B.E./B.Tech. DEGREE EXAMINATION, NOVEMBER/DECEMBER 2011
SEVENTH SEMESTER
ELECTRICAL AND ELECTRONICS ENGINEERING
IC1016 BIO-MEDICAL INSTRUMENTATION
(REGULATION 2008)

Time: Three hours
Maximum: 100 marks

Answer ALL questions.

PART A — (10 × 2 = 20 marks)

1. At resting potential of a cell, why the inside of the cell is negatively charged?
2. What are active and passive transducers?
3. Mention the salient features of needle electrodes.
4. What are the requirements for physiological signal amplifier?
5. Give the heart beat rate of the human being when he is sleeping and working.
6. Define systolic and diastolic pressure.
7. Mention few applications of X-ray examination.
8. What is the importance of biotelemetry in modern world?
9. List out any two advantages of therapeutic diathermy.
10. State the functions of speech audiometers and screening audiometers.

PART B — (5 × 16 = 80 marks)

11. (a) Explain the characteristics of resting potential, with reference to Goldman's and Nernst equation. (8)
    (b) Explain the respiratory system in detail. (8)

Or
12. (a) Write the various types of transducer. Explain in detail about the piezo electric transducer. (8)

(b) Describe the working of LVDT along with its electrical characteristics. (8)

13. (a) Develop the electrical equivalent circuit of a micro electrode and discuss its salient features. (8)

(b) Explain the characteristics of resting potential and discuss the different events that occur during action potential in a cell. (8)

Or

14. With a neat labelled diagram explain the function of EEG and its significance. (16)

15. (a) Explain in detail about the “lung machine”. (8)

(b) Write a note on Plethysmography. (8)

Or

16. Explain the complete blood gas analyser designed to measure pH, pCO₂, pO₂ from a sample of blood. (16)

17. (a) Explain the operation of X-ray machine with the help of block diagram. (8)

(b) Explain MRI system. (8)

Or

18. Explain the operation of computer tomography by using the mathematical basis of image construction. (16)

19. Describe with a sketch the working of a cardiac pacemaker. What are the additional features that a programmable pacemaker has? (16)

Or

20. (a) Explain the need for diathermy unit. Briefly explain the operation and features of surgical units. (10)

(b) Explain the working of DC defibrillator. (6)
PART A — (10 × 2 = 20 marks)

1. Write few applications of Operations Research.

2. What are the assumptions underlying in linear programming?

3. Name any two methods used for solving linear programming problems, having artificial variables.

4. When can we say that a transportation problem is balanced?

5. What is a mixed integer programming problem?


7. Outline the independent float.

8. What is a zero-sum game?

9. Write a note on carrying cost.

10. What is a deterministic queueing system?
PART B — (5 × 16 = 80 marks)

11. (a) What are the phases of OR? Explain. (8)
(b) Solve graphically the following LPP:
Maximize \( Z = 8x_1 + 16x_2 \)
subject to \( x_1 + x_2 \leq 200 \)
\( x_2 \leq 125 \)
\( 3x_1 + 6x_2 \leq 900; \)
\( x_1, x_2 \geq 0. \)

Or

12. Solve the following LPP:
Maximize \( Z = 2x_1 + 4x_2 \)
subject to \( 2x_1 + x_2 \leq 18 \)
\( 3x_1 + 2x_2 \geq 30 \)
\( x_1 + 2x_2 = 26 \)
\( x_1, x_2 \geq 0. \)

13. (a) What is Primal problem and Dual problem? (2)
(b) Use duality to solve the following LPP:
Maximize \( Z = 2x_1 + x_2 \)
subject to the constraints:
\( x_1 + 2x_2 \leq 10 \)
\( x_1 + x_2 \leq 6 \)
\( x_1 - x_2 \leq 2 \)
\( x_1 - 2x_2 \leq 1 \)
\( x_1, x_2 \geq 0. \)

Or

14. (a) Find the initial basic feasible solution to the following transportation problem using VAM:

\[
\begin{array}{c|cccc|c}
D & D_1 & D_2 & D_3 & D_4 & \text{Supply} \\
\hline
S_1 & 20 & 25 & 28 & 31 & 200 \\
S_2 & 32 & 28 & 32 & 41 & 180 \\
S_3 & 18 & 35 & 24 & 32 & 110 \\
\hline
\text{Demand} & 150 & 40 & 180 & 170 & \\
\end{array}
\]

