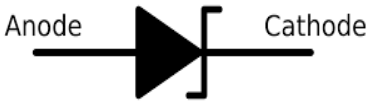
WINTER-19 EXAMINATION

Subject Name: Elements of Electronics engineering **Subject Code:** 22213

Model Answer

Important Instructions to examiners:

1) The answers should be examined by key words and not as word-to-word as given in themodel answer scheme.
2) The model answer and the answer written by candidate may vary but the examiner may tryto assess the understanding level of the candidate.
3) The language errors such as grammatical, spelling errors should not be given moreImportance (Not applicable for subject English and Communication Skills.
4) While assessing figures, examiner may give credit for principal components indicated in thefigure. The figures drawn by candidate and model answer may vary. The examiner may give credit for anyequivalent figure drawn.
5) Credits may be given step wise for numerical problems. In some cases, the assumed constantvalues may vary and there may be some difference in the candidate's answers and model answer.
6) In case of some questions credit may be given by judgement on part of examiner of relevant answer based on candidate's understanding.
7) For programming language papers, credit may be given to any other program based on equivalent concept.

Q. No.	Sub Q. N.	Answers	Marking Scheme
1	(A)	**Attempt any FIVE of the following:**	**10- Total Marks**
	(a)	**Draw symbols of zener diode and LED.**	**2M**
	Ans:	**Symbol of zener diode :**  **Symbol of LED :** 	**1 mark each**
	(b)	**List the types of filters.**	**2M**
	Ans:	**Types of filter are as follows:** **1. Shunt Capacitor filter (C filter)**	**½ M each**

		2. Series Inductor filter (L filter) 3. LC filter 4. π filter (CLC filter)	
	(c)	**Draw symbol of NPN and PNP transistors.**	**2M**
	Ans:		**1 M each**
	(d)	**Define the term line regulation and load regulation.**	**2M**
	Ans:	**Line Regulation :** Line regulation is the ability of a power supply to maintain a constant output voltage irrespective of any changes in input voltage. **Load Regulation :** Load regulation is the ability of a power supply to maintain a constant output voltage irrespective of any changes in load current. $$Load\ regulation = \left(\frac{V_{NL} - V_{FL}}{V_{FL}} \right) \times 100\%$$ **(Formula is optional)**	**1 M each**
	e)	**Suggest the diode material suitable to rectify 0.5V AC signal.**	**2M**
	Ans:	The diode material suitable to rectify 0.5V AC signal is **silicon.**	**2M**
	f)	**Draw circuit of zener diode as a voltage regulator.**	**2M**

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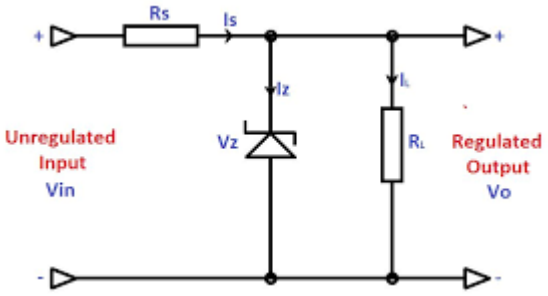
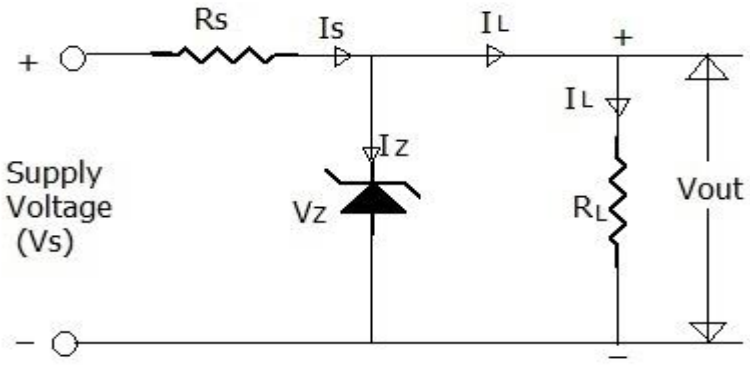
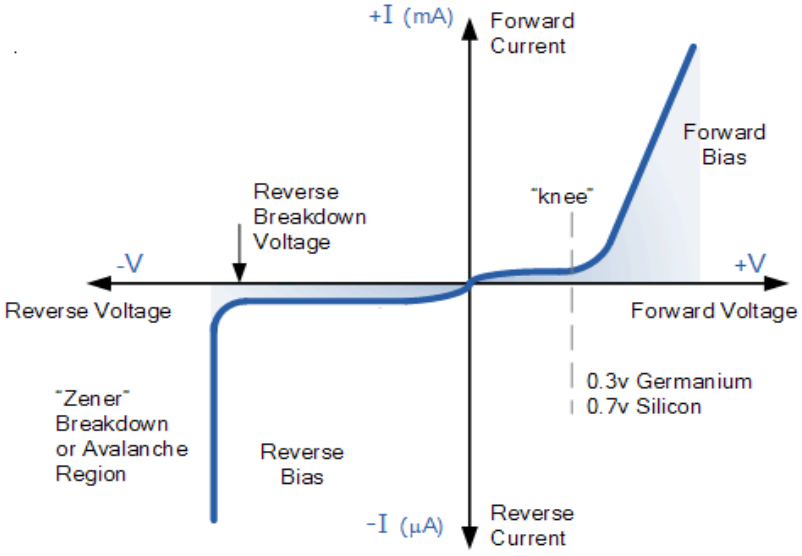
	Ans:	**Circuit Diagram:**  **OR**  Zener diode Voltage Regulator	**2M**
	g)	**Draw truth table for logic gates represented by following IC's.** **(i) IC 7400** **(ii) IC 7402**	**2M**
	Ans:	**i) IC 7400 - NAND gate** **ii) IC 7402 - NOR gate**	**½ M identify each IC ½ M Truth table**

