(3 Hours) [Total Marks: 80]

N.B.: (1) Question No. 1 is compulsory.
(2) Solve any three questions from the remaining five.
(3) Figures to the right indicate full marks.
(4) Assume suitable data if necessary and mention the same in answer sheet.

Q.1 **Attempt any 4 questions:** [20]
(A) Give any five features of IC 555.
(B) How does precision rectifier differ from conventional rectifier?
(C) In a Fig. 1(C) using multiplier IC AD534, show that the output voltage is
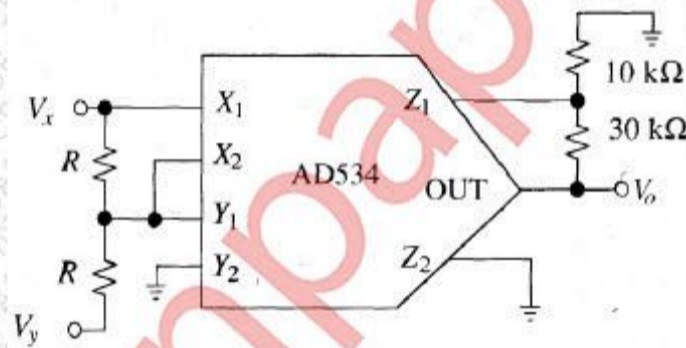
$$Vo = \frac{(V_x^2 - V_y^2)}{10}.$$

Fig. 1(C)

(D) Draw a neat circuit diagram and input-output waveforms of an inverting Schmitt trigger. Give the expressions for its threshold levels.
(E) If the input to the ideal comparator shown in the Fig. 1(E) is a sinusoidal signal of 8 volt peak to peak without any DC component, then check whether the duty cycle of the output of comparator is 33.33% or 25% or 20%. Prove it.
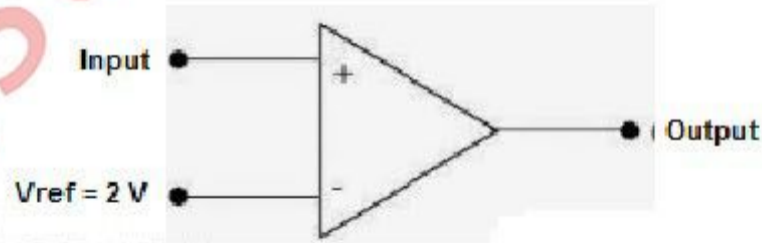

Fig. 1(E)

Q.2 (A) With the help of a neat circuit diagram explain any one application of PLL 565. [10]
(B) Design a square wave generator using IC 555 for an output frequency of 5 [10]
kHz and an adjustable duty cycle of 70% to 90%.

Q.3 (A) Draw a neat circuit diagram of a Wein bridge oscillator using op-amp. Derive its [10]
frequency of oscillation. What are the values of R and C for frequency of
oscillation to be 10 kHz?
(B) Draw a neat circuit of voltage to current converter with floating load and derive [10]
the expression for its output current.

Q.4 (A) Design a Second order Butterworth non-inverting high pass filter to provide a cut-off frequency of 5 KHz and pass band gain of AF=2. **[10]**

(B) Design a counter for counting a sequence 5, 6, 7, 8…15, 5... using MSI 74163 IC. The pin terminology and functionality of MSI 74163 is given in Fig. 4(B). **[10]**

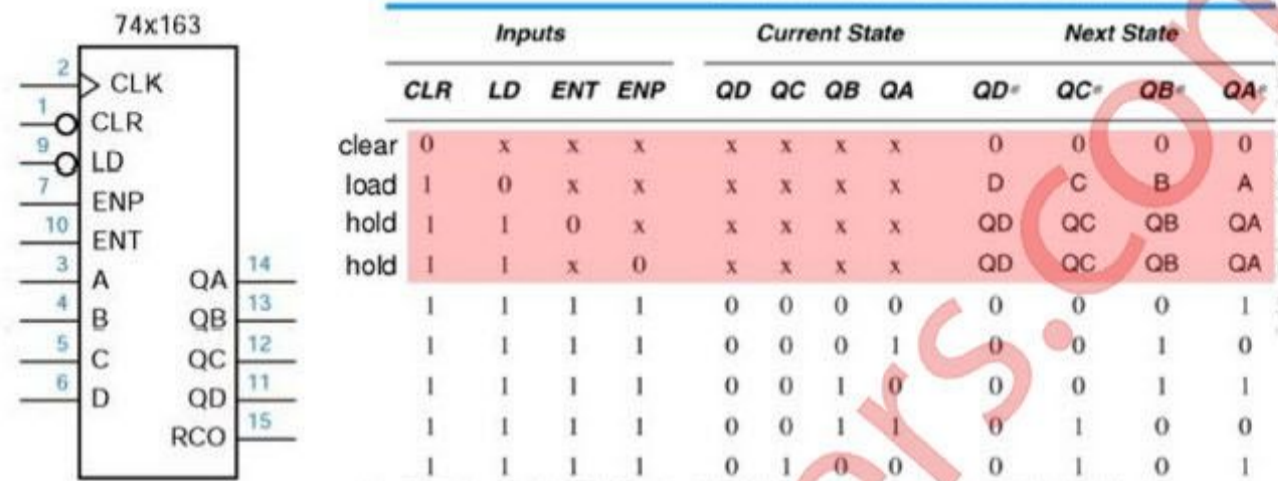|	Inputs				Current State				Next State			
	CLR	LD	ENT	ENP	QD	QC	QB	QA	QD*	QC*	QB*	QA*
clear	0	x	x	x	x	x	x	x	0	0	0	0
load	1	0	x	x	x	x	x	x	D	C	B	A
hold	1	1	0	x	x	x	x	x	QD	QC	QB	QA
hold	1	1	x	0	x	x	x	x	QD	QC	QB	QA
	1	1	1	1	0	0	0	0	0	0	0	1
	1	1	1	1	0	0	0	1	0	0	1	0
	1	1	1	1	0	0	1	0	0	0	1	1
	1	1	1	1	0	0	1	1	0	1	0	0
	1	1	1	1	0	1	0	0	0	1	0	1

Fig. 4(B)

Q.5 (A) With the help of functional block diagram explain the working of voltage regulator LM317 to give an output voltage variable from 5 V to 10 V to handle maximum load current of 500 mA. **[10]**

(B) What is an instrumentation amplifier? Draw its neat circuit using three op-amps. Design instrumentation amplifier for variable gain of 0.5 to 100. **[10]**

Q.6 **Write short notes on: (Attempt any two)** **[20]**
(A) Current fold-back protection in IC 723.
(B) Sample and Hold Circuit.
(C) IC74181 Arithmetic Logic Unit.

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