1. Decision taken by the JCTE Office on 09.05.2025 based on the complaints received from students of various Polytechnic Colleges in connection with the Diploma Examination April 2025 Question papers and recommendations of expert committee from different departments.

OUT OF SYLLABUS/ DEFECTIVE QUESTIONS – Guidelines for valuation

R.21	Fundaments of Electrical and Electronics Engineering (2031)	Part C Question No X	Within the syllabus
R.21	Fluid Mechanics & Heat Transfer (4111)	Part C. Question No. III	If attended the first part, proportional mark shall be awarded to the second part too.
		Part C. Question No. V(a)	If attended V (b), proportional mark shall be awarded to V (a).
		Part C. Question No. VII	This question is out of syllabus as recommended by the expert committee. Hence, following guidelines shall be used to calculate the mark of the students who had tried to attend the above specific questions. (a) Calculate the percentage of marks obtained by the student considering the total marks excluding the marks of out of syllabus question. (b) Then, the proportionate marks of out of syllabus question shall be calculated based on the above obtained percentage. (c) Marks obtained in the above cases shall be added to get actual marks admissible to the student.

CONTROLLER OF TECHNICAL EXAMINATIONS * TRIVANDRUM * Govt. Of Kerala Dept. Of Techl. Edn.

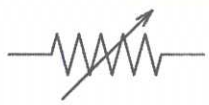
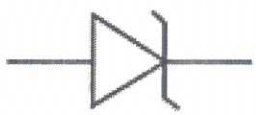
V.V.RAY
JOINT CONTROLLER

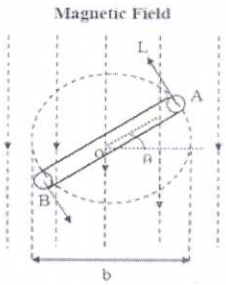
Joint Controller of Technical Examinations Thiruvananthapuram

Scoring Indicators

COURSE NAME : FUNDAMENTALS OF ELECTRICAL & ELECTRONICS ENGINEERING

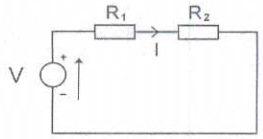
COURSE CODE : 2031 **QID:2106220064**

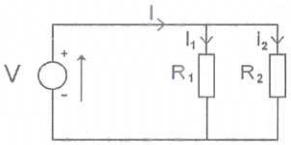
Q No	Scoring Indicators	Split score	Sub Total	Total Score
	PART A			9
I. 1	(a) Angular velocity - (B) Rad/S (b) Time period - (C) Sec (c) Frequency - (D) Hz (d) Impedance - (A) Ohm	1	1	
I.2	Volt	1	1	
I.3	$v = Vm \sin \omega t$	1	1	
I.4	Expanded form of MCB is **Miniature Circuit Breaker**	1	1	
I.5	**Active Power** = $\sqrt{3}VI \cos \phi$	1	1	
I.6		1	1	
I.7	The transformer turns ratio is the number of turns of the primary winding divided by the number of turns of the secondary coil.	1	1	
I.8	Symbol of Zener diode 	1	1	
I.9	***Any two*** Clipping circuits,clamping circuits,rectifier,Voltage multiplier etc.	0.5x2	1	

	PART B			24
II. 1	***Amplitude-1.5*** ***Angular frequency-1.5***	1.5x2	3	
	V= 25 Sin 628 t *Comparing with* v = Vm sin ωt Amplitude = 25 V Angular frequency=628 rad/s			
II. 2	***Definition-1x2*** ***Unit-0.5x2***	2+1	3	
(b) (a)	Resistance is the property of a substance due to which it opposes the flow of current through it.Unit- Ohm Current is the rate of flow of electric charge.Unit-Ampere			
II. 3	***Effective resistance of parallel combination-1*** ***Total effective resistance-2***	1+2	3	
	Effective resistance of parallel combination=4||4=2ohm Total effective resistance =3+2=5ohm			
II. 4	***Figure … 1 mark*** ***Explanation … 2 marks***	1+2	3	
	Consider a rectangular coil of N turns placed in a uniform magnetic field as shown in the figure  The coil is rotating in the anticlockwise direction at an uniform angular velocity of ω rad/sec			