Inputs		Output
A	B	$Y=\overline{A.B}$
0	0	1
0	1	1
1	0	1
1	1	0

Inputs		Output
A	B	$Y=\overline{A+B}$
0	0	1
0	1	0
1	0	0
1	1	0

Q. No.	Sub Q. N.	Answers	Marking Scheme
2		**Attempt any THREE of the following:**	**12- Total Marks**
	a)	**Draw and explain V-I characteristics of PN junction diode.**	**4M**
	Ans:	V-I characteristics of PN junction diode:  	**2M Charact eristics**

		Explanation: Forward Bias: • If the external voltage applied on the silicon diode is less than 0.7 volts, the silicon diode allows only a small negligible electric current. • When the external voltage applied on the silicon diode reaches 0.7 volts, the p-n junction diode starts allowing large electric current through it. • At this point, a small increase in voltage increases the electric current rapidly. • The forward voltage at which the silicon diode starts allowing large electric current is called cut-in voltage. • The cut-in voltage for silicon diode is approximately 0.7 volts. Reverse Bias: • Due to thermal energy in crystal minority carriers are produced. • These minority carriers are the electrons and holes pushed towards P-N junction by the negative terminal and positive terminal, respectively. • Due to the movement of minority carriers, a very little current flows, which is in nano Ampere range (for silicon). This current is called as reverse saturation current. • When the reverse voltage is increased beyond the limit and the reverse current increases drastically is called as reverse breakdown voltage. • Diode breakdown occurs by two mechanisms: Avalanche breakdown and Zener breakdown.	**1M** **1M**
	b)	**Explain shunt capacitor filter with the help of circuit diagram and waveform.**	**4M**

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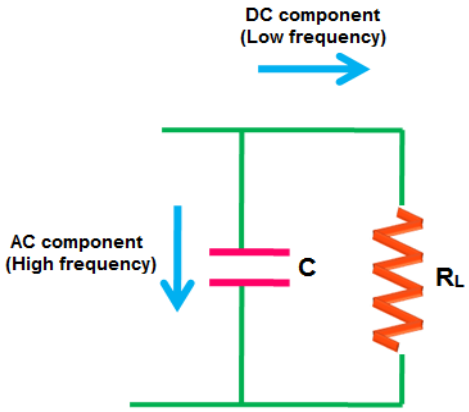
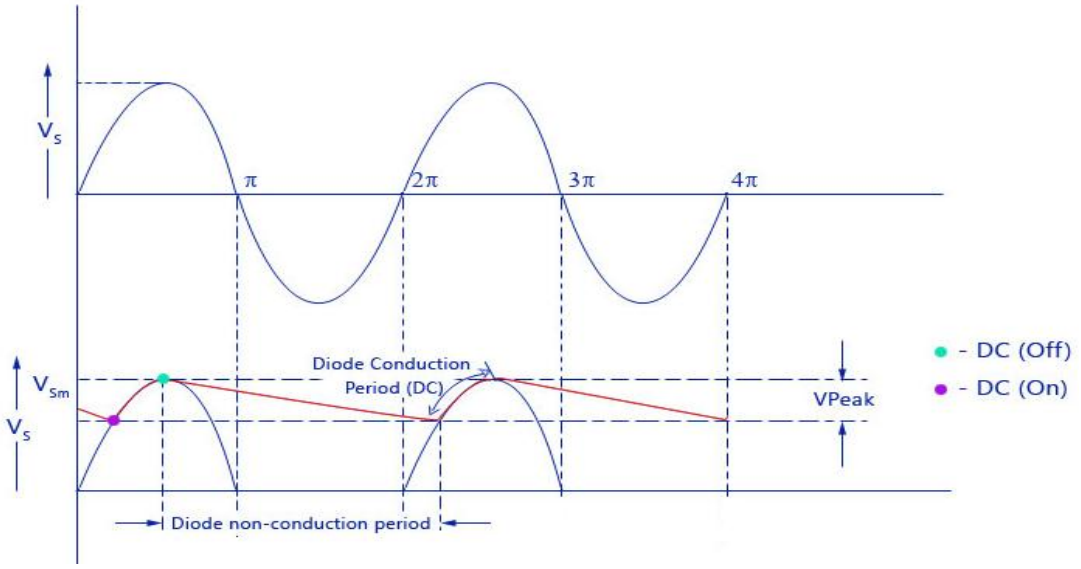
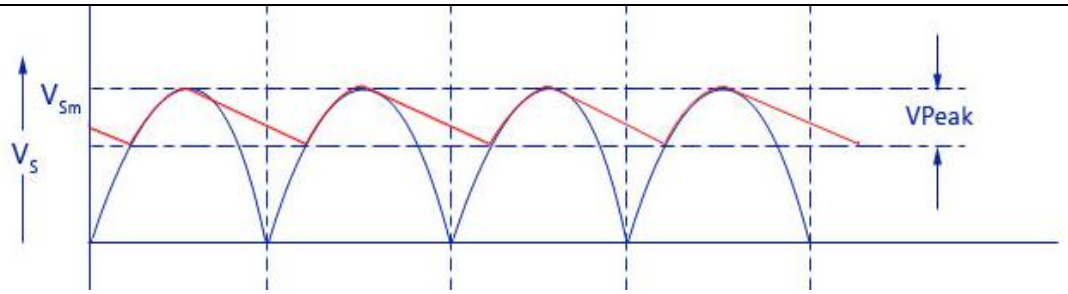
	Ans:	**Circuit Diagram:**  **Waveforms:**  **Half wave Rectifier with shunt capacitor**	**Diagram -1Mark** **Any waveform-1 Mark (either half wave or full wave)** **Explanation-2mark**



