester: VI

Name of the Course: Sensors and Actuators

Duration: 3 hr.

Program: Electrical

Course Code: PE-BTE502

Instructions:

- Question 1 is compulsory.
- Attempt any four from remaining six questions.
- Illustrate your answers with neat sketches wherever necessary.
- Assume appropriate data if required and state your reason.
- Preferably, write the answers in sequential order.

21/6/26

Question No		Maximum Marks	Course Outcome Number	Module No.
Q1	a. Describe the working principle of a Resistance Temperature Detector (RTD). Why is platinum the preferred material for RTDs, and how do 3-wire and 4-wire configurations improve measurement accuracy?	5	1	1
	b. What is thermal imaging? Explain how it is used for temperature measurement in industrial and medical applications.	5	2	2
	c. Discuss the principle of operation of a Doppler flow meter. In what situations is this method preferable for flow measurement?	5	2,3	3
	d. Explain the operating principle of a pH sensor. Discuss its applications in industrial and laboratory settings.	5	1,3	4
Q2	a. Explain the construction and working of a Linear Variable Differential Transformer (LVDT) for measuring linear displacement. Derive the relationship between core displacement and the output differential voltage.	6	1,2	1

	b. Differentiate between active and passive transducers. Provide examples of applications where each type is preferred.	7	2,3 ^a	1
	c. Explain the working principle of a thermistor. How does it differ from an RTD in terms of temperature measurement?	7	1,2	2
Q3	a. Describe the working principle of a strain gauge. How is it used to measure motion or dimensional changes?	6	1,2	2
	b. With a neat schematic diagram, explain the working principle of an Electromagnetic Flow Meter (Magmeter). Derive the expression showing that the induced voltage is proportional to the fluid velocity. List two major advantages of this type of flow meter.	7	1,2	3
	c. Compare the methods used for measuring water flow and blood flow. What unique challenges are associated with blood flow measurement?	7	2,3	3
Q4	a. Describe the electrochemical working principle of a common blood glucose sensor, including the enzymatic reaction involving glucose oxidase (GOx) and how the final current measurement relates to glucose concentration. Differentiate between the three generations of glucose sensors.	7	2,3	4
	b. Describe the working principle of a chemical sensor. How does it differ from a biosensor in terms of operation and application?	7	1,2	4
	c. Define Microsystems and explain their significance in modern sensor technology. Provide examples of applications where Microsystems are used.	6	1	5
Q5	a. Explain how a micro-accelerometer works. Discuss its applications in the automotive and consumer electronics industries.	7	2,3	5
	b. Compare and contrast Electric, Hydraulic, and Pneumatic actuators based on their power source, typical operating pressure, application suitability (high power vs. precision), and general advantages.	7	1,2	6
	c. Define a smart sensor and list five key properties of an intelligent field device. Explain how self-calibration and self-testing capabilities improve the reliability of smart sensors in industrial automation.	6	1,2	5

Q6	a. Compare and contrast AC motors and stepper motors in terms of their operation, control, and applications.	7	1,2	6
	b. Describe the function of solenoids as electric actuators. How are they used in automation systems?	6	1,2	6
	c. Discuss the applications of smart sensors in automatic robots and automobile engine controls. How do smart sensors enhance the performance of these systems?	7	2,3	5
Q7	a. Select a case study from a process industry (e.g., power plant, chemical plant). Identify the key sensors used and justify their selection based on system requirements.	7	3	7
	b. Discuss the application of smart sensors in an automation industry. How do they improve system performance and reliability?	7	1,3	7
	c. Explain the role of sensors in process industries. Provide examples of key sensors used in the power industry and their functions.	6	1	7



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End/~~Exam~~ Semester AY2025-2026



Program: B. Tech Electrical *sem VI*

Duration: 3 Hrs

Course Code: PC-BTE603

Maximum Points: 100

Course Name: Control System II

Semester: VI

Note: Q1 is compulsory. Solve any four questions out of remaining six questions

Assume suitable data if required.

26/5/26

Q. No	Questions	Poi nts	CO	BL	Module no
1	a> Describe the physical meaning of observability? How is observability determined mathematically? b> Derive Ackerman's formula for state feedback controller design. c> Define Lyapunove stability criteria. Explain direct method of finding Lyapunove stability. d> For the system with transfer function $\frac{Y(s)}{U(s)} = \frac{12s^3+18s^2+24s+30}{6s^3+12s^2+18s+24}$ Obtain state space model in Controllable Canonical Form	20	1,2	2-3	1-6
2 a	A series RLC circuit has a voltage source $V_s(t)$, a resistor R, an inductor L, and a capacitor C. Find the state-space model where the output is the voltage across the capacitor V_c .	06	1	3	1
b	Realize the system with transfer function $T(s) = \frac{2s^2+8s+10}{s^3+7s^2+15s+5}$ in controllable and observable canonical forms.	07	1	3	2
c	Explain how the diagonal form is realized from transfer function. Realize the system with transfer function $T(s) = \frac{s^2+2s+5}{(s+3)^2(s+1)}$ in diagonal form	07	1	3	2



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End/Reexam Semester AY2025-2026



