UNIVERSITI KUALA LUMPUR  
Malaysia France Institute

FINAL EXAMINATION  
JULY 2010 SESSION

SUBJECT CODE : FED 20202  
SUBJECT TITLE : MOTOR STARTER & DRIVES  
LEVEL : DIPLOMA  
TIME / DURATION : 8.00pm – 10.00pm  
( 2 HOURS )  
DATE : 12 NOVEMBER 2010

INSTRUCTIONS TO CANDIDATES

1. Please read the instructions given in the question paper CAREFULLY.
2. This question paper is printed on both sides of the paper.
3. Please write your answers on the answer booklet provided.
4. Answers should be written in blue or black ink except for sketching, graphic and illustration.
5. This question paper consists of TWO (2) sections. Section A and B. Answer all questions in Section A. For Section B, answer two (2) questions only.
6. Answer all questions in English.
7. Graph paper is appended.

THERE ARE 8 PAGES OF QUESTIONS, EXCLUDING THIS PAGE.
SECTION A (Total: 60 marks)
INSTRUCTION: Answer ALL questions.
Please use the answer booklet provided.

Question 1

Figure 1 and Figure 2 shows two types of 240V/415V induction motor connection

![Figure 1](image1.png) ![Figure 2](image2.png)

a) Answer the following questions

i. What type of connection shown in figure 1?

ii. Determine VL, VP and VX for figure 1.

iii. What type of connection shown in figure 2?

iv. Determine VL, VP and VX for figure 2.

(10 marks)
b) A 3-phase 240 / 415 V motor is connected in STAR. Figure 3 shows name plate of that motor. The power supply available is 3-phase 240 V and 3-phase 415 V.

Determine;

I. The suitable power supply, $V_s$; Line voltage, $V_L$ and phase voltage, $V_p$.

II. The input power drawn from the supply.

III. The efficiency of the motor.

IV. The torque produced by the motor.

(10 marks)

<table>
<thead>
<tr>
<th>3-phase Induction Motor Name Plate</th>
</tr>
</thead>
<tbody>
<tr>
<td>$V$</td>
</tr>
<tr>
<td>Δ 220/230</td>
</tr>
<tr>
<td>Δ 240</td>
</tr>
<tr>
<td>Y 380/400</td>
</tr>
<tr>
<td>Y 415</td>
</tr>
</tbody>
</table>

Figure 3
Question 2

A star-delta starting method is used to run a 415V/50Hz induction motor for a conveyor system. The specifications of the motors are given in Table 1;

<table>
<thead>
<tr>
<th>Constant load</th>
</tr>
</thead>
<tbody>
<tr>
<td>Speed range : 1 to 3</td>
</tr>
<tr>
<td>Motor speed : 480 to 1440 rpm</td>
</tr>
<tr>
<td>Resistance torque : 7Nm</td>
</tr>
<tr>
<td>No. of motors : 20 unit</td>
</tr>
</tbody>
</table>

In order to upgrade the existing system, you are required to
i. Calculate the total power consumed by all motors having a derating factor of 0.8.
ii. Refer to Appendix 1. Select an appropriate VSD for the new system to replace the Star-Delta starting method.

(20 marks)
Question 3

Refer to Figure 4

I. Identify the components S1, S2, F1 and KM1

II. Identify and describe the function of X

III. Describe the function of KM2 (13-14); KM2 (33-34) and KM3 (33-34)

IV. Explain the operation of cutting saw (KM1)

V. Explain what happen when motor conveyor overheats. (20 marks)
SECTION B (Total: 40 marks)

INSTRUCTION: Answer TWO (2) questions only
Please use the answer booklet provided.

Question 4

Figure 5 shows a Power circuit to control a Dallander Motor. The motor had a single winding which can be divided into two parts to give a two to one pole-pair ratio depending on their connection.

i. what is the name of the connection?
ii. What is the speed ratio of the motor?
iii. How to connect the motor in low speed?
iv. How to connect the motor in high speed?
v. How to Inverse the rotation of the motor?
vi. Explain the operation of the power circuit
vii. Design a control circuit that would match the power circuit in part (vi).

(20 marks)
Question 5

In one application, a 3-phase induction motor is used with Rotor Resistance Starter. The power circuit of this system is shown in Figure 6.

i. Name the type of induction motor and give the power rating (output power) that normally used with Stator Resistance starter.

ii. Explain the principle operation of Stator Resistance Starter.

iii. Draw the control circuit.

iv. Plot the graph: Starting current/speed characteristic for Stator Resistance starter.