Full wave Rectifier with shunt capacitor

Note: Consider any one Waveform = half wave or Full wave rectifier with shunt capacitor

Explanation:

- The pulsating DC produced by the rectifier contains both AC and DC components.
- The capacitor allows the AC components and blocks the DC components of the current.
- When the DC current that contains both DC components and AC components reaches the filter, the DC components experience a high resistance from the capacitor whereas the AC components experience a low resistance from the capacitor.
- Electric current always prefers to flow through a low resistance path. So the AC components will flow through the capacitor whereas the DC components are blocked by the capacitor. Therefore, they find an alternate path and reach the output load resistor RL.
- Thus, the filter converts the pulsating DC into pure DC.

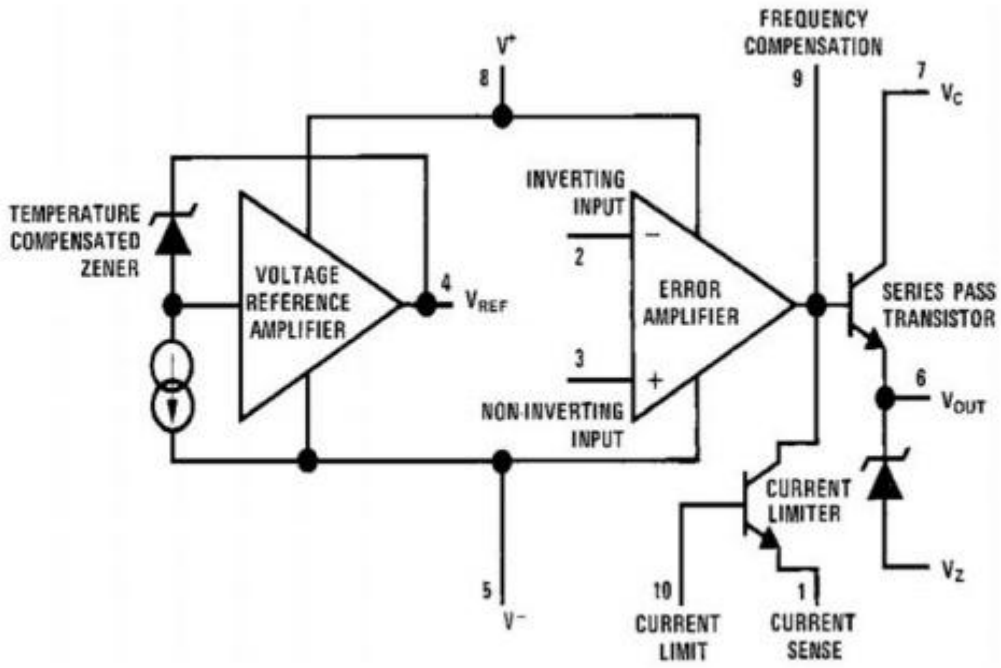
c) **Compare CB, CE, CC configuration of BJT with respect to following points:** **4M**

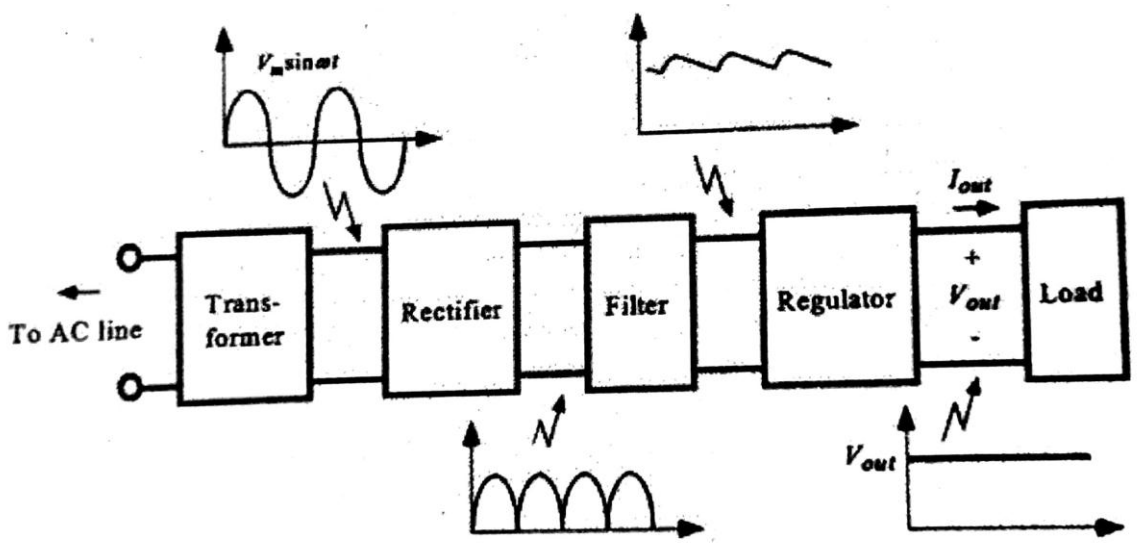
(i) Input impedance
(ii) Output impedance
(iii) Current gain
(iv) Voltage gain