3 a	Consider the system $\dot{x} = \begin{bmatrix} 0 & 1 \\ -1 & -2 \end{bmatrix} x + \begin{bmatrix} 1 \\ -1 \end{bmatrix} u; y = [1 \ 0]x; x(0) = \begin{bmatrix} 0 \\ 1 \end{bmatrix}$ Determine solution of state equation to unit step input.	10	1	3	3
b	Derive an expression to find transfer function for the system represented by state space equations. Using the same and not otherwise find the transfer function of the system represented by $\dot{x} = \begin{bmatrix} 0 & 1 & 0 \\ 0 & 0 & 1 \\ -2 & -8 & -2 \end{bmatrix} x + \begin{bmatrix} 0 \\ 0 \\ 1 \end{bmatrix} u \text{ and } y = [6 \ 3 \ 1]x$	10	1	3	3
4 a	The state space model of system is given by $\begin{bmatrix} \dot{x}_1 \\ \dot{x}_2 \end{bmatrix} = \begin{bmatrix} -2 & 5 \\ 0 & -2 \end{bmatrix} \begin{bmatrix} x_1 \\ x_2 \end{bmatrix} + \begin{bmatrix} 0 \\ 1 \end{bmatrix} u$ Determine stability using 1. Eigen values 2. Lyapunov Stability Check stability with converse Lyapunov Approach	08	1	3	3
b	What is state controllability? Discuss and compare Kalman and Gilbertz tests to check controllability of the system. For the system $\dot{x} = \begin{bmatrix} 0 & 1 \\ -2 & -3 \end{bmatrix} x + \begin{bmatrix} 0 \\ 1 \end{bmatrix} u$ determine if the system is controllable or not using (i) Kalman Test (ii) Gilbertz test	12	2	3	4
5 a	A regulator system has plant $\frac{Y(s)}{U(s)} = \frac{10}{(s+1)(s+2)(s+3)}$ in which the state variables are defined as $x_1 = y, x_2 = \dot{x}_1$ and $x_3 = \dot{x}_2$. The system uses the state feedback control $u = -kx$ which places the closed loop poles at $s=-10$ and $s=-2 \pm j2\sqrt{3}$. Find the state feedback gain matrix.	10	2	3	4.5



b	For the plant $G(s) = \frac{10(s+8)}{(s+2)(s+10)}$ Design controller $u=-kx$ using Ackerman's formula to yield 5% overshoot and peak time of 0.3 sec.	10	2	3	4,5
6 a	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 $s^3 + 100s^2 + 2200s + 40000.$	10	2	3	4,6
b	For reduced order observer, derive the equivalence from full order observer. For the system shown below state x_1 is measurable whereas states x_2, x_3 are not measurable. Design the observer to predict the same such that observer poles are at -5,-5. $\dot{x} = \begin{bmatrix} -1 & 1 & 0 \\ 0 & -2 & 1 \\ 0 & 0 & -3 \end{bmatrix} x + \begin{bmatrix} 0 \\ 0 \\ 1 \end{bmatrix} u \text{ and } y = [1 \ 0 \ 0]x$	10	2	3	4,6
7 a	Explain various types of system non-linearity and their effect on system performance	07	3	2	7
b	What is singular point? With an example, explain how it is used to determine stability.	06	3	2	7
c	With an example, explain how the phase plane analysis is used to observe the effect of different initial conditions	07	3	2	7



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~~END SEM~~ RE-EXAM EXAMINATION ~~May~~ June 2026

Program: T.Y. Electrical

Sem VI

Duration: 3 h

Course Code: PC BTE 601

Maximum Points: 100

Course Name: Electric Drives

Semester: VI

Note:

- Attempt any five questions
- Group sub parts of questions together
- Paper is 3 pages long

20/7/26

Q.No.	Questions	Points	CO	BL	Module No.
Q1(a)	Evaluate the technical and economic considerations in selecting an electrical drive for industrial applications, and recommend a suitable drive for a given scenario where multiple motors are to be driven at same speed.	10	1	3	1
Q1(a)	Describe and analyze the four-quadrant operation of a motor driving a hoist. Explain each quadrant in terms of direction of motion, torque, and power flow, and illustrate with a neat diagram.	10	1,2	3,4	2
Q2(a)	A drive has the following parameters: $J=10\text{Kg m}^2$, $T=15+0.05N(\text{Nm})$ and $T_L=5+0.06N(\text{Nm})$, where N is speed in rpm. Initially the drive is working in steady state. Now the drive is braked by electrical braking. Torque of the motor in braking is given by $T=-10-0.04N(\text{Nm})$. Estimate time taken by the drive to stop.	6	1,2	4	2
Q2(b)	With the help of a neat block diagram, explain the operation of a closed-loop speed control system with an inner current control loop. Discuss the functions performed by the inner loop.	8	1,2	2,3	4
Q2(c)	An induction motor of 100 KW has an efficiency of 80% at full load. The motor operates with the following duty cycle. (i) Acceleration for 10 s with an energy loss of 50 KWs (ii) Running at full load for 10 s (iii) Braking for 10 s with an energy loss of 50 KWs (iv) Idling interval	6	2	4	3



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~~END SEM~~ **RE-EXAM EXAMINATION May/June 2026**

