FIJI NATIONAL UNIVERSITY

COLLEGE OF ENGINEERING, SCIENCE & TECHNOLOGY (CEST)

SCHOOL OF ELECTRICAL & ELECTRONICS ENGINEERING

ELECTRICAL SERVICEMAN'S COURSE

EEE221- APPLIED ELECTRICITY 2

FINAL EXAMINATION – PENSTER 3, 2014

MARKING SCHEME GUIDE

EXAMINER: SANDEEP SARWAN LAL

BA CAMPUS

Section A **Multiple Choice** **[10 Marks]**

1. D

2. D

3. B

4. B

5. C

6. A

7. C

8. A

9. B

10. B

Section B **TRUE OR FALSE** **[10 marks]**

1. F

2. F

3. F

4. T

5. F

6. T

7. T

8. T

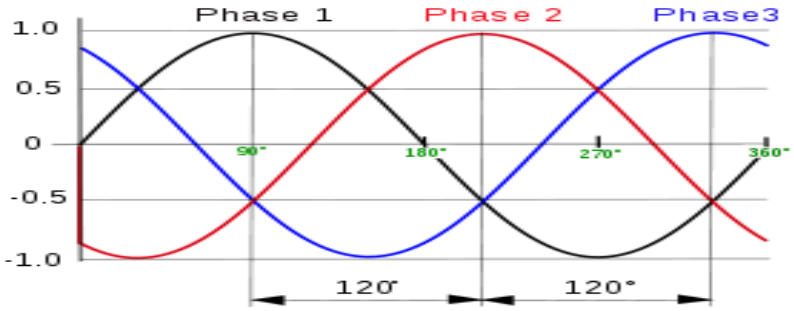
9. F

10. F

Section C THEORY QUESTIONS [80 Marks]

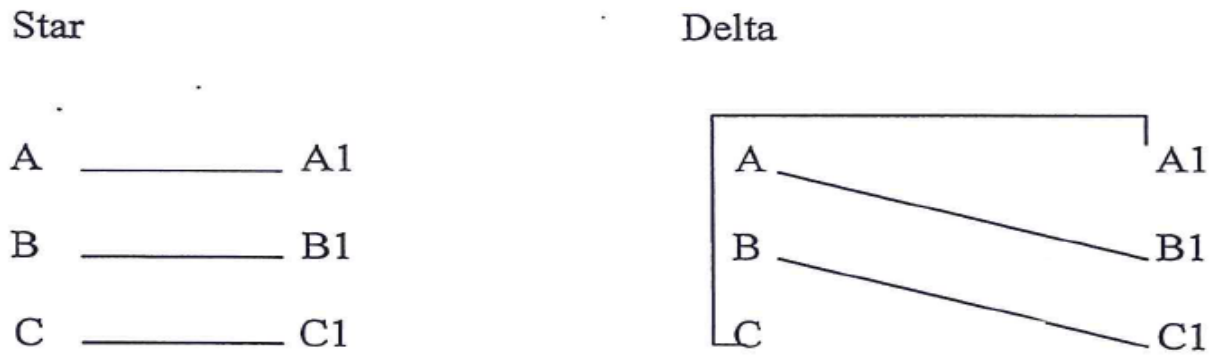
Question 1 **3 PHASE SYSTEM** **[20 Marks]**

1. **(2 marks)**



2. Red –White –Blue (RWB) **(2 marks)**

3.



(4marks)

4.

Star system	Delta system
1. Similar ends connected	1. Dissimilar ends connected
2. For balanced loads and $I_L = I_P$, $V_L = \sqrt{3}\ V_P$	2. For balanced loads and $V_L = V_P$, $I_L = \sqrt{3}\ I_P$
3. Two voltage are available	3. One voltage available only
4. Line voltage leads phase voltage by 30° E	4. Line current leads phase current by 30° E
5. Suited for long distance power transmission	5. Suited to localized rotating machinery

(Any four) **(4mark)**

5. a) Line voltage **(1 mark)**

$$\text{Line Voltage: } Vline = Vp \qquad Vl = 415volts$$

b) Phase voltage **(1 mark)**

$$\text{Phase Voltage: } Vp = 415volts$$

c) Line current **(1 mark)**

$$\text{Line Current: } Iline = 3 \times Ip \quad = 1.732 \times 5 \quad = 8.66amperes$$

d) Phase current: **(1 mark)**

$$\text{Phase Current: } Ip = \frac{Iline}{3} \quad = \frac{8.66}{1.732} \quad = 5amperes$$