(8)
(b) A departmental head has four subordinates, and four tasks to be performed. The subordinates differ in efficiency, and the tasks differ in their intrinsic difficulty. His estimate, of the time each man would take to perform each task, is given in the matrix below:

<table>
<thead>
<tr>
<th>Tasks</th>
<th>E</th>
<th>F</th>
<th>G</th>
<th>H</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>18</td>
<td>26</td>
<td>17</td>
<td>11</td>
</tr>
<tr>
<td>B</td>
<td>13</td>
<td>28</td>
<td>14</td>
<td>26</td>
</tr>
<tr>
<td>C</td>
<td>38</td>
<td>19</td>
<td>18</td>
<td>15</td>
</tr>
<tr>
<td>D</td>
<td>19</td>
<td>26</td>
<td>24</td>
<td>10</td>
</tr>
</tbody>
</table>

How should the tasks be allocated, one to a man, so as to minimize the total man-hours?

15. (a) What is an integer programming problem?
(b) Find the optimum integer solution to the following L.P.P.:

Maximize \( Z = x_1 + 4x_2 \)
subject to the constraints:
\[
\begin{align*}
2x_1 + 4x_2 & \leq 7 \\
5x_1 + 3x_2 & \leq 15 \\
x_1, x_2 & \geq 0 \text{ and are integers.}
\end{align*}
\]

Or

16. Use Branch and Bound method to solve the following LPP:

Maximize \( Z = 7x_1 + 9x_2 \)
subject to the constraints:
\[
\begin{align*}
-x_1 + 3x_2 & \leq 6 \\
7x_1 + x_2 & \leq 35 \\
x_2 & \leq 7 \\
x_1, x_2 & \geq 0 \text{ and are integers.}
\end{align*}
\]

17. (a) What is a dummy activity?
(b) A work project consists of twelve activities labelled A through L. Upon being asked to specify the order in which the jobs had to be done, the manager answered as follows:

A, B and C are the first activities of the project and can start simultaneously and immediately A and B precede D while B precedes E, F and H. Activities F and C precede G while E and H precede I and J. C, D, F and J precede K which, in turn, precedes L. Further, I, G and L are the terminal activities of the project.
The completion times of the various activities are listed as follows:

<table>
<thead>
<tr>
<th>Activity</th>
<th>A</th>
<th>B</th>
<th>C</th>
<th>D</th>
<th>E</th>
<th>F</th>
<th>G</th>
<th>H</th>
<th>I</th>
<th>J</th>
<th>K</th>
<th>L</th>
</tr>
</thead>
<tbody>
<tr>
<td>Time (days):</td>
<td>6</td>
<td>4</td>
<td>10</td>
<td>1</td>
<td>1</td>
<td>3</td>
<td>14</td>
<td>6</td>
<td>9</td>
<td>2</td>
<td>7</td>
<td>5</td>
</tr>
</tbody>
</table>

(i) Draw a network diagram corresponding to this project.

(ii) Obtain the lengths of all the paths and determine critical path. (14)

Or

18. Reduce the following two person zero-sum game to $2 \times 2$ order, and obtain the optimal strategies for each player and the value of the game:

<table>
<thead>
<tr>
<th>Player B</th>
<th>B₁</th>
<th>B₂</th>
<th>B₃</th>
<th>B₄</th>
</tr>
</thead>
<tbody>
<tr>
<td>A₁</td>
<td>3</td>
<td>2</td>
<td>4</td>
<td>0</td>
</tr>
<tr>
<td>A₂</td>
<td>3</td>
<td>4</td>
<td>2</td>
<td>4</td>
</tr>
<tr>
<td>A₃</td>
<td>4</td>
<td>2</td>
<td>4</td>
<td>0</td>
</tr>
<tr>
<td>A₄</td>
<td>0</td>
<td>4</td>
<td>0</td>
<td>8</td>
</tr>
</tbody>
</table>

Player A

19. (a) What are the types of inventories? Explain. (8)