	The value of β is 0.4. Can the drive be operated at a frequency of 100 cycles per hour.				
Q3(a)	With the help of neat diagrams, explain the working of dynamic braking methods of a DC motor and illustrate torque-speed characteristics.	8	3	3,2	5
Q3(c)	Explain the operation of a Class E chopper-fed DC motor drive. Illustrate its four-quadrant operation with appropriate circuit diagram and waveforms.	12	3	3,2	5
Q4(a)	A 230 V, 500 rpm, 90 A separately excited dc motor has the armature resistance and inductance of 0.115 Ω and 11 mH respectively. The motor is controlled by a class C two quadrant chopper operating with the source voltage of 230V and a frequency of 400Hz. (i) Calculate the motor speed for a motoring operation at $\delta = 0.5$ and half of the rated torque. (ii) What will motor speed be when regenerating at $\delta = 0.5$ and rated torque.	8	3	4	5
Q4(b)	Explain the operation of a single-phase controlled rectifier-fed DC motor with the help of a neat schematic diagram. Describe the different modes of operation—continuous and discontinuous conduction—during motoring and regeneration, with appropriate waveforms.	12	3	3	5
Q5(a)	Analyze the slip power control method used for speed control of a three-phase induction motor. Compare the stator current, slip speed, torque, and power flow characteristics for different modes of operation (different k).	10	3	4	6
Q5(b)	A slip-ring induction motor is controlled using a closed-loop static rotor resistance control scheme. (i) Explain the operating principle of the control scheme with the help of a suitable block diagram. (ii) Derive the expression for the effective rotor circuit resistance in terms of the chopper duty ratio. (iii) Discuss the speed-torque characteristics, performance, and efficiency of the drive system under different operating conditions.	10	3	3	6



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~~END SEM~~ **RE-EXAM EXAMINATION May/June 2026**

Q6(a)	What is a slip power recovery scheme? Explain the operation of the static Scherbius drive with the help of a suitable schematic diagram. Derive the expression for electromagnetic torque and sketch the speed-torque characteristics of the drive.	10	3	3	6
Q6(b)	Draw the equivalent circuit of a three-phase induction motor and explain its operation during two-lead AC dynamic braking. Derive the torque equations and sketch their speed-torque characteristics.	10	3	3,2	6
Q7(a)	Explain the construction and working of a BLDC motor drive. Describe electronic commutation and compare it with conventional DC motor operation.	10	3	3	7
Q7(b)	Develop the thermal model of an electrical motor under heating and cooling conditions by addressing the following: (i) State the assumptions made in the thermal modelling of electrical machines. (ii) Derive the differential equation governing the heating process of the motor. (iii) Obtain the expression for temperature rise as a function of time during heating.	10	1,2	2,3	3



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RE- EXAMINATION ~~MAY-JUNE~~ JULY 2026

Program: T.Y. B.Tech.

Course Code: MI-BT043

Course Name: Mechanics of Robots

Duration: 3 Hours

Maximum Points: 100

Semester: VI

- Notes:
1. Question No. 1 is compulsory.
 2. Solve any four questions from remaining six.
 3. Draw neat diagrams wherever necessary.
 4. Assume suitable data if necessary.

17/7/26

Q.No.	Questions	Points	CO	BL	Module No.
1.	Solve any FOUR from the following.	05			
a)	Define Direct and Inverse Kinematics Problem.	05	1	1,2	3,4
b)	Interpret the meaning of columns of Homogeneous Transformation Matrix.	05	1,2	1,2	1
c)	Derive Resultant Rotation matrix for Z-Y-Z Euler angle representation.	05	1,2	1,2,3	2
d)	Describe Jacobian and Singularity.	05	1,3	1,2,3	5,6
e)	Define Mass Moment of Inertia and Mass Product of Inertia	05	1,4	2,3	7
2. a)	Describe the followings; 1. Fundamental Rotations 2. Equivalent Angle-Axis Rotation	05 05	1,2	2,3	1
b)	A frame {B} is located initially coincident with a frame {A}. We rotate {B} about Z_B by 30 degrees, and then we rotate the resulting frame about X_B by 45 degrees. Give the rotation matrix that will change the description of vectors from ${}^B P$ to ${}^A P$.	05	1	2,3	1
c)	Consider the following coordinate transformation matrix, which represent a fundamental rotation. What is the axis of rotation and what is the angle of rotation. $\begin{bmatrix} 0.500 & 0 & -0.866 \\ 0 & 1 & 0 \\ 0.866 & 0 & 0.500 \end{bmatrix}$	05	1	2,3	1
3. a)	Derive rotational matrices for X-Y-Z fixed angle and Z-Y-X Euler angles rotations.	10 07	1 1,2	1,2 2,3	2 3,4

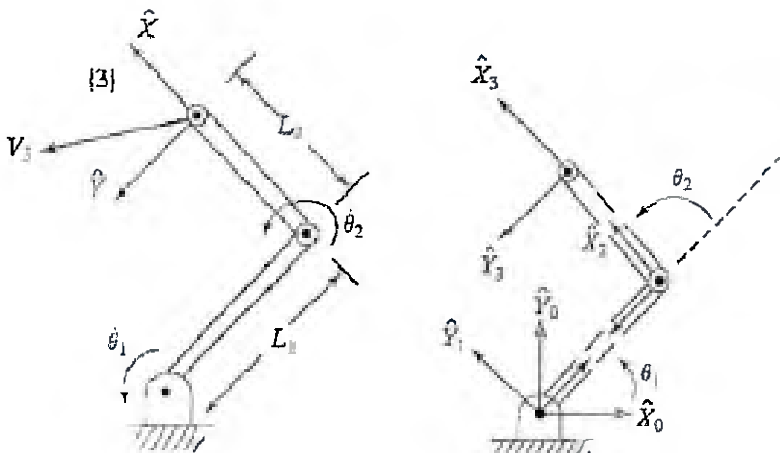


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END SEMESTER/ RE- EXAMINATION MAY-JUNE-JULY 2026