Ans: **1M each point**

Parameter	CB	CE	CC
Input impedance	Very Low(less than 100 ohm)	Low(less than 1K)	Very High(750K)

		Output impedance	**Very High**	**High**	**Low**
		Current gain	**Less than 1**	**High**	**Very high**
		Voltage gain	**Greater than CC but less than CE**	**Highest**	**Lowest(less than 1)**

d)	**Draw the functional block diagram of IC 723. State any two features of IC 723.**	**4M**
Ans:	**Functional block diagram of IC 723:** 	**2M**
	Features of IC 723: (Any two points) • Unregulated dc supply voltage at the input between 9.5V & 40V • Adjustable regulated output voltage between 2 to 3V. • Maximum load current of 150 mA (ILmax = 150mA). • With the additional transistor used, ILmax upto 10A is obtainable. • Positive or Negative supply operation • Internal Power dissipation of 800mW.	**2M**

		• Built in short circuit protection. • Very low temperature drift. • High ripple rejection.	
Q. No.	Sub Q. N.	Answers	Marking Scheme
3		**Attempt any THREE of the following :**	**12- Total Marks**
	a)	**Draw block diagram of DC regulated power supply and explain function of each block with waveform.**	**4M**
	Ans:	**Block diagram of DC regulated power supply** 	**2marks for Block diagram**

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		Function of each block: **1. Step Down Transformer:** A step down transformer will step down the voltage from the ac mains to the required voltage level. The turn's ratio of the transformer is so adjusted such as to obtain the required voltage value. The output of the transformer is given as an input to the rectifier circuit. **2. Rectifier** Rectifier is an electronic circuit consisting of diodes which carries out the rectification process. Rectification is the process of converting an alternating voltage or current into corresponding direct (dc) quantity. Examples of rectifiers: full wave rectifier or a bridge rectifier **3. DC Filter:** The rectified voltage from the rectifier is a pulsating dc voltage having very high ripple content. To remove the ripple content and to get a pure ripple free dc waveform. Hence a filter is used. Different types of filters are: capacitor filter, LC filter, Choke input filter, π type filter. **4. Regulator:** This is the last block in a regulated DC power supply. The output voltage or current will change or fluctuate when there is change in the input from ac mains or due to change in load current at the output of the regulated power supply or due to other factors like temperature changes. This problem can be eliminated by using a regulator. A regulator will maintain the output constant even when changes at the input or any other changes occur.	**2marks for Explanation**
	b)	**State and explain Barkhausen's criteria required for oscillations.**	**4M**
	Ans:	**Barkhausen's criteria :** An amplifier will work as an oscillator if and only if it satisfies a set of conditions called Barkhausen's criterion. It states that: • An oscillator will operate at that frequency for which the total phase shift around loop equals to 0◦ or 360◦. • At the oscillator frequency, the magnitude of the product of open loop gain of the amplifier A and the feedback factor β is equal or greater than unity. ie. $A\beta \geq 1$	**2marks for Statement** **2marks for Explanation**

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	c)	**State need of biasing of BJT. List types of biasing.**	**4M**
	Ans:	**Need of biasing :** The basic need of transistor biasing is to keep the base – emitter (BE) junction properly forward biased and the collector – emitter (CE) junction properly reverse biased during the application of AC signal. This type of transistor biasing is necessary for normal and proper operation of transistor to be used for amplification. **Types of biasing** 1. Fixed bias. 2. Collector-to-base bias. 3. Fixed bias with emitter resistor. 4. Voltage divider bias or potential divider. 5. Emitter bias.	**2marks for need of biasing** **2marks for Types of biasing**
	d)	**A half wave rectifier is used to supply 50V DC to a resistive load of 1KΩ. The diode has a resistance of 10Ω. Calculate required input AC voltage.**	**4M**

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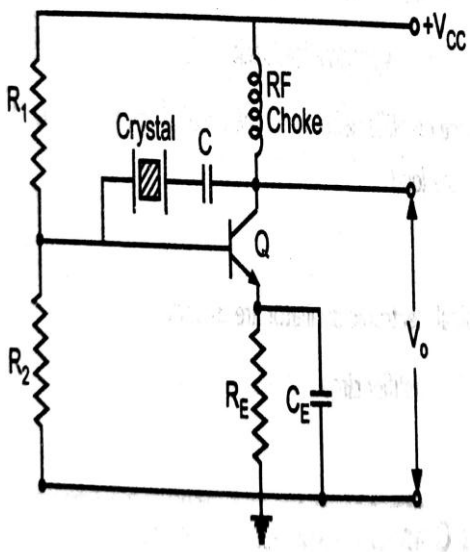
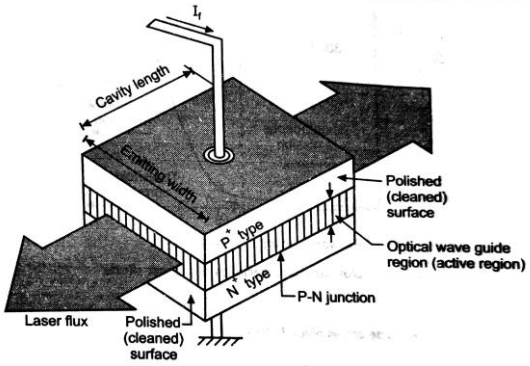
	Ans:	3d Sol $V_{dc} = 50V$, $R_L = 1K\Omega$, $R_f = 10\Omega$ find $V_{in} = ?$ The average value of load current $I_{dc} = \frac{V_{dc}}{R_L} = \frac{50}{1000} = 0.05A$ and maximum value of the load current $I_m = \pi \times I_{dc} = \pi \times 0.05$ $= 0.157 A$ ∴ Required Input AC voltage is $V_{in} = I_m \times (R_f + R_L)$ $= 0.157 \times (10 + 1000)$ $V_{in} = 158.57 V$	**2marks for Im** **2marks for V_{in}**