6. a) Line Current **(2 marks)**

Here impedence / phase $Z_P = (10 + j\,5)\ \Omega$

$= 11.18\ \angle 26.57°\ \Omega$

$E_L = 400\ V$

$E_P = E_L / \sqrt{3} = 400/\sqrt{3} = 231\ \angle 0°\ V$ **Ans.**

(*a*) In star, phase current = line current

$I_L = I_P = E_P / Z_P = 231\ \angle 0° / 11.18\ \angle 26.57°$

$= 20.65\ \angle -26.57°$ Amp

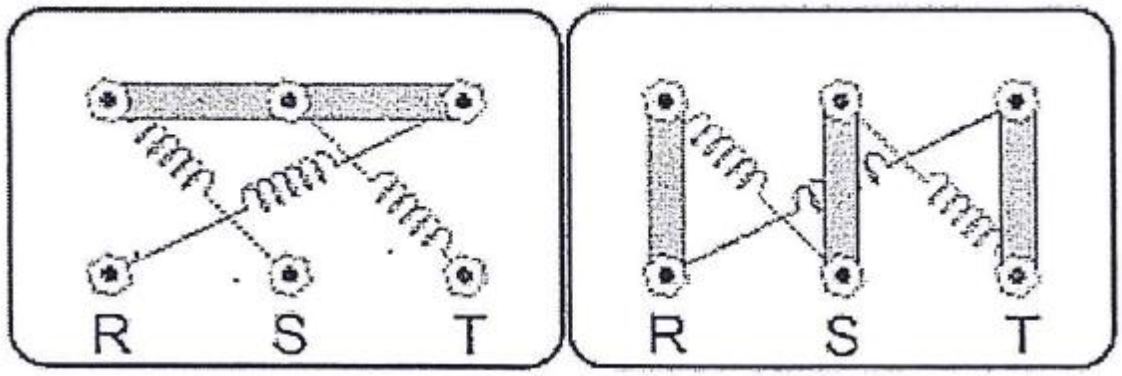
b) Power factor **(2 marks)**

(*b*) Power factor (P.F.) $\cos\phi = \cos(-26.57°) = 0.894$ (lag)

Question 2 **THREE PHASE MOTOR** **[20Marks]**

1. Squirrel-cage rotor and Wound rotor. **(2 marks)**

2.



(4 marks)

3. Change the three phase sequence. (RWB to RBW or BWR or WRB or BRW or WBR)

(2 marks)

4.

– For the same power output, a three phase motor is physically smaller and lighter
- More efficient use of the iron core.
- Higher efficiency- less input power for the same input power
- For the same output power, line currents are smaller
- Suitable for power line frequencies in excess of several hundred hertz
- Less mechanical vibration, owing to magnetic fields of more constant strength
- Direction can be reversed externally by interchanging supply lines
- No starting mechanism or switches required

(Any Three). **(3 marks)**

5.

a) Line voltage **(1 mark)**

$$\text{Line voltage} = 415volts$$

b) Phase voltage **(1 mark)**

$$\text{Phase voltage} = \frac{Vline}{3} \qquad = \frac{415}{1.732} \qquad = 240volts$$

