Register Number:……..

B.E DEGREE EXAMINATIONS: NOV/DEC 2024

(Regulation 2018)

Third Semester

MECHATRONICS ENGINEERING

U18MCI3201: Electronics Devices and Circuits

COURSE OUTCOMES

CO1: Use passive elements and basic theorems to solve electric circuits.
CO2: Understand the basic principles of semiconductor devices.
CO3: Use diode to construct regulators, rectifiers, and other applications.
CO4: Analyze small signal amplifiers and oscillators constructed using transistors.
CO5: Apply op-amp to construct various applications.

Time: Three Hours **Maximum Marks: 100**

Answer all the Questions:-

PART A (10 x 2 = 20 Marks)

(Answer not more than 40 words)

1.	State Kirchhoff's current law (KCL).	CO1	[K_2]
2.	Define the concept of maximum power transfer theorem.	CO1	[K_2]
3.	What is a PN junction? Discuss its properties.	CO2	[K_2]
4.	Explain the difference between forward bias and reverse bias of a diode.	CO2	[K_2]
5.	What is a half-wave rectifier?	CO3	[K_2]
6.	Differentiate between series and shunt voltage regulators.	CO3	[K_2]
7.	State Barkhausen's stability criterion.	CO4	[K_2]
8.	State the principle of a differential amplifier.	CO4	[K_2]
9.	Describe the operation of an inverting op-amp.	CO5	[K_2]
10.	What is a comparator in an operational amplifier?	CO5	[K_2]

Answer any FIVE Questions:-

PART B (5 x 16 = 80 Marks)

(Answer not more than 400 words)

11. You are tasked with designing a power supply for an electronic device that operates on 12V DC. The input available is 230V AC. You need to design a power supply circuit that includes a rectifier, filter, and voltage regulator. The load requires a current of 1.5A. Assume that a full-wave rectifier is used.

	a)	Calculate the value of the transformer secondary voltage and current.	7	CO1	[K_3]
	b)	Design a full-wave rectifier circuit and explain how the components work together to convert AC to DC.	7	CO3	[K_3]
	c)	Explain the function of a filter and voltage regulator in the circuit.	2	CO3	[K_2]
12.		You are designing an amplifier for a communication system that requires an output of 10W with an input signal of 0.1V peak. The frequency of operation is 1 kHz. The amplifier must have a voltage gain of 100 and operate efficiently within this frequency range.			
	a)	Explain how you would design a common-emitter amplifier to meet the voltage gain requirements.	7	CO4	[K_3]
	b)	Analyze the stability and bandwidth of the amplifier. How would you ensure that the signal is amplified without distortion?	7	CO4	[K_3]
	c)	Describe the role of feedback in improving the performance of the amplifier.	2	CO2	[K_2]
13.	a)	Derive the h-parameter model for a low-frequency small-signal amplifier using a common-emitter configuration.	7	CO3	[K_3]
	b)	Discuss the effect of cascading amplifiers on the overall gain and bandwidth of the system.	7	CO3	[K_3]
	c)	How does temperature affect the performance of a small-signal amplifier?	2	CO2	[K_2]
14.	a)	Explain the operation of a Hartley oscillator. Provide the necessary design equations.	7	CO4	[K_3]
	b)	Compare the Colpitts oscillator and Hartley oscillator in terms of their design and application.	7	CO4	[K_3]
	c)	Why is it important for an oscillator circuit to meet the Barkhausen stability criterion?	2	CO4	[K_2]
15.	a)	Design a Zener diode-based voltage regulator for a 5V output with a current rating of 100mA.	7	CO3	[K_3]
	b)	Explain the working of a clipper circuit using diodes to limit the voltage of a signal.	7	CO5	[K_3]

c)	What is the significance of a clamping circuit in signal processing?	2	CO5	[K_2]

16.	a)	Explain the working of a Schmitt trigger circuit using an operational amplifier.	7	CO5	[K_3]
	b)	How is an astable multivibrator designed using op-amps? Explain with a circuit diagram.	7	CO5	[K_3]
	c)	What is the role of an integrator circuit in signal conditioning?	2	CO5	[K_2]

COURSE OUTCOME	**CO1**	**CO2**	**CO3**	**CO4**	**CO5**
Marks (%)	17	23	23	20	17
COGNITIVE LEVEL	**Remember (K1)**	**Understand (K2)**	**Apply (K3)**	**Analyse (K4)**	**Evaluate (K5)**
Marks (%)	0	28	72	0	0

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