	When the coil is in the vertical position, the flux linking the coil is zero because the plane of the coil is parallel to the direction of the magnetic field. Hence at this position, the emf induced in the coil is zero. When the coil moves by some angle in the anticlockwise direction, there is a rate of change of flux linking the coil and hence an emf is induced in the coil. When the coil reaches the horizontal position, the flux linking the coil is maximum, and hence the emf induced is also maximum. When the coil further moves in the anticlockwise direction, the emf induced in the coil reduces. Next when the coil comes to the vertical position, the emf induced becomes zero. After that the same cycle repeats and the emf is induced in the opposite direction. When the coil completes one complete revolution, one cycle of AC voltage is generated.			
II. 5	***Any three difference —3 x 1 marks each***	1 mark each	3	
	<table><tr><th>Fuse</th><th>MCB</th></tr><tr><td>Automatic protection</td><td>An either be automatic or manually operated</td></tr><tr><td>Works on the thermal and electrical properties of the conducting materials</td><td>Works on the switching principle and electromagnetism</td></tr><tr><td>Fuse needs replacement after a fault in circuit</td><td>Can be used many numbers of times</td></tr></table>			

II. 6	The first digit is 3, second digit is 3, third digit '3' is multiplier in picofarads. Capacitance = $33x10^3$pF=**33nF**	3	3	
II. 7	***Calculation… 3 marks***	1 mark each	3	
	Red- 2 Green- 5 Brown- 1 Gold -+/-5% Resistance =25x 10^1 ± 5 % Ohm			
II. 8	***Definition of Self inductance … 1.5 mark*** ***Definition of Mutual inductance … 1.5 marks***	1.5x2	3	
	Self inductance When a alternating current flows in a coil, the magnetic field linking the coil also changes. Therefore, according to Faraday's law of electromagnetic induction, an EMF known as *self-induced EMF* is induced. This property of the coil to oppose the change in current.is called self-inductance. Mathematically, self-induced EMF is given by, e =Ldi/dt where L is called as self inductance of the coil ***Mutual Inductance*** Mutual Inductance between the two coils is defined as the property of the coil due to which it opposes the change of current in the other coil or the neighbouring coil. Mathematically, the mutually induced EMF is given by, e_m=M di_1/dt where M is called mutual inductance			

<table>
<tr><td>II. 9</td><td>Definition of step up transformer - 1.5 marks
Definition of step down transformer - 1.5 marks</td><td>1.5 marks each</td><td>3</td><td></td></tr>
<tr><td></td><td>Step up transformer: A transformer that increases the voltage from primary to secondary (more secondary winding turns than primary winding turns) is called a step-up transformer.Transformation ratio >1
Step down transformer: A transformer that reduces the voltage from primary to secondary (more primary winding turns than secondary winding turns) is called a step-down transformer.Transformation ratio <1</td><td></td><td></td><td></td></tr>
<tr><td>II. 10</td><td><table><tr><th colspan="2">INPUT</th><th>OUTPUT</th></tr><tr><th>A</th><th>B</th><th>Y=A.B</th></tr><tr><td>0</td><td>0</td><td>0</td></tr><tr><td>0</td><td>1</td><td>0</td></tr><tr><td>1</td><td>0</td><td>0</td></tr><tr><td>1</td><td>1</td><td>1</td></tr></table></td><td></td><td>3</td><td></td></tr>
<tr><td></td><td>PART C</td><td></td><td></td><td>42</td></tr>
<tr><td>III</td><td>Circuit-1 Marks each
Derivation-2 Marks each
Final Equation-0.5 each</td><td>2+ 4+1</td><td>7</td><td></td></tr>
<tr><td></td><td>(a)Series:
 