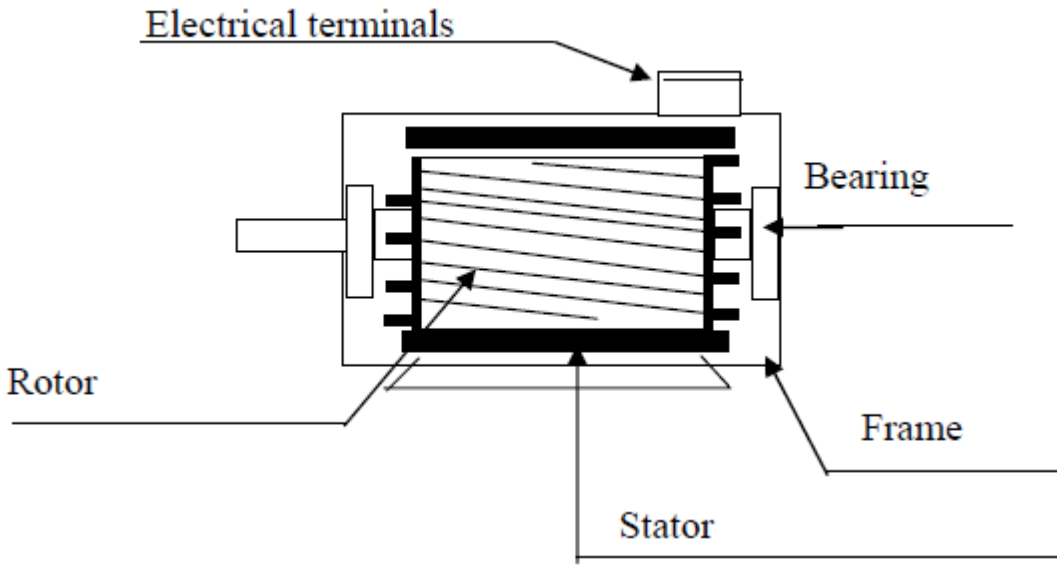
c) Line current **(1 mark)**

$$\text{Line current} = Il = Ip \qquad Il = 3.6amperes$$

d) Phase current: **(1 mark)**

$$\text{Phase current} = 3.6amperes$$

6. **(5marks)**



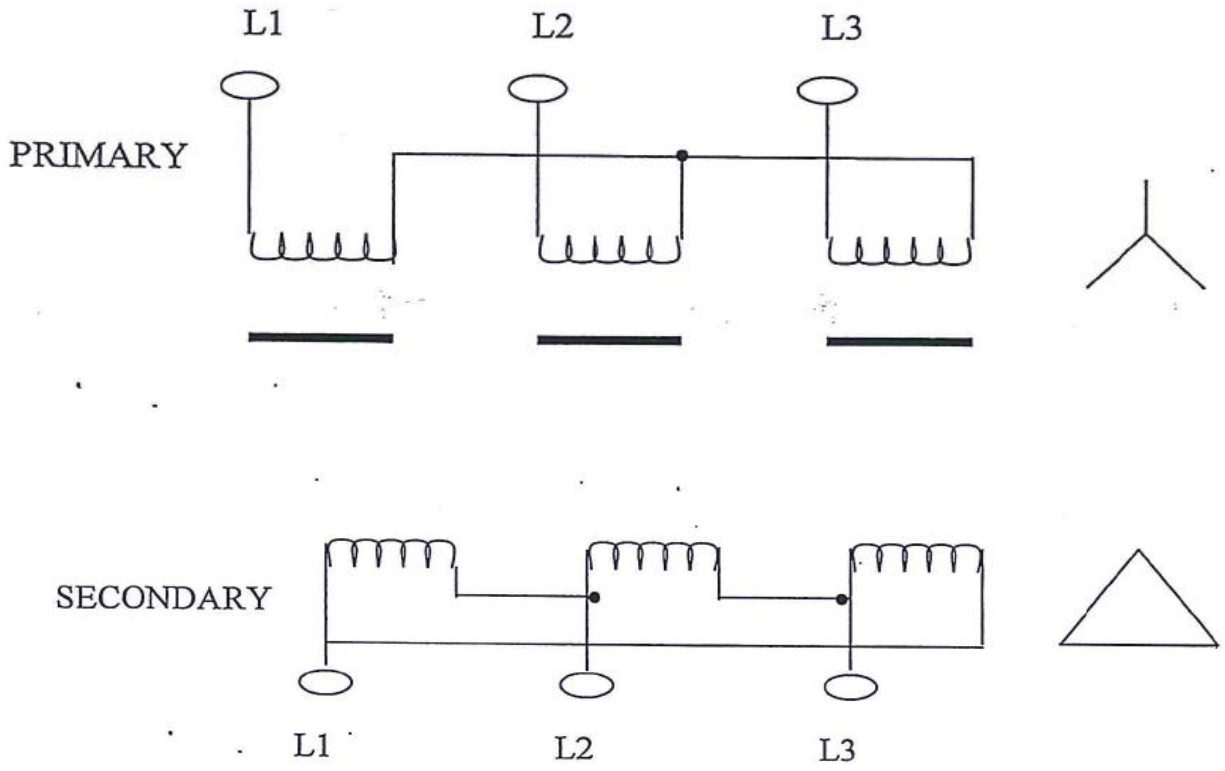
Question 3 **TRANSFORMERS** **[20 Marks]**

1. i) Step up transformer

ii) Step down transformer

iii) Isolating transformer **(3 marks)**

2.