6. a)	Fig. 1 shows a fixed universe frame, {U}, a frame attached to a train travelling at 100 mph, {T}, and a frame attached to a car traveling at 30 mph, {C}. Both vehicles are heading in the X direction of {U}. The rotation matrices, as shown below are known and constant. Find the followings $\frac{d}{dt} {}^U P_{CORG}?$ $C({}^U V_{TORG})?$ $C({}^T V_{CORG})?$	06	1,4	2,3,4	5
b)	A two-link manipulator with rotational joints is shown in Fig.5. Calculate the velocity of the tip of the arm as a function of joint rates. Give the answer in two forms—in terms of frame {3} and also in terms of frame {0}. Frame {3} has been attached at the end of the manipulator. 	14	1,4	2,3,4	6
7. a)	Derive the relations for Linear and Angular acceleration of a rigid body.	10	1,4	2,3,4	7

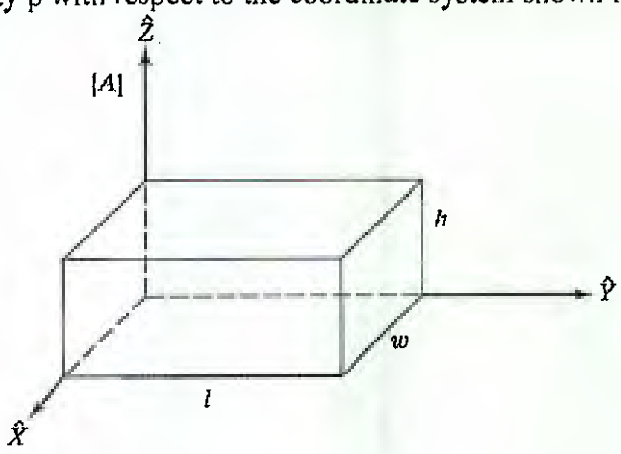


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END-SEMESTER/ RE- EXAMINATION MAY-JUNE-JULY 2026

b)	Find the inertia tensor for the rectangular body of uniform density ρ with respect to the coordinate system shown in Fig. 6.	10	1,4	2,3,4	7
 Fig. 6					



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~~END SEM~~ **RE EXAM EXAMINATION MAY/JUNE 2026**

Program: BTECH (MECH. ENGG.)

Duration: 3 hrs

Course Code: MI-BT022

Maximum Points: 100

Course Name: Artificial Intelligence and Machine Learning

Semester: VI

17/7/26

Q.No.	Questions	Points	CO	BL	Module No.										
Q.1 (a)	<table border="1"><thead><tr><th>X(Hours Studied)</th><th>Y(Score)</th></tr></thead><tbody><tr><td>1</td><td>3</td></tr><tr><td>2</td><td>5</td></tr><tr><td>3</td><td>7</td></tr><tr><td>4</td><td>9</td></tr></tbody></table> Assume the model: $\hat{y} = wx + b$ Initial values: $w = 0, b = 0$ Learning rate: $\alpha = 0.1$ Questions 1. Compute the predicted values $\hat{y}$ for all data points. 2. Calculate the Mean Squared Error (MSE) loss. 3. Compute the gradients $\frac{\partial J}{\partial w}$ and $\frac{\partial J}{\partial b}$. 4. Perform all iteration of gradient descent and find the updated values of w and b.	X(Hours Studied)	Y(Score)	1	3	2	5	3	7	4	9	10	1,2	2	3
X(Hours Studied)	Y(Score)														
1	3														
2	5														
3	7														
4	9														
(b)	Explain the working of the Logistic Regression algorithm with the help of: • Linear combination equation • Sigmoid function • Loss function • Gradient descent optimization • Also explain how the model updates its parameters during training.	10	1,2	2	3										



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END SEM/RE EXAM EXAMINATION MAY/JUNE 2026

Q.2 (a)	Explain the following AI algorithms (Any two) 1] Breadth first search 3] Uniform Cost search 4] Heuristic informed search algorithm - Explain supervised, Unsupervised and reinforcement learning with examples.	05 05	1,2	2	1						
(b)	-What is Principal Component Analysis (PCA)? Explain the step-by-step procedure of PCA and discuss its applications in feature reduction and dimensionality reduction. -Explain different Model Evaluation Metrics such as Accuracy, Precision, Recall, F1-Score, MAE, MSE, and RMSE with suitable examples.	10	1,2	2	2						
Q.3 (a)	Apply the DBSCAN algorithm on the above dataset using the following parameters: - Epsilon radius (ϵ) = 2 - Minimum points (MinPts) = 2 <table><tr><td>P1 (1,2)</td></tr><tr><td>P2 (2,2)</td></tr><tr><td>P3 (2,3)</td></tr><tr><td>P4 (8,7)</td></tr><tr><td>P5 (8,8)</td></tr><tr><td>P6 (25,80)</td></tr></table> Using Euclidean distance, perform the following tasks: - Calculate the neighborhood points for each data point. - Identify the core points, border points, and noise points. - Form the clusters generated by DBSCAN. - Draw the final clustered representation on a 2D plane.	P1 (1,2)	P2 (2,2)	P3 (2,3)	P4 (8,7)	P5 (8,8)	P6 (25,80)	10	1,2	2	2
P1 (1,2)											
P2 (2,2)											
P3 (2,3)											
P4 (8,7)											
P5 (8,8)											
P6 (25,80)											
(b)	Explain the concept of Predictive Maintenance in Mechanical Engineering using AI and ML. Discuss different sensors, data acquisition techniques, and ML algorithms used for fault prediction along with neat figures	10	1,2	2	2						
Q.4 (a)	Explain the concept of Generative Adversarial Networks (GANs). Discuss the roles of Generator and Discriminator	10	1,2	2	2						