$V = V_1 + V_2$
$V = IR_1 + IR_2 = I(R_1 + R_2)$
$V/I = R_{eff} = R_1 + R_2$
$R_{eff} = R_1 + R_2$</td><td>(b) Parallel:
 

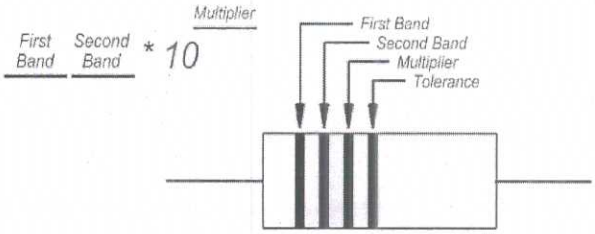
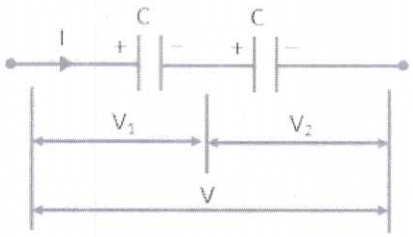
$I = I_1 + I_2$
$I = V/R_1 + V/R_2$
$V/I = R_{eff} = R_1R_2/(R_1 + R_2)$
$\frac{1}{R_{eff}} = \frac{1}{R_1} + \frac{1}{R_2}$</td><td></td><td></td></tr>
</table>

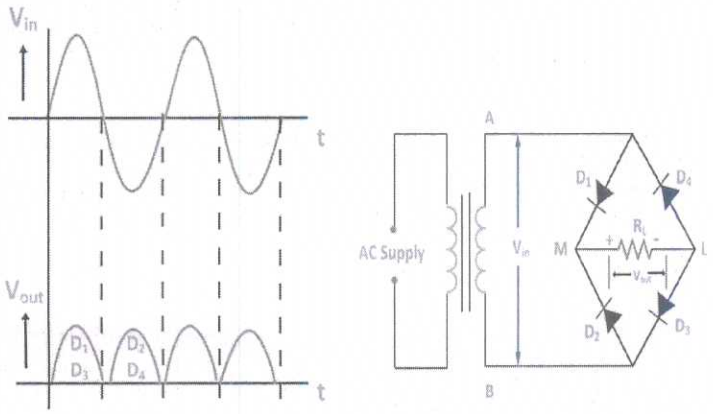
IV	***Faraday's Laws of Electromagnetic induction*** ***First Law --- 3 marks*** ***Second Law --- 3 marks*** ***Equation ---- 1 mark***	3+3+1	7	
	Faradays First Law: Whenever magnetic flux linking with a conductor changes an emf is induced in it. ***Faradays Second Law:*** The emf induced is directly proportional to rate of change of flux linkage. Flux linkage = flux * No of turns of the coil $e \alpha \frac{d(N\phi)}{dt}$ *Thus* $e = -N\frac{d\phi}{dt}$			
V	***Energy consumption … 4marks*** ***Monthly electricity bill … 3 marks***	4+3	7	
	(a) Energy consumption in kWh in one day $=\frac{40}{1000}$x10x5 + $\frac{60}{1000}$x5x10 + $\frac{1000}{1000}$x1x2 + $\frac{250}{1000}$x1x20 **=12 kWh** (b)Monthly electricity bill for the month of December =12x 2x31 = **Rs 744**			
VI	***Power factor=2 marks*** ***Active power =2.5 marks*** ***Reactive power=2.5 marks***	2+2.5+2.5	7	
	Φ=30° (a) Power factor = cos (30°) = **0.866lag** (b) Active power = VIcosΦ =100 x 10x 0.866=**866W** (c) Reactive power=VIsinΦ =100x10xsin(30)=**500W**			