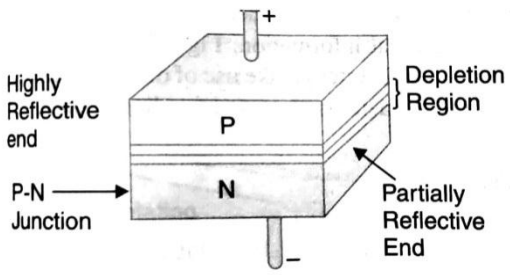
Q. No.	Sub Q. N.	Answers	Marking Scheme
4		**Attempt any THREE of the following :**	**12- Total Marks**
	(a)	**Draw the circuit diagram of crystal oscillator and give the basic principle of piezoelectric crystal.**	**4M**
	Ans:	**circuit diagram of crystal oscillator:**	**2marks for circuit diagram**

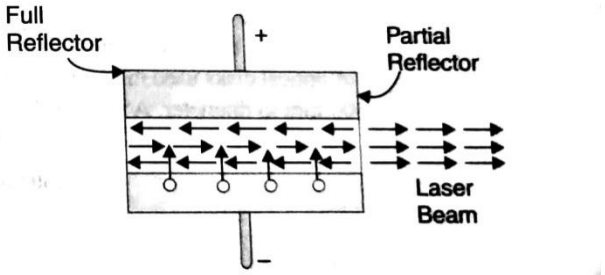
		 **Piezoelectric principle** : Crystal exhibits a property called as piezo-electric property, which states that: When the crystal is placed across an ac source, it starts vibrating. The amount of vibration depends upon the frequency of the applied voltage (By changing the frequency , we can find a frequency at which the crystal vibrations reach its maximum value & this frequency called as resonant frequency = $\frac{1}{2\Pi\sqrt{LC}}$ Also if mechanical force is applied to crystal then it generates electric potential.	**2marks for principle**
	(b)	**Compare half wave rectifier and full wave rectifier with respect to:** **(i) PIV** **(ii) Ripple frequency** **(iii) TUF** **(iv) Efficiency**	**4M**
	Ans:	**Ans:(Note: Bridge rectifier also can be considered)**	**1mark for Each point**

		S. N.	Parameter	Half Wave Rectifier	Full Wave Rectifier(center tap)
		1	PIV	Vm	2Vm
		2	Ripple frequency	f_{in}	$2f_{in}$
		3	TUF	0.287	0.693
		4	Efficiency	40.6%	81.2%
	(c)	**In a common base configuration, current amplification factor is 0.8. If current is 2mA, determine the value of base current.**			**4M**
	Ans:	4C Sol $\alpha = 0.8$, $I_E = 2mA$ Find $I_B = ?$ $\because I_C = \alpha I_E$ $= 0.8 \times 2mA = 1.6mA$ $\therefore I_B = I_E - I_C = 2 - 1.6$ $= 0.4mA$ $\therefore I_B = 0.4mA$			**2 marks for Ic** **2 marks for I_B**
	(d)	**Describe the operating principle of LASER diode with constructional diagram.**			**4M**
	Ans:	**constructional diagram of LASER diode:**			**2marks for any relevant diagram**



(OR)





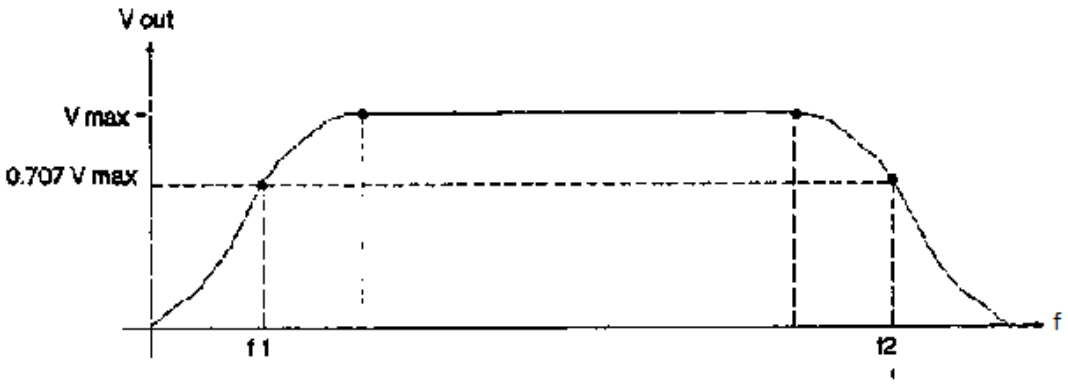
2marks for operating principle

Operating principle of LASER diode :

When the P-N junction is forward-biased by an external voltage source, electrons move across the junction and usual recombination occurs in the depletion region which results in the production of photons. As forward current is increased, more photons are produced which drift at random in the depletion region. Some of these photons strike the reflective surface perpendicularly. These reflected photons move back and forth between the two reflective surfaces. The photon activity becomes so intense that at some point, a strong beam of laser light comes out of the partially reflective surface of the diode.