**END SEM/RE EXAM EXAMINATION MAY/JUNE 2026**

	networks and explain the training process of GANs. along with neat figures																																
(b)	-Explain the concept of Bias in Artificial Intelligence. Discuss different sources of bias in AI systems and their impact on engineering and society. -Discuss the importance of Transparency and Accountability in AI Systems. Explain the challenges associated with explainable AI and ethical decision-making.	10	1,2	2	2																												
Q.5 (a)	A manufacturing company wants to predict whether a machine condition is “Faulty” or “Normal” based on two features: • Temperature = High / Low • Vibration = High / Low The following training dataset is available: <table><tr><th>Machine</th><th>Temperature</th><th>Vibration</th><th>Condition</th></tr><tr><td>M1</td><td>High</td><td>High</td><td>Faulty</td></tr><tr><td>M2</td><td>High</td><td>Low</td><td>Faulty</td></tr><tr><td>M3</td><td>Low</td><td>High</td><td>Faulty</td></tr><tr><td>M4</td><td>Low</td><td>Low</td><td>Normal</td></tr><tr><td>M5</td><td>Low</td><td>Low</td><td>Normal</td></tr><tr><td>M6</td><td>High</td><td>Low</td><td>Normal</td></tr></table> Using the Naïve Bayes Classifier, predict the condition of a machine having: • Temperature = High • Vibration = High	Machine	Temperature	Vibration	Condition	M1	High	High	Faulty	M2	High	Low	Faulty	M3	Low	High	Faulty	M4	Low	Low	Normal	M5	Low	Low	Normal	M6	High	Low	Normal	10	1,2	2	2
Machine	Temperature	Vibration	Condition																														
M1	High	High	Faulty																														
M2	High	Low	Faulty																														
M3	Low	High	Faulty																														
M4	Low	Low	Normal																														
M5	Low	Low	Normal																														
M6	High	Low	Normal																														
(b)	Discuss the Backpropagation Algorithm used in training neural networks. Explain forward propagation, error calculation, gradient descent, and weight updation.	10	1,2	2	2																												
Q.6	A manufacturing company wants to classify machine components as Defective or Non-Defective using the Random Forest Algorithm. The following dataset is given:	20	1,2	2	2																												

**END SEM/RE EXAM EXAMINATION MAY/JUNE 2026**

Component	Temperature	Vibration	Pressure	Condition
C1	High	High	Low	Defective
C2	High	Low	Low	Defective
C3	Low	High	High	Non-Defective
C4	Low	Low	High	Non-Defective
C5	High	High	High	Defective
C6	Low	High	Low	Non-Defective

A new component has:

- Temperature = High
- Vibration = High
- Pressure = Low

Random Forest generates 3 decision trees.

Tasks

1. Create bootstrap sample datasets for Tree 1, Tree 2, and Tree 3.
2. Randomly select any two features for each tree.
3. Using the sampled datasets and selected features, predict the class of the new component for each tree.
4. Determine the final prediction using majority voting.
5. Explain how Random Forest reduces overfitting compared to a single Decision Tree.



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~~END SEM~~/RE EXAM EXAMINATION MAY/JUNE 2026

Q.7 (a)	What is Generative Artificial Intelligence (Generative AI)? Explain its working principle and discuss various Generative AI models such as GANs and Large Language Models (LLMs). Also explain its applications in engineering and industry.	10			
(b)	Explain the architecture and working of a Convolutional Neural Network (CNN) with suitable diagram. Discuss the functions of convolution layer, pooling layer, and fully connected layer, and explain the applications of CNN in image processing and engineering systems..	10	4	2	2

***** ** ALL THE BEST *****



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~~END SEMESTER EXAMINATION MAY 2026~~ / RE - EXAM JULY 2026

Program: Electrical Engineering *Seen VI*

Course Code: PC-BTE602

Course Name: Switchgear and protection

Duration: 3 hours

Maximum Points: 100

Semester: VI

- Question 1 is compulsory
- Solve 4 questions from remaining 6 questions
- Draw neat diagram if necessary
- Assume suitable data if required

16/7/26

Q.No.	Questions	Points	CO	BL	Module No.													
1	A. In what way is distance protection superior to overcurrent protection for the protection of transmission lines?	6	2	3	2													
	B. A 1200/5, C400 CT is connected on the 1000/5 tap. What is the maximum secondary burden that can be used and we can maintain rated accuracy at 20 times rated symmetrical secondary current?	8	1	3	1													
	<table border="1"><thead><tr><th>Current Ratio</th><th>500/5</th><th>600/5</th><th>800/5</th><th>900/5</th><th>1000/5</th><th>1200/5</th></tr></thead><tbody><tr><td>Secondary Resistance ohms</td><td>0.25</td><td>0.31</td><td>0.41</td><td>0.46</td><td>0.51</td><td>0.61</td></tr></tbody></table>	Current Ratio	500/5	600/5	800/5	900/5	1000/5	1200/5	Secondary Resistance ohms	0.25	0.31	0.41	0.46	0.51	0.61			
Current Ratio	500/5	600/5	800/5	900/5	1000/5	1200/5												
Secondary Resistance ohms	0.25	0.31	0.41	0.46	0.51	0.61												
	C. How transmission lines are protected from lightening over-voltages?	6	2	3	6													
2 A	In given fig. consider that the plant imports at all times a minimum power of 5 MW. Studies indicate that for various faults in utility side, minimum power export from the plant generator is 0.5 MW. Find which relay (shown by Relay 1) will give exact operation? Deduce the setting of selected relay 1. If the plant generator is of 50 MW capacity, what is likelihood of under-frequency or rate of change of frequency relay picking up on such faults?	6	4	3	7													