(b) A manufacturing company purchases 9000 parts of a machine for its annual requirements, ordering one month usage at a time. Each part cost Rs. 20. The ordering cost per order is Rs. 15 and the carrying charges are 15% of the average inventory per year. You have been assigned to suggest a more economical purchasing policy for the company. What advice would you offer and how much would it save the company per year? (8)

Or

20. (a) What are the elements of a queueing system? Explain. (8)

(b) Assume that the goods trains are coming in a yard at the rate of 30 trains per day and suppose that the inter-arrival times follow an exponential distribution. The service time for each train is assumed to be exponential with an average of 36 minutes. If the yard can admit 9 trains at a time (there being 10 lines, 1 of which is reserved for shunting purposes), calculate the probability that the yard is empty and find the average queue length. (8)
B.E./B.Tech. DEGREE EXAMINATION, NOVEMBER/DECEMBER 2011
SEVENTH SEMESTER
ELECTRICAL AND ELECTRONICS ENGINEERING
EE1402 POWER SYSTEM PROTECTION AND SWITCHGEAR
(REGUALTION 2008)

Time : Three hours
Maximum : 100 marks

Answer ALL questions.

PART A — (10 × 2 = 20 marks)

1. What is meant by voltage surge?

2. Define basic impulse insulation level.

3. Define restriking voltage and recovery voltage.

4. List the problems encountered during DC circuit breaking.

5. What are isolators? Mention its types.

6. Write down the process of fuse selection.

7. What are the different types of faults expected in an alternator?

8. Mention relay scheme suits for inter turn fault in a generator.

9. How the relays are basically classified?

10. What are the essential qualities of a relay?
PART B — (5 x 16 = 80 marks)

11. (a) Describe the construction and operation of metal oxide surge arrestors. 

(b) What are its merits and demerits of metal oxide surge arrestors over conventional arrestors? 

Or

12. Explain

(a) Earthing screens
(b) Overhead ground wires

13. In a 132kV system the reactance and capacitance up to the location of the CB is 50Ω and 0.02μf respectively. A resistance of 500Ω is connected across the contacts of the CB. Determine.

(a) Natural frequency of oscillation.
(b) Frequency of damped oscillation
(c) Critical value of resistance.
(d) The value of resistance which will give frequency of damped oscillations which is equal to 1/4th the natural frequency. 

Or

14. (a) Explain the resistance switching for arc interruption in CB.
(b) Explain capacitor switching in detail.

15. Explain the advantages of gas insulator substation, probable location where it can be located and its demerits. 

Or

16. (a) Describe the HRC fuse action with neat diagram. Also explain its operating characteristics in detail.
(b) Explain the sequence of operation of circuit breaker insulator and earthing switch, during the action of fault and after the clearance of fault.

17. With a neat sketch explain the Merz-price circulating current scheme applied for stator protection of alternators. 

Or

18. Explain the principle of pilot wire relaying schemes for protection of transmission line. List out its merits and demerits.
19. Explain with a neat diagram, the principle of operation and characteristics of an impedance relay. (16)

Or

20. Discuss in detail with neat diagram the operating principle of non-directional over current relay. (16)
PART A — (10 × 2 = 20 marks)

1. State the advantages of Electric Drives.

2. Name the different classes of duty cycle with regard to the application of load.

3. How are phase controlled drives classified?

4. Mention the relation between armature current and terminal voltage in a two quadrant chopper fed separately excited DC Motor drive.

5. What is the condition for operating induction motor to field weakening mode?

6. What is meant by vector control of induction motor?

7. Name the different mode of operation of synchronous motor.

8. Why the current source inverters are preferred for synchronous motor drives.

9. List the Applications of BLDC Motor.

10. Define the term step angle in stepper motor.
PART B — \(5 \times 16 = 80\) marks

11. (a) Derive an expression for the rise in temperature of a motor when it is subjected to continuous rated load. \((8)\)

(b) Develop and discuss the closed loop scheme for speed control of a Electric drive. \((8)\)

Or

12. Develop an expression for the power rating of an electric motor when it is subjected to both short time intermittent and periodic intermittent duty. \((16)\)

13. (a) Describe with neat diagram, the operation of a three phase full converter fed separately excited DC motor drive. \((10)\)

(b) Derive an expression for the speed in terms of torque and duty ratio of step down dc chopper fed dc motor drive. \((6)\)

Or

14. Derive an expression for the steady state current of a two quadrant chopper fed separately excited DC motor. \((16)\)