	(e)	**List out advantages and disadvantages of bridge rectifier.**	**4M**
	Ans:	**Advantages :** 1. Bridge rectifier can be used in applications allowing floating output terminals i.e. not output terminal is grounded. 2. The need of center-tapped transformer is eliminated.	**2 Marks for any 2 advantages**

		3. If stepping up or stepping down of AC voltage is not needed, then it does not even require any transformer. 4. Transformer needed is less costly as it is required to provide only half the voltage of an equivalent centre tapped transformer used in a full wave rectifier circuit. 5. The output is twice that of centre tapped circuit for the same secondary voltage 6. Transformer utilization factor, in case of a bridge rectifier, is higher than that of a centre-tap rectifier. **Disadvantages :** 1. It requires four semi conductor diodes 2. Two diodes in series conduct at a time on alternate half cycles. This creates a problem when low DC voltages are required. This leads to poor regulation. 3. The value of the diodes used should be precise , else there will be an error in rectification. **Note: Any relevant points to be considered**	**2 Marks for any 2 disadvantages**

Q. No.	Sub Q. N.	Answers	Marking Scheme
5.		**Attempt any TWO of the following:**	**12- Total Marks**
	a)	**Draw frequency response of two stage RC coupled amplifier. Write procedure to calculate bandwidth and state any two methods to improve bandwidth.**	**6M**
	Ans:		**frequency response-1 mark** **procedure to calculate**

		1. Find the Frequency points i.e. f_1 and f_2 relate to the lower corner or cut-off frequency and the upper corner or cut-off frequency points respectively were the circuits gain falls off at high and low frequencies. 2. These points on a frequency response curve are known commonly as the -3dB (decibel) points. 3. The bandwidth is given as: Bandwidth=f2-f1 **Bandwidth improved by-** 1. By using Negative feedback 2. By Modifying Input and Output Impedance	**bandwidth-2 marks Bandwidth improved-1 mark**
	b)	**State the need of regulator. Draw the circuit diagram of DC regulated dual power supply for ± 12 V using IC 78XX and IC 79XX.**	**6M**
	Ans:	**Need of regulator-** The purpose of a voltage **regulator** is to keep the voltage in a circuit relatively close to a desired value. There are considerable variations in a.c. line voltage caused by outside factors. This changes the d.c. output voltage and may damage the electronic circuits and appliances. This necessitates to use regulator. The internal resistance of ordinary power supply is relatively large (>3Ω). Therefore, output voltage is affected by the amount of load current drawn from the supply. These variation in d.c. voltage may cause deviation in operation of electronic circuits. Therefore, voltage regulator is the only solution in such situations.	**Need-2M**

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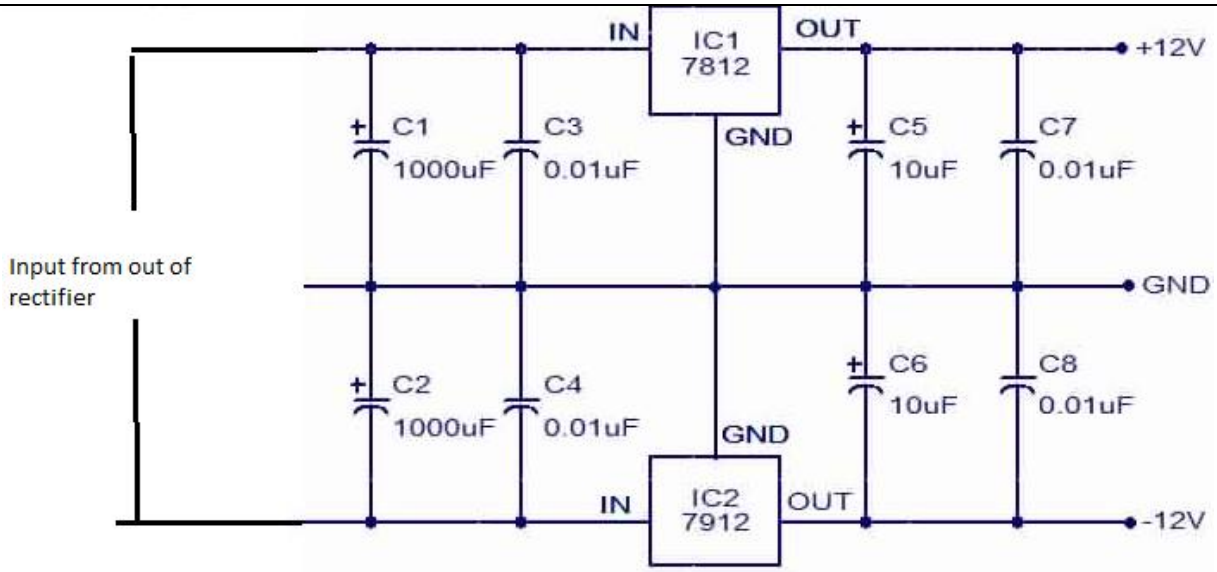
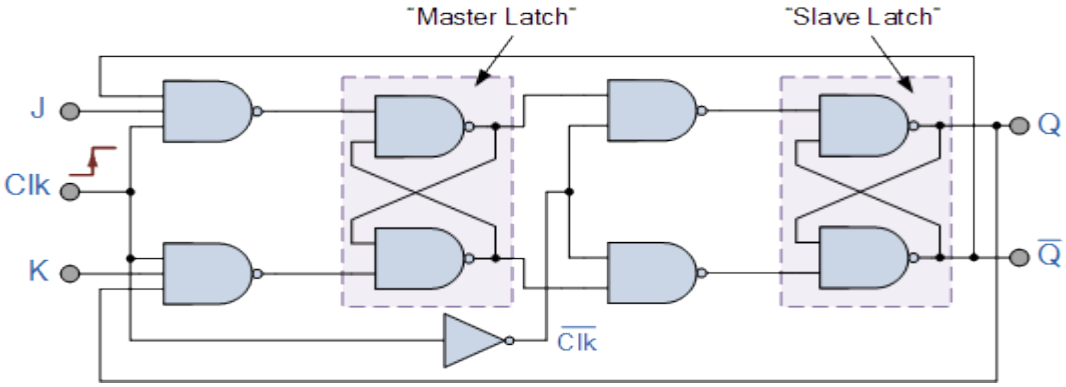
			**Diagram -4M**
	c)	**State the race around condition. Draw the circuit diagram of master slave JK flip flop using NAND gates and explain its operation.**	**6M**
	Ans:	In JK flip flop as long as clock is high for the input conditions J&K equals to the output changes or complements its output from 1–>0 and 0–>1. This is called toggling output or uncontrolled changing or racing condition. Circuit Diagram-  The Master-Slave Flip-Flop is basically a combination of two JK flip-flops connected together in a series configuration. Out of these, one acts as the **"master"** and the other as a **"slave"**. The output from the master flip flop is connected to the two inputs of the slave flip flop whose output is fed back to inputs of the master flip flop.	**State- 2M** **Diagram -2M**