(4 marks)

3. a) 960:48
P1=960
P2 = 48
=20
Turn ratio = 20:1 **(2marks)**

b) V1 = 240V

P1 = 960
P2 = 48
V2 = V1 x N2/N1
= 240 x 48/960
= 12Volts **(2marks)**

5. Cooling is achieved by air in small transformers and oil in large transformers.

(4 marks)

6. Power supply **(1 mark)**

7. i) Step down transformer

   ii) Step up transformer

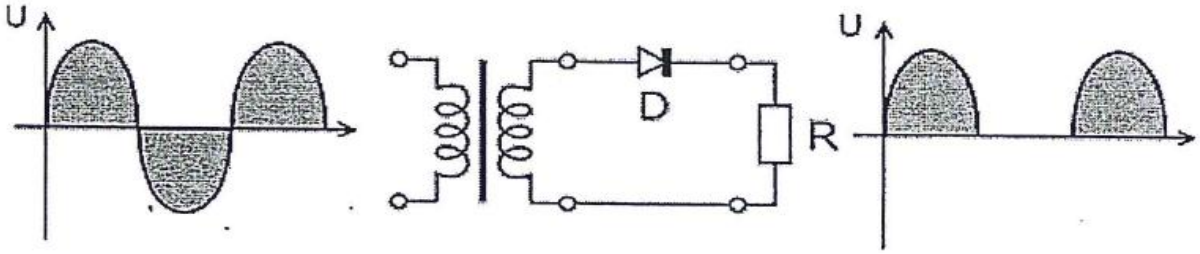
   iii) Center tap transformer

   iv) Isolation transformer

(4 marks)

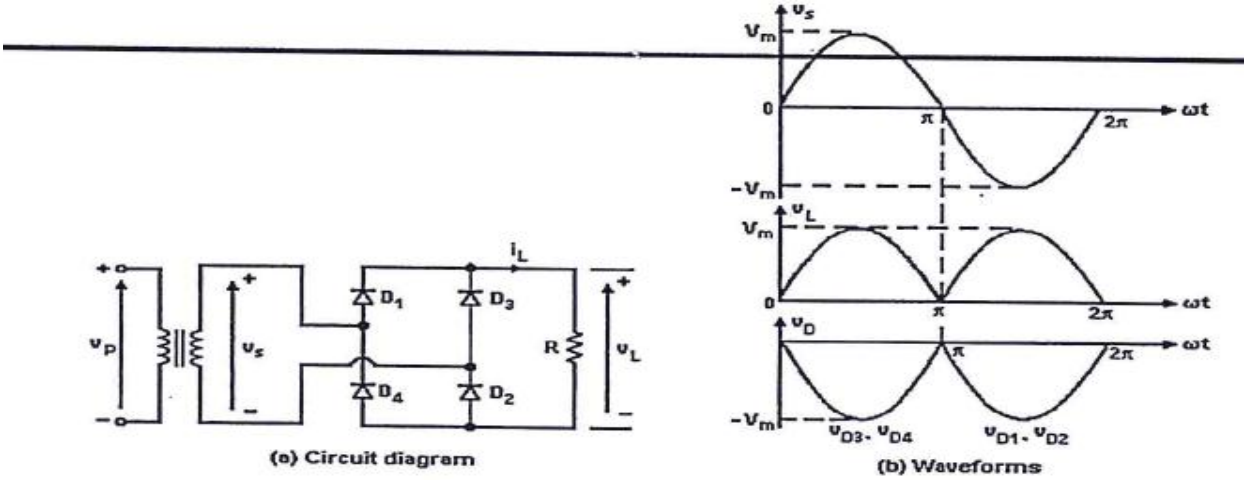
Question 4 RECTIFIERS [20 Marks]

