JHARKHAND UNIVERSITY OF TECHNOLOGY
DIPLOMA 3RD SEMESTER EXAMINATION
ANALOG ELECTRONICS (ECE 301)
DIPLOMA WALLAH
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Time: 3 Hours　　　　　**Full Marks: 70**　　　　　**SET: 3**

Q.1. MULTIPLE CHOICE QUESTIONS　　　　　**[2 × 7 = 14]**

(i) A UJT is essentially a:

(a) Current controlled device　　(b) Voltage controlled device
(c) Relaxation Oscillator　　(d) All of the above

(ii) The feedback fraction of Hartley Oscillator is decided by:

(a) Capacitor divider　　(b) Inductor divider
(c) Resistor divider　　(d) Transistor beta

(iii) Op-Amp can be used as a summing amplifier in:

(a) Inverting mode only　　(b) Non-inverting mode only
(c) Both modes　　(d) Saturation mode

(iv) Darlington Pair is used to achieve:

(a) High Voltage Gain　　(b) High Current Gain
(c) High Bandwidth　　(d) Low Input Impedance

(v) Which class of amplifier conducts for less than 180 degrees?

(a) Class A　　(b) Class B
(c) Class C　　(d) Class AB

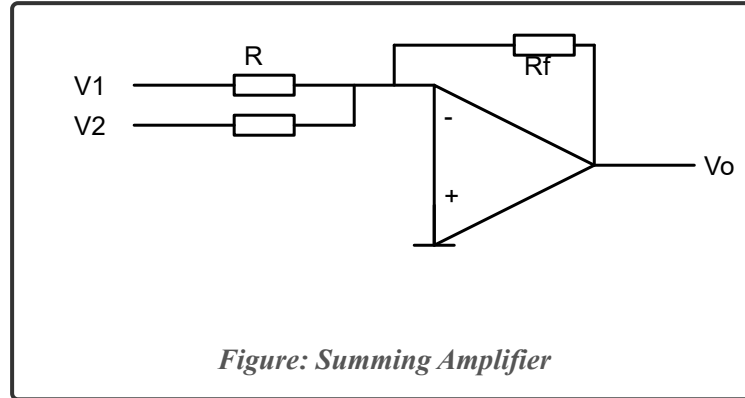**(vi) A series voltage regulator uses a transistor in:**

(a) Series with Load　　(b) Parallel with Load
(c) Feedback loop　　(d) None

(vii) The maximum efficiency of a Centre-Tapped Full Wave Rectifier is:

(a) 40.6%   (b) 50%
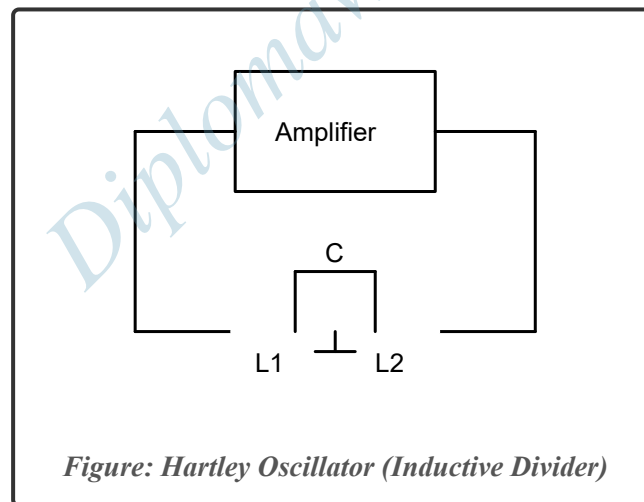(c) 81.2%   (d) 100%

SECTION B (LONG ANSWER TYPE)

Q.2. (a) Explain the working of an **Op-Amp as a Summing Amplifier** (Adder) in inverting mode. Derive the expression: $V_o = -(V_1 + V_2 + V_3)$. **[7]**
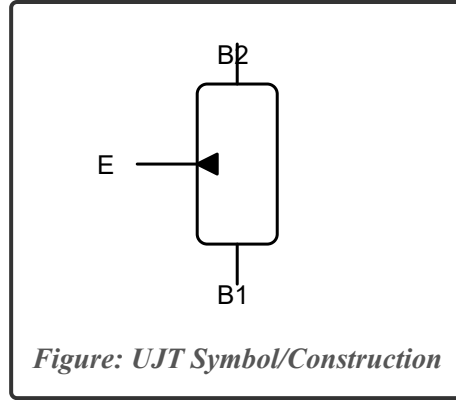