15. (a) Describe with neat diagram for the stator voltage control of three phase induction motor drive. \((10)\)

(b) Bring out its limitations and advantages of stator voltage control. \((6)\)

Or

16. (a) Explain with neat diagram, for the operation of Static Kramer drive. \((8)\)

(b) Deduce an expression relating speed and torque of a three phase induction motor for static Kramer drive. \((8)\)

17. (a) Explain how the speed of a synchronous motor can be controlled using a current source inverter. \((8)\)

(b) Develop a microprocessor based algorithm for generating the firing pulses for the power switches in the current source inverter. \((8)\)

Or

18. (a) Explain with the aid of a diagram the operation of a surface mounted permanent magnet Synchronous motor. \((10)\)

(b) Discuss the advantages and limitations of PMSM. \((6)\)
19. (a) Describe the theory and operation of BLDC motor drive. (8)
(b) Derive an expression for the torque developed in BLDC motor. (8)

Or

20. (a) Explain with neat diagram, the operation of a permanent magnet stepper motor. (10)
(b) Discuss in detail merits and demerits of a variable reluctance motor. (6)
M 0736

B.E./B.Tech. DEGREE EXAMINATION, NOVEMBER/DECEMBER 2011
SEVENTH SEMESTER
ELECTRICAL AND ELECTRONICS ENGINEERING
EE1403 SOLID STATE DRIVES
(REGULATION 2008)

Time : Three hours
Maximum : 100 marks

* Answer ALL questions.

PART A — (10 × 2 = 20 marks)

1. What is meant by an electrical drive system and mention the different types of drives?

2. What are the advantages of a group drive over an individual drive?

3. Mention the drawbacks of controlled rectifier fed DC motor drives.

4. What are the advantages of closed loop control of DC drives?

5. What are the different methods of speed control of induction motors?

6. A 220V, 50 Hz, 6 pole induction motor runs at a speed of 800 r.p.m find its slip.

7. Mention the two modes employed in variable frequency control of synchronous motor drives.

8. What is a commutatorless motor?

9. Determine the step angle of a four phase steppe motor with 8 stator teeth and 6 rotor teeth.

10. List out the applications of BLDC motors.
PART B — \((5 \times 16 = 80\) marks)

11. (a) Derive the condition for steady state stability of equilibrium point for Electric drive. \(\text{(8)}\)

(b) Discuss the various factors that should be considered for the selection of the motor drive. \(\text{(8)}\)

Or

12. (a) Discuss the various speed control methods adapted in the electrical drive systems with their advantages and drawbacks. \(\text{(8)}\)

(b) Explain in detail the multi quadrant dynamics in the speed-torque plane. \(\text{(8)}\)

13. Explain the operation of single phase fully controlled converter fed separately excited dc motor with neat waveforms and derive the torque speed characteristics. \(\text{(16)}\)

Or

14. (a) Explain the operation of four quadrant chopper control in dc motor drives. \(\text{(8)}\)

(b) A 250 V separately excited dc motor has an armature resistance of 2.50. When driving a load at 600 r.p.m. with constant torque, the armature takes 20 A. This motor is controlled by a chopper circuit with a frequency of 400 Hz and an input voltage of 250 V. What should be the value of the duty ratio if one desires to reduce the speed from 600 to 400 r.p.m with the load torque maintained constant. \(\text{(8)}\)

15. (a) Explain in detail with suitable diagrams and waveforms the (v/f) control applied to induction motor drives. \(\text{(10)}\)

(b) Discuss briefly the various braking methods used in induction motor drives. \(\text{(6)}\)

Or

16. (a) Explain the vector control of induction motor. \(\text{(8)}\)

(b) Explain with neat diagram the static Scherbius system of slip power recovery scheme. \(\text{(8)}\)
17. (a) Explain the open loop volts/hertz control of VSI fed synchronous motor with a neat diagram. (8)

(b) Explain power factor control of synchronous motor with relevant diagram. (8)

Or

18. (a) Explain the microprocessor based synchronous motor control. (10)

(b) Write short notes on PMSM. (6)

19. Explain the construction and working of switched reluctance motor. (16)

Or

20. Discuss the operation of brushless DC motor drives with necessary waveforms. (16)