1.a) Single phase half wave



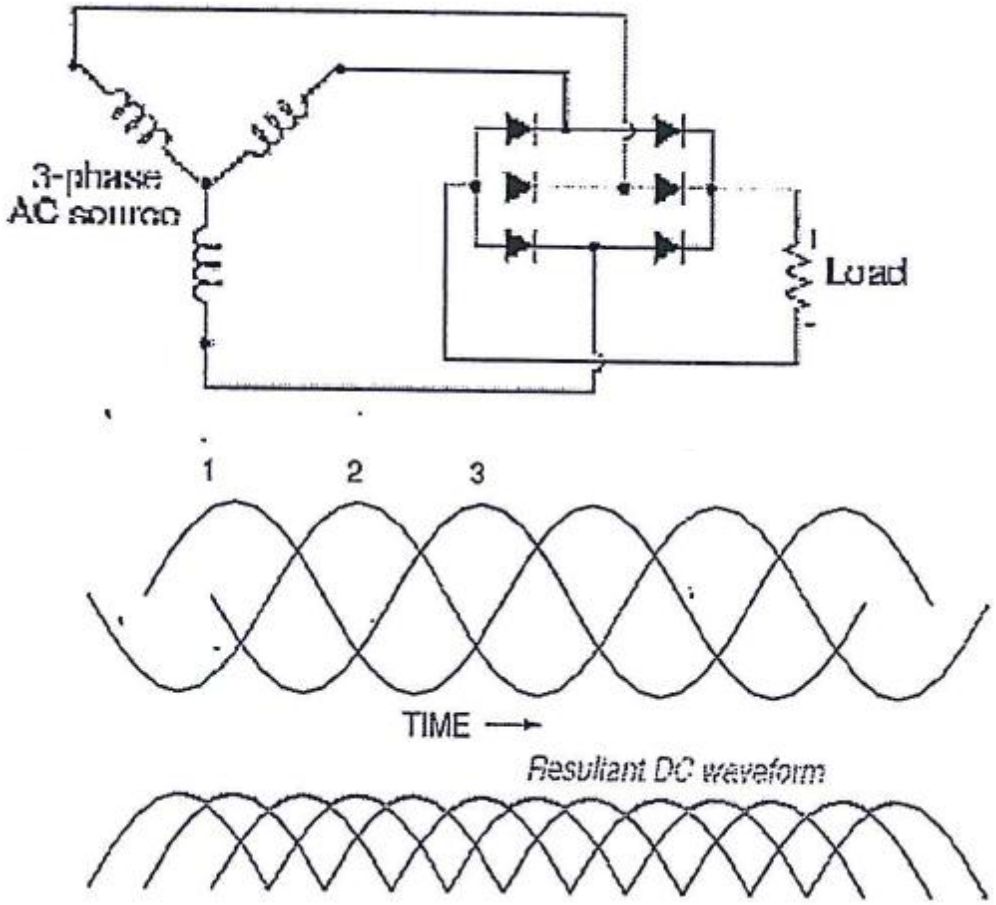
(3 marks)

a) Single phase bridge



(3 marks)

b) Three phase full wave bridge



(3 marks)

2.

$$V_{d.c.} = 0.45V_S = 0.45\ x\ 240\ = 108v$$

$$I_{d.c.} = \frac{V_{d.c.}}{R} = \frac{108}{100} = 1.08 amps$$

$$Power = I^2R = 1.08^2\ x100 = 116 watts$$

(4 marks)

2. a) The load voltage

$$V_L = 0.9V_{a.c.} = 0.9 \times 32 = V_L = 28.8V$$

(1mark)

b)The load current

$$I_L = \frac{V_L}{R_L} = \frac{28.8}{5.0} = I_L = 5.76A$$

(1 mark)

c) the ripple voltage

$$V_R = \sqrt{2}V_{a.c.} = \sqrt{2} \times 32 = V_R = 42.25V$$

(2 marks)

d)The ripple frequency

$$f_R = 2f_{supply} = 2 \times 50 = f_R = 100Hz$$

(1mark)

e) The peak root value

$$PRV = 2\sqrt{2}V_{a.c.} = 2 \times \sqrt{2} \times 32 = PRV = 90.5V$$

(2 marks)

THE END