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		In addition to these two flip-flops, the circuit also includes an **inverter**. The inverter is connected to clock pulse in such a way that the inverted clock pulse is given to the slave flip-flop. In other words if CLK=0 for a master flip-flop, then CLK=1 for a slave flip-flop and if CP=1 for master flip flop then it becomes 0 for slave flip flop. 1. When the clock pulse goes to 1, the slave is isolated; J and K inputs may affect the state of the system. The slave flip-flop is isolated until the CLK goes to 0. When the CLK goes back to 0, information is passed from the master flip-flop to the slave and output is obtained. 2. If J=0 and K=1, the output Q reset 3. If J=1 and K=0, the output Q set 4. If J=1 and K=1, it toggles on the positive transition of the clock and thus the slave toggles on the negative transition of the clock. 5. If J=0 and K=0, the flip flop is disabled and Q remains unchanged.	**Operation-2M**
Q. No.	Sub Q. N.	Answers	Marking Scheme
6.		**Attempt any TWO of the following :**	**12- Total Marks**
	a)	**List two applications of oscillator. Calculate the frequency of oscillation for RC phase shift oscillator for the component values R=8.2KΩ, C =0.01µF, R_1=1.2KΩ, R_F= 39KΩ.**	**6M**

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	Ans:	**Applications of oscillator:** 1. In radio and television receivers 2. Used in computers, metal detectors, stun guns, inverters, ultrasonic and radio frequency applications. 3. Used to generate clock pulses for microprocessors and micro-controllers 4. Quartz watches (which uses a crystal oscillator) **5.** Used in various audio systems and video systems **Given** **R=8.2KΩ, C =0.01µF, R_1=1.2KΩ, R_F= 39KΩ** $$f = \frac{1}{2\pi RC\sqrt{6}}$$ $$f = \frac{1}{2\pi * 8.2 * 10^3 * 0.01 * 10^{-6} * \sqrt{6}}$$ $$f = \frac{1}{0.515 * 10^{-3} * \sqrt{6}}$$ $$f = \frac{1}{1.26 * 10^{-3}}$$ $$f = 793.65HZ$$	**Application-3M** **3M**
	b)	**Define transistor. Explain how transistor works as a switch with input and output waveforms.**	**6M**
	Ans:	Definition of transistor: A semiconductor device with three connections, capable of amplification in addition to rectification.	**1M**

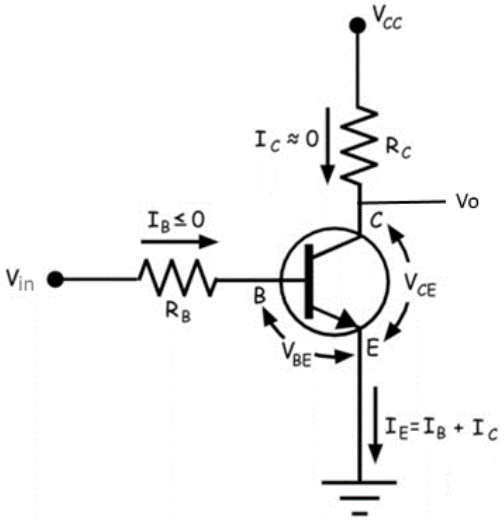


Diagram -2M

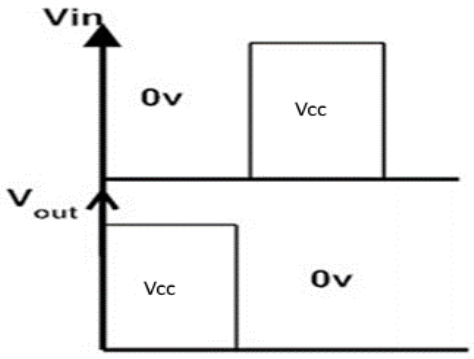
Working -2M

Working: Control input Vin is given to base through a current limiting resistor R_B and Rc is the collector resistor which limits the current through the transistor .When a sufficient voltage V is given to input, transistor becomes ON & it goes into saturation. During this condition the Collector Emitter voltage V_{CE} will be approximately equal to zero, ie the transistor acts as a short circuit & Vo = 0.