VII	***Definition-2 Marks each*** ***Expansion of ELCB-1 Marks***	6+1	7	
	(a) **Energy meter**-The meter which is used for measuring the energy utilised by the electric load is known as the energy meter. The energy is the total power consumed and utilised by the load at a particular interval of time. (b) **ELCB**-Earth Leakage circuit Breaker.The main purpose of ELCB is to detect Earth leakages and prevent injury to human beings from electrical shocks and prevent electrical fires that are caused by short circuit (c) **Main switch**-The purpose of this switch is to control all the subcircuits provided in the building			
VIII	***Safety precautions while working with electricityAny 7 safety precautions … 7 x 1 marks = 7 marks***	1 mark each	7	
	1. Always use insulated tools while working. 2. Never touch or try repairing any electrical equipment or circuits with wet hands. 3. Never use equipment with frayed cords, damaged insulation or broken plugs. 4. Before working on live mains, first switch off the supply of electricity to them 5. If at all a person gets an electric shock, rescue him with the help of an insulator 6. Never use metallic pencils or rulers, or wear rings or metal watch bands when working with electrical equipment			

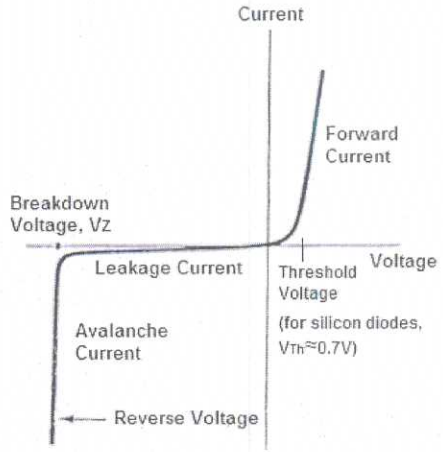
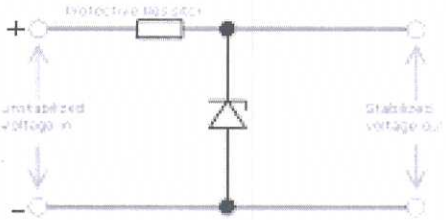
	7. Enclose all electric contacts and conductors so that no one can accidentally come into contact with them 8. Do not store highly flammable liquids near electrical equipment. 9. Do not wear loose clothing or ties near electrical equipment			
IX	***Colour coding of Resistance*** ***explanation with figure & table---- 7 marks***	3+4	7	

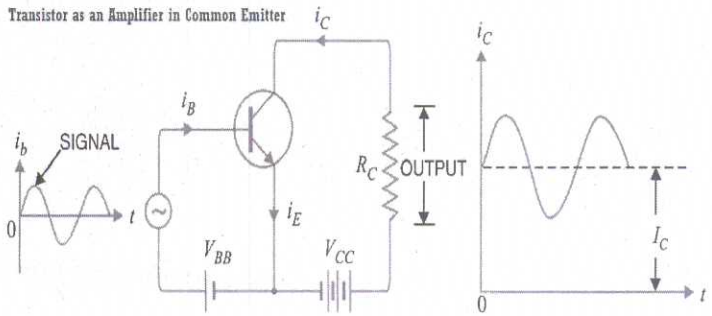
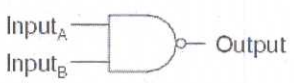
Colour	1st Band	2nd band	3rd band Multiplier	4th band Tolerance
Black	0	0	10^0	
Brown	1	1	10^1	
Red	2	2	10^2	
Orange	3	3	10^3	
Yellow	4	4	10^4	
Green	5	5	10^5	
Blue	6	6	10^6	
Violet	7	7	10^7	
Grey	8	8	10^8	
White	9	9	10^9	
Gold			10^{-1}	± 5 %
Silver			10^{-2}	± 10 %
None				± 20 %

	Color coding is used to identify the value of the resistor. The first two color bands represent the first two significant digits of the resistor value. The color of the third band represents a multiplier of 10^N, where N is the value represented by the color. The fourth band is always gold or silver, which indicates a tolerance of ±5% or ±10%. 			
X	***Circuit-2 Marks*** ***Derivation-4Marks*** ***Equation-1 Marks***	1+6	7	
	 Here Q is same $Q = C_{eff}V$ $V = V_1 + V_2 = \frac{Q}{C} + \frac{Q}{C} = \frac{2Q}{C}$ $Q = \frac{CV}{2}$ Comparing, $C_{eff} = \frac{C}{2}$			