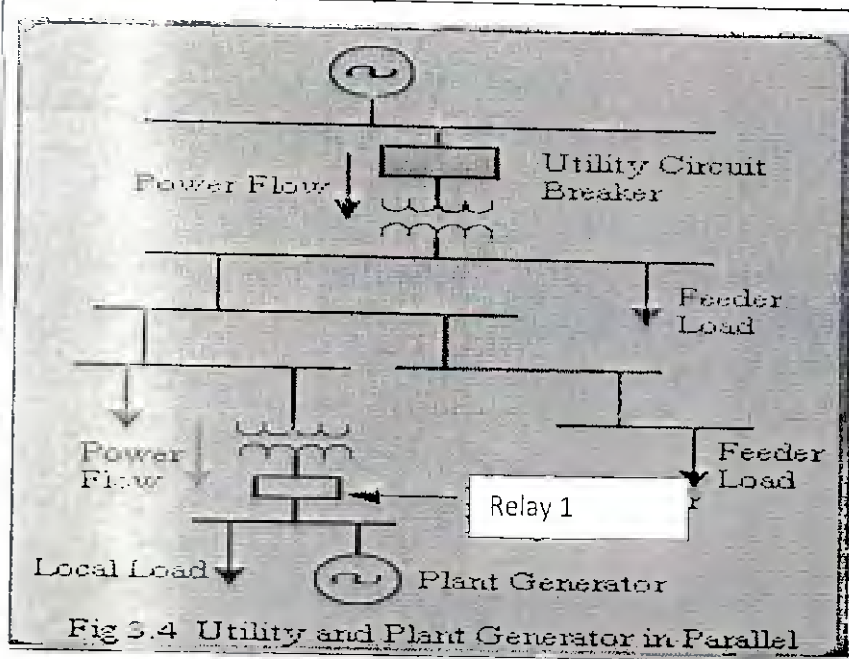


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~~END SEMESTER EXAMINATION MAY 2026 / RE~~ - EXAM JULY 2026



2B	A three-phase, 11 kV/132 kV, D-Yg connected power transformer is protected by differential protection. The CT on the LV side have a current ratio of 500/5. What must be the current ratio of the HV side CT there be connected. Draw neat diagram of protection scheme (show polarity marks on CTs, transformer windings, currents through transformer, current through pilot wires and through relay operating coil).	6+8	2	3	1,3
3A	An 11 kV, 100 MVA alternator is provided with differential protection. The percentage of winding to be protected against phase to ground fault is 85%. The relay is set to operate when there is 20% out of balance current. Determine the value of the resistance to be placed in the neutral to ground connection.	12	2	3	3 1
3B	Discuss various ratings of a Circuit Breaker.	8	3	3	4
4A		10	3	3	5



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	The faulted equivalent power system is shown in above figure, derive restriking voltage appearing across circuit breaker contacts and rate of rise of restriking voltage.				
4B	Explain with the waveform, capacitor bank switching by the circuit breaker. Suggest the solution.	8+2	2	3	3
5A	Discuss Type 2 coordination in three phase induction motor protection with time-current characteristic of motor, relay, HRC fuse and contactor.	10	2	3	3
5B	Discuss the range setting of distance relays placed at a particular location. Discuss the zone-II setting with proper diagram.	10	2	3	3
6A	Suggest a suitable protection to be used in case of loss of excitation of Synchronous Generator?	10	2	3	3
6B	Distinguish between PSM and TMS of a relay. Explain with suitable radial power system network.	10	1	3	1
7A	Compare Air Circuit Breaker (ACB) with Air Blast circuit breaker based on working, voltage rating, applications and limitations.	8	3	3	5
7B	Define Micro-grid. List out the components of the Microgrid.	6	4	3	7
7C	Explain the terms 'through fault stability limit' and 'stability ratio' with respect to the percentage differential relay.	6	1	3	2



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Academic Year 2025 - 26 [First Half]

Regulation - 2022

~~End Semester Examination~~ / Re-examination [May-June 2026]

Program: B. Tech. Electrical Engineering

Course: Digital Signal Processing

Course Code: PE-BTE605

Semester: VI

Total Points: 100

Time: 3 hrs

Note: Solve any FIVE questions of the following. Write answers of all sub-questions together.

Q. No.		Question	Points	CO	Module No.
1	A	Design an analog filter using Butterworth, Chebyshev and inverse Chebyshev approximation to meet following specifications: $A_p \leq 1 \text{ dB}$ for $\Omega_p \leq 4 \text{ rad/s}$ and $A_s \geq 20 \text{ dB}$ for $\Omega_s \geq 8 \text{ rad/s}$.	20	4	5
2	A	Determine 8-point DFT of the sequence $x(n) = \{2, 1, 2, 1, 1, 2, 1, 2\}$ using radix-2 DIF FFT algorithm.	10	3	3
	B	Determine IDFT of the following sequence using radix-2 DIT-FFT algorithm: $X(k) = \begin{cases} 36, -4 + j9.656, -4 + j4, -4 + j1.656, -4, -4 - j1.656, \\ -4 - j4, -4 - j9.656 \end{cases}$	10	3	3
3	A	Design a linear phase FIR highpass filter using Hanning window function, for the specifications given below: Stopband edge = 2 kHz, Stopband attenuation $\geq 40 \text{ dB}$, Passband edge = 9.5 kHz, Passband attenuation $< 1 \text{ dB}$, Sampling frequency = 25 kHz.	10	4	6
	B	Using frequency sampling method determine the coefficients and draw realization diagram of a linear-phase FIR filter of length 15 which has a symmetric unit sample response and a frequency response that satisfies the condition, $H\left(\frac{2\pi k}{15}\right) = \begin{cases} 1, & k = 0, 1, 2, 3 \\ 0.4, & k = 4 \\ 0, & k = 5, 6, 7 \end{cases}$	10	4	6