When input voltage V=0, transistor becomes OFF & it goes into cutoff. The transistor acts as an open circuit. During this condition the Collector Emitter voltage V_{CE}=Vcc. Therefore Vo = Vcc.

Waveform-1M

Waveform:



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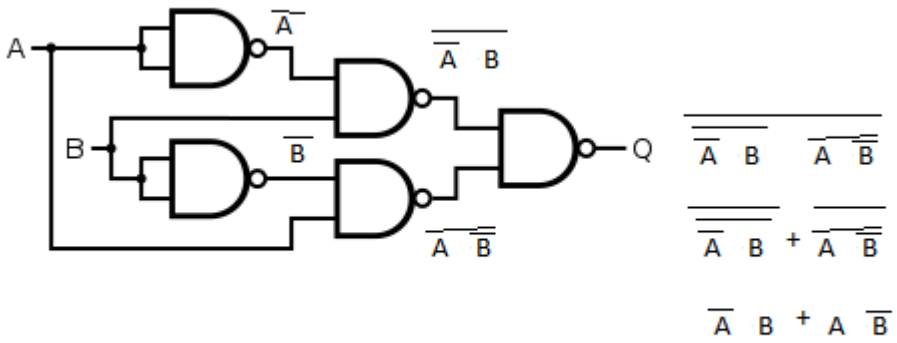
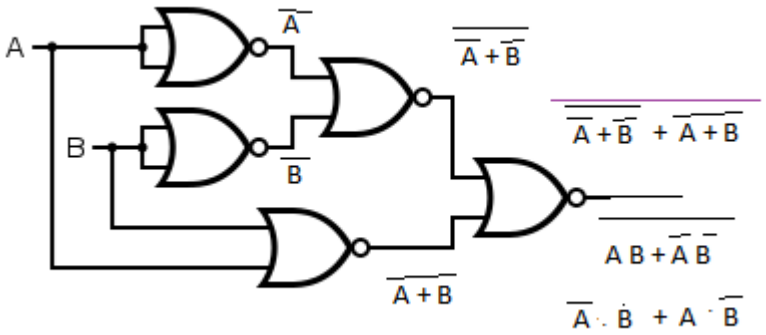
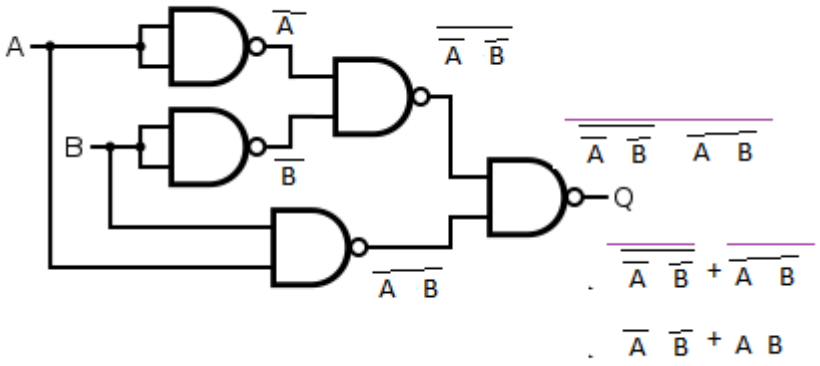
	c)	**Draw implementation of EX-OR and EX-NOR logic gate using NAND and NOR gate.**	**6M**
	Ans:	EX-OR gate using NAND:  EX-OR gate using NOR:  EX-NOR gate using NAND:	**1.5M each**

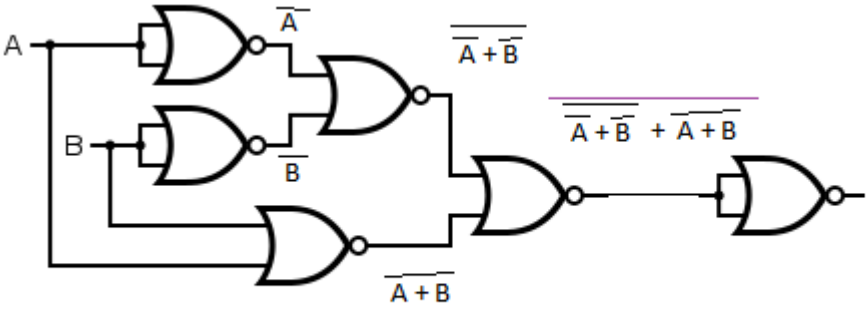


$\overline{\overline{A}\ \overline{B}}\ \ \overline{A\ B}$

$\overline{\overline{A}\ \overline{B}} + \overline{A\ B}$

$\overline{A}\ \overline{B} + A\ B$

EX-NOR gate using NOR:



$\overline{A+B}\ + \overline{A+B}$

$\overline{\overline{A+B}\ + \overline{A+B}}$

$\overline{\overline{A+B}\ + \overline{A+B}}$

$A\,B + \overline{A}\,\overline{B}$