XI	***Full Wave Bridge Rectifier circuit*** ***Circuit diagram ---- 2 marks*** ***Waveforms ---- 2 marks*** ***Operation ----- 3 marks***	2+ 3+2	7	
	 During the positive half cycle of the secondary voltage, the end A becomes positive, and end B becomes negative. The diodes D_1 and D_3 are forward biased and the diodes D_2 and D_4 are reverse biased. Therefore, diodes D_1 and D_3 conduct and diodes D_2 and D_4 do not conduct. The current flows through diode D_1, load resistor R_L (from M to L), diode D_3 and the transformer secondary. During the negative half cycle, the end A becomes negative and end B positive. The diodes D_2 and D_4 are forward biased and the diodes D_1 and D_3 are reverse biased. Therefore, diodes D_2 and D_4 conduct while diodes D_1 and D_3 do not. Thus, current thus flows through the diode D_2, load resistor R_L (from M to L), diode D_4 and the transformer secondary. The current flows through the load resistor RL in the same direction (M to L) during both the half cycles. Hence, a DC output voltage V_{out} is obtained across the load resistor.			

XII	***Operation .... 4 marks*** ***Figures ... 3 marks***	4+3	7	
	Operation: A Zener Diode, also known as a breakdown diode, is a heavily doped semiconductor device that is designed to operate in the reverse direction. When the voltage across the terminals of a Zener diode is reversed and the potential reaches the Zener Voltage (knee voltage), the junction breaks down and the current flows in the reverse direction. This effect is known as the Zener Effect A Zener diode operates just like a normal diode when it is forward-biased. However, when connected in reverse biased mode, a small leakage current flows through the diode. As the reverse voltage increases to the predetermined breakdown voltage (Vz), current starts flowing through the diode. The current increases to a maximum, which is determined by the series resistor, after which it stabilizes and remains constant over a wide range of applied voltage. There are two types of breakdowns for a Zener Diode: • Avalanche Breakdown • Zener Breakdown Forward Characteristics of Zener Diode It is almost identical to the forward characteristics of any other P-N junction diode. Reverse Characteristics of Zener Diode When a reverse voltage is applied to a Zener voltage, initially a small reverse saturation current Io flows across the diode. This current is due to thermally generated minority carriers. As the reverse voltage is increased, at a certain value of reverse voltage, the reverse current			

	increases drastically and sharply. This voltage is called breakdown voltage or Zener voltage and it is denoted by Vz.   			
XIII	***Sketches showing proper biasing …. 3 marks*** ***Explanation …. 4 marks***	3+4	7	
	Transistor can be used to increase the strength of the weak input signals without distorting the signal and hence used as amplifiers. For a transistor to work as an amplifier ,it should be operated in the active region. Common Emitter configuration is commonly used for amplification, due to high current, voltage and power gain. The circuit diagram is shown below: The weak input signal is applied between emitter and base junction while the output is taken across the load resistor R_C connected in series with collector supply voltage V_{CC}. For faithful amplification input circuits should be forward biased and have low resistance. Small			

	change in input voltage causes relatively large change in collector current ($I_C = \beta I_B$; β being large). The collector current flowing through a high load resistance R_C develops a large voltage across it. Thus it functions as an amplifier.  			
XIV	***Symbol of gate – 1.5 mark each (3 marks)*** ***Truth Table – 2 marks each (4 marks)***	3+4	7	
	NAND gate: *NAND gate*  XOR gate: *Exclusive-OR gate*  A | B | Output 0 | 0 | 1 0 | 1 | 1 1 | 0 | 1 1 | 1 | 0 A | B | Output 0 | 0 | 0 0 | 1 | 1 1 | 0 | 1 1 | 1 | 0			