4	A	Convert the analog filter with system function, $H(s) = \frac{1}{(s+0.5)(s^2+0.5s+2)}$ into a digital IIR filter using impulse invariance method, with $T_s = 1$ sec.	10	4	5
	B	A simple LRC notch filter has following normalized, s-plane transfer function: $H(s) = \frac{s^2 + 1}{s^2 + s + 1}$ Determine the transfer function of an equivalent digital filter using BLT. Assume a notch frequency of 60 Hz and sampling frequency of 960 Hz	10	4	5
5	A	a. Determine 8-point DFT of the sequence $x(n) = \begin{cases} 1 & 0 \leq n \leq 3 \\ 0 & 4 \leq n \leq 7 \end{cases}$ Using DFT properties only determine, DFT of, $x_1(n) = \begin{cases} 1 & n = 0 \\ 0 & 1 \leq n \leq 4; \\ 1 & 5 \leq n \leq 7 \end{cases} \quad x_2(n) = \begin{cases} 0 & 0 \leq n \leq 1 \\ 1 & 2 \leq n \leq 5; \\ 0 & 6 \leq n \leq 7 \end{cases}$	10	3	3
	B	For the sequences $x_1(n) = \{1, 1, 2, 2\}$ and $x_2(n) = \{1, 2, 3, 4\}$, determine: i. linear convolution ii. circular periodic convolution using DFT / IDFT.	10	3	3
6	A	For a causal discrete-time LTI system, which is described by a difference equation $y(n) + \frac{1}{4}y(n-1) = x(n) + \frac{1}{2}x(n-1)$, determine its, i. impulse response, ii. system transfer function iii. frequency response and iv. magnitude and phase response	10	2	1, 2
	B	Determine the transfer function and sketch poles and zeros of an LTI system described by the equation, $y(n) = x(n) + 0.8x(n-1) + 0.8x(n-2) - 0.49y(n-2).$ Comment on the stability of this system.	10	2	2

7	A	Determine total response of the system, $y(n) - \frac{1}{4}y(n-1) - \frac{1}{8}y(n-2) = x(n) + x(n-1)$ to the input $x(n) = \left(\frac{1}{8}\right)^n u(n)$. Assume zero initial conditions.	10	2	1
	B	Explain the ARMA model used in signal processing.	05	1	7
	C	Explain the role of DSP in noise reduction using Wiener filtering.	05	1	7

* * * * *



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~~END SEMESTER EXAMINATION MAY 2026~~ / RE - EXAM JULY 2026

7-4.
Program: B. Tech. Electrical *sem VI*
Course Code: PE-BTE604
Course Name: Renewable Energy Sources & Grid integration

Duration: 3 Hrs.
Maximum Points: 100
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.

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Q. No.	Questions	Points	CO	BL	Mod. No.
1.	With the help of neat diagram explain the complete control strategy of a grid-connected solar PV system. Describe the role of: 1. MPPT 2. DC-DC converter 3. Voltage Source Converter (VSC) 4. PLL 5. Current regulator and PWM Illustrate how power flows from PV array to grid.	20	3,4	3	7
2.(a)	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
2.(b)	A 2.5 MW, 6-pole Doubly Fed Induction Generator (DFIG) is connected to a 50 Hz grid. The wind turbine drives the generator at a speed of 920 rpm. The stator delivers 2 MW power to the grid. Calculate 1. Calculate the synchronous speed, slip, and rotor current frequency of the generator. 2. Identify the mode of operation (sub-synchronous or super-synchronous). Justify your answer. 3. Calculate the power handled by the rotor-side converter. Also state the direction of power flow in the rotor circuit.	10	3	2,3	02



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3.	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>6</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>100</td><td>1</td><td>2</td></tr></table> Consider following data 1. The refrigerator operates with a duty cycle of 0.5 2. Efficiency of battery : 90 % 3. Efficiency of Inverter : 95 % 4. Efficiency of charge controller and cables : 85 % 5. Safety factor of charge controller : 1.25 6. Surge factor of inverter : 2 7. 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	6	6	2	Ceiling Fan	75	3	8	3	TV	100	1	4	4	Refrigerator	180	1	24	5	Miscellaneous	100	1	2	20	2,5	4	03
Sr. No.	Load Name	Power on Load (W)	No. of Load	Operating Hrs																															
1	LED Light	9	6	6																															
2	Ceiling Fan	75	3	8																															
3	TV	100	1	4																															
4	Refrigerator	180	1	24																															
5	Miscellaneous	100	1	2																															
4.(a)	With the help of following points describe how a typical hydropower plant generates electricity. 1. Schematic diagram of hydro power plant 2. Role of the dam 3. Role of reservoir 4. Role of penstock 5. Role of turbine and generator.	10	1,2	2	05																														
4.(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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~~END-SEMESTER EXAMINATION MAY-2026~~ / RE - **EXAM JULY 2026**