Figure: Summing Amplifier

Q.2. (b) Draw and explain the working of a **Centre-Tapped Full Wave Rectifier**. Calculate its Ripple Factor and Efficiency. **[7]**

Q.3. (a) Draw the circuit diagram of **Hartley Oscillator**. Explain its operation and write the formula for frequency of oscillation. **[7]**
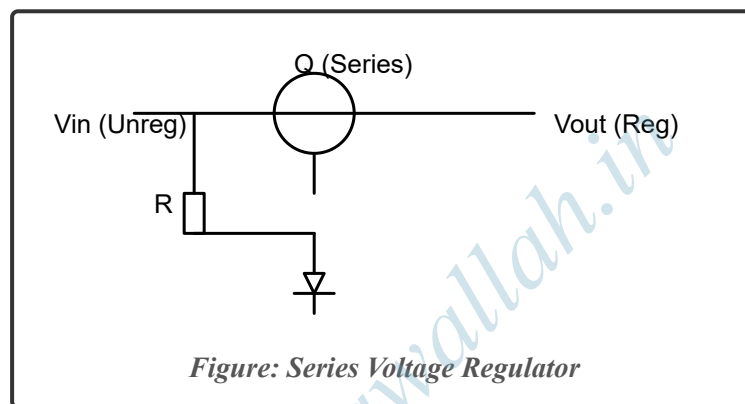

Figure: Hartley Oscillator (Inductive Divider)

Q.3. (b) Explain **Colpitts Oscillator**. How does it differ from Hartley Oscillator? (Hint: Uses Capacitive Divider). **[7]**

Q.4. (a) Explain the construction and characteristics of **UJT (Uni-Junction Transistor)**. How is it used as a Relaxation Oscillator? **[7]**
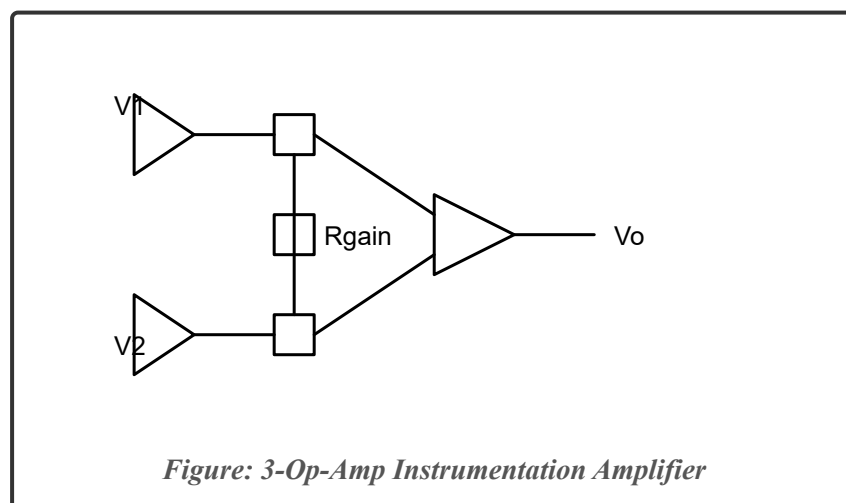
Figure: UJT Symbol/Construction

Q.4. (b) Explain **Load Line Analysis** (DC Load Line). What is the significance of the Q-point in amplification? **[7]**

Q.5. (a) Draw the circuit of a **Series Voltage Regulator** using a Transistor and Zener Diode. Explain its working. **[7]**

Figure: Series Voltage Regulator

Q.5. (b) Explain **Voltage Doubler** circuit (Half Wave or Full Wave) with a neat diagram. **[7]**

Q.6. [Long Answer] Draw the circuit diagram of an **Instrumentation Amplifier** using 3 Op-Amps. Derive the expression for its output voltage. Why is it used in medical and industrial applications? **[14]**

Figure: 3-Op-Amp Instrumentation Amplifier

Q.7. WRITE SHORT NOTES ON (ANY FOUR): [3.5 × 4 = 14]

    a. Current Series Feedback

b. Darlington Pair
c. LED vs LCD
d. Opto-Isolator
e. Band Pass Filter

✅ **SOLUTION KEY (PAPER 3)**

Q1 MCQ: (i) b (Double base), (ii) b, (iii) a, (iv) b, (v) c, (vi) a, (vii) c.

Q2(a) Hint: Current at inverting node is sum of currents: $I1 + I2 + I3 = -If$. Leads to $Vo = -(V1+V2+V3)$.

Q3(a) Hint: Hartley uses two Inductors (L1, L2) in series with parallel Capacitor.

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