(20 marks)

Figure 6: Power Diagram of Rotor Resistance Starter
Question 6

a) Design a control circuit of a Forward –Reverse Star-Delta Starter that operate:
   i. Actuate pushbutton S 1, the control circuit will receive supply of 48VAC. Indicator light H1 will lights on.
   ii. Actuate pushbutton S 2, the motor will rotate in forward direction.
   iii. Actuate pushbutton S 3, the motor will rotate in reverse direction.
   iv. Actuate Pushbutton S4, the motor will stop.
   v. Incase of emergency, there should have two emergency stop pushbuttons in the circuit.
   vi. Incase of motor over loaded, the TOR will trip and indicator light H2 will lights on.

b) Draw a power circuit of a Forward –Reverse Star-Delta Starter for the motor.

(20 marks)
Variable speed controllers for asynchronous motors

Allivar 18
for asynchronous motors from 0.37 to 15 kW or 0.5 to 20 HP

References

Speed controllers with a frequency range of 0.5 Hz to 320 Hz

<table>
<thead>
<tr>
<th>Mains supply</th>
<th>Motor</th>
<th>Allivar 18</th>
</tr>
</thead>
<tbody>
<tr>
<td>Power supply</td>
<td>Voltage</td>
<td>Line current (2)</td>
</tr>
<tr>
<td>V</td>
<td>A</td>
<td>A</td>
</tr>
<tr>
<td>1</td>
<td>200...240</td>
<td>0.37</td>
</tr>
<tr>
<td>2</td>
<td>50/60 Hz single phase</td>
<td>3.6</td>
</tr>
<tr>
<td>3</td>
<td></td>
<td></td>
</tr>
<tr>
<td>4</td>
<td>200...230</td>
<td>1.5</td>
</tr>
<tr>
<td>5</td>
<td>3-phase</td>
<td>19.4</td>
</tr>
<tr>
<td>6</td>
<td>20.4</td>
<td>18.8</td>
</tr>
<tr>
<td>7</td>
<td>26.5</td>
<td>5.5</td>
</tr>
<tr>
<td>8</td>
<td>35.3</td>
<td>7.5</td>
</tr>
<tr>
<td>9</td>
<td>360...460</td>
<td>7.5</td>
</tr>
<tr>
<td>10</td>
<td>50/60 Hz 3-phase</td>
<td>2.9</td>
</tr>
<tr>
<td>11</td>
<td>5.1</td>
<td>4.8</td>
</tr>
<tr>
<td>12</td>
<td>6.8</td>
<td>6.3</td>
</tr>
<tr>
<td>13</td>
<td>9.8</td>
<td>8.4</td>
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<tr>
<td>14</td>
<td>12.5</td>
<td>10.9</td>
</tr>
<tr>
<td>15</td>
<td>16.9</td>
<td>15.3</td>
</tr>
<tr>
<td>16</td>
<td>21.5</td>
<td>19.4</td>
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<tr>
<td>17</td>
<td>31.8</td>
<td>28.7</td>
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<tr>
<td>18</td>
<td>42.9</td>
<td>38.6</td>
</tr>
</tbody>
</table>

Dialogue options for ATV-18 speed controllers of all ratings

<table>
<thead>
<tr>
<th>Description</th>
<th>Reference</th>
<th>Weight (kg)</th>
</tr>
</thead>
<tbody>
<tr>
<td>RS 232 C &quot;PC interconnection&quot; option with software (6)</td>
<td>VW3-A18104</td>
<td>0.500</td>
</tr>
<tr>
<td>2½&quot; diskettes (software only)</td>
<td>VW3-A18105</td>
<td>0.100</td>
</tr>
</tbody>
</table>

(1) Nominal power supply voltages, minimum : U1, maximum : U2.
(2) Typical value without additional choke.
(3) These power values are given for a switching frequency of 4 kHz.
(4) For 60 seconds.
(5) Speed controllers supplied with user guide in four languages (German, English, Spanish, French).
(6) Kit comprising :
- a connection cable for the PC, fitted with connectors, 5 m long,
- a connection cable for the speed controller, fitted with connectors, 1.2 m long,
- an adaptation module,
- 3½" diskettes containing the software.

APPENDIX