5.(a)	With the help of neat diagram Explain the different types of tidal energy systems and their working principles.	10	1	1,2	06
5.(b)	How to calculate hosting capacity for the transmission and distribution system for connecting distributed renewable energy sources?	10	3	3	07
6.(a)	A hydroelectric power plant operates under a head of 120 m. The rate of water discharge is 90 m ³ /s. The overall efficiency of the turbine-generator system is 88%. 1. Calculate the power generated by the plant. 2. If the plant operates for 8 hours per day, determine the annual energy generated.	05	2,3	2,3	05
6.(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
6.(c)	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
7.(a)	A wind turbine has a rotor radius of 40 m and operates at a wind speed of 10 m/s. The air density is 1.225 kg/m ³ . The power coefficient $C_p = 0.42$ and thrust coefficient $C_T = 0.8$ 1. Calculate the actual power extracted by the turbine. 2. Determine the thrust force acting on the turbine. 3. If the rotor speed is 20 rpm, calculate the tip speed ratio (λ).	10	2,3	2,3	02
7.(b)	Explain the role of FRT in maintaining: 1. Grid stability 2. Power system reliability	10	2	2	04



Program: B. Tech Electrical

Duration: 3 Hrs

Course Code: PC-BTE603

Maximum Points: 100

Course Name: Control System II

Semester: VI

Note: Q1 is compulsory. Solve any four questions out of remaining six questions

Assume suitable data if required.

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Q. No	Questions	Poi nts	CO	BL	Module no
1	a> Discuss separation principle in a system with controller and observer b> For reduced order observer, derive the equivalence from full order observer. c> Define Lyapunove stability criteria. Explain direct method of finding Lyapunove stability. d> The system is represented by $\ddot{y} + 3\dot{y} + 2y = \dot{u} + 3u$. Considering all initial conditions zero, represent the system in Diagonal Canonical form	20	1,2	2-3	1-6
2 a	Consider a mass-spring-damper system where a force $F(t)$ is applied to a mass M , with a spring constant K and a damping coefficient B . Derive the state-space representation where the output is the position of the mass.	06	1	3	1
b	Realize the system with transfer function $T(s) = \frac{12s+10}{s^3+8s^2+12s+5}$ in controllable and observable canonical forms.	07	1	3	2
c	Realize the system with transfer function $T(s) = \frac{2s^2+6s+5}{(s+2)^3}$ in diagonal form	07	1	3	2
3 a	The state equation of LTI system is given by $\dot{x} = \begin{bmatrix} 0 & 1 & 0 \\ 0 & 0 & 1 \\ -6 & -11 & -6 \end{bmatrix} x + \begin{bmatrix} 0 \\ 0 \\ 1 \end{bmatrix} u$ with initial conditions	12	1	3	3



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End/~~Reexam~~ Semester AY2025-2026



	$x(0) = [1 \ 0 \ 0]^T$ and $y(t) = [1 \ 0 \ 0]x$ Determine $x_1(t), x_2(t), x_3(t)$ and $y(t)$ for unit step input.				
b	Derive an expression to find transfer function from state space model. Using the same and not otherwise find the transfer function of the system represented by $\dot{x} = \begin{bmatrix} -1 & 0 & 0 \\ 0 & -2 & 0 \\ 0 & 0 & -3 \end{bmatrix} x + \begin{bmatrix} 1 \\ 1 \\ 1 \end{bmatrix} u$ and $y = [1 \ 2 \ 1]x$	08	1	3	3
4 a	The state space model of system is given by $\begin{bmatrix} \dot{x}_1 \\ \dot{x}_2 \end{bmatrix} = \begin{bmatrix} -2 & 5 \\ 0 & -2 \end{bmatrix} \begin{bmatrix} x_1 \\ x_2 \end{bmatrix} + \begin{bmatrix} 0 \\ 1 \end{bmatrix} u$ Determine stability using 1. Eigen values 2. Lyapunov Stability Check stability with converse Lyapunov Approach	08	2	3	3
b	What is state controllability? Discuss and compare Kalman and Gilbertz tests to check controllability of the system. For the system $\dot{x} = \begin{bmatrix} -1 & 0 & 0 \\ 0 & -2 & 0 \\ 0 & 0 & -5 \end{bmatrix} x + \begin{bmatrix} 1 \\ 0 \\ 1 \end{bmatrix} u$ determine if the system is controllable or not using (i) Kalman Test (ii) Gilbertz test	12	2	3	4
5 a	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 control $u = -kx$. Find the state feedback gain matrix which places the closed loop poles at $s = -10$ and $s = -2 \pm j4$.	10	2	3	4,5



b	A system is given by $\dot{x} = \begin{bmatrix} 0 & 1 \\ -2 & -3 \end{bmatrix} x + \begin{bmatrix} 0 \\ 1 \end{bmatrix} u$ Design a state feedback controller $u = -Kx$ such that the closed-loop poles are located at $s = -2$ and $s = -2$ using Ackerman's formula.	10	2	3	4,5
6 a	The plant transfer is given by $T(s) = \frac{s + 4}{s^3 + 8s^2 + 17s + 10}$ Design full order observer to have 10 % OS and 0.1 sec settling time	10	2	3	4,6
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 x_1, x_2, x_3. The observer poles are at -3, -4, -5.	10	2	3	4,6
7 a	Explain various types of system non-linearity and their effect on system performance	06	3	2	7
b	What is phase plane analysis. Draw and explain phase portrait of mass spring system	07	3	3	7
c	Define isoclines. With an example, explain how isoclines can be used to get phase portrait	07	3	2	7