Hall Ticket No | | | | | | | | | | | Question Paper Code: BCS001

# INSTITUTE OF AERONAUTICAL ENGINEERING

**(Autonomous)**

M.Tech I Semester End Examinations (Regular) - February, 2017

**Regulation: IARE–R16**

## FOUNDATIONS OF DATA SCIENCES

**(Computer Science and Engineering )**

**Time: 3 Hours** **Max Marks: 70**

**Answer ONE Question from each Unit**
**All Questions Carry Equal Marks**
**All parts of the question must be answered in one place only**

### UNIT – I

1. (a) Discuss the roles of data scientist and data architects. **[7M]**
   (b) W.r.t. bar charts write a code snippet in R for **[7M]**
      i. side by side bar chart and faceted bar chart
      ii. specifying different styles of bar chart

2. (a) Assume that you have been given customer dataset file consisting of 50000 records of customers along with their income data. However, during analysis, you may observe that some values are missing systematically. How do you handle this scenario? **[7M]**
   (b) Explain for and while loop in R with syntax and example for each. **[7M]**

### UNIT – II

3. (a) Assume an employee.xml file containing records of employee including id, name, salary, startdate and department are stored for n employees. Write a R script to get the number of nodes present in this XML file. Further, get the details of the first node and get different elements of a node. **[9M]**
   (b) What is heteroscedasticity? Explain **[5M]**

4. (a) Write a code snippet in R to create a new empty .xlsx file with one empty sheet named 'Input', add day and month to the empty sheet input. **[5M]**
   (b) Assume that you have been given the R built in data set mtcars. **[9M]**
   We observe that the field "am" represents the type of transmission (auto or manual). It is a categorical variable with values 0 and 1. The miles per gallon value(mpg) of a car can also depend on it besides the value of horse power("hp"). Suggest the best way to study the effect of the value of "am" on the regression between "mpg" and "hp".

| | mpg | cyl | disp | hp | drat | wt | qsec | vs | am | gear | carb |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 21.0 | 6 | 160.0 | 110 | 3.90 | 2.620 | 16.46 | 0 | 1 | 4 | 4 |
| 2 | 21.0 | 6 | 160.0 | 110 | 3.90 | 2.875 | 17.02 | 0 | 1 | 4 | 4 |
| 3 | 22.8 | 4 | 108.0 | 93 | 3.85 | 2.320 | 18.61 | 1 | 1 | 4 | 1 |
| 4 | 21.4 | 6 | 258.0 | 110 | 3.08 | 3.215 | 19.44 | 1 | 0 | 3 | 1 |
| 5 | 24.4 | 4 | 146.7 | 62 | 3.69 | 3.190 | 20.00 | 1 | 0 | 4 | 2 |
| 6 | 22.8 | 4 | 140.8 | 95 | 3.92 | 3.150 | 22.90 | 1 | 0 | 4 | 2 |
| 7 | 32.4 | 4 | 78.7 | 66 | 4.08 | 2.200 | 19.47 | 1 | 1 | 4 | 1 |
| 8 | 30.4 | 4 | 75.7 | 52 | 4.93 | 1.615 | 18.52 | 1 | 1 | 4 | 2 |
| 9 | 33.9 | 4 | 71.1 | 65 | 4.22 | 1.835 | 19.90 | 1 | 1 | 4 | 1 |
| 10 | 21.5 | 4 | 120.1 | 97 | 3.70 | 2.465 | 20.01 | 1 | 0 | 3 | 1 |
| 11 | 27.3 | 4 | 79.0 | 66 | 4.08 | 1.935 | 18.90 | 1 | 1 | 4 | 1 |
| 12 | 26.0 | 4 | 120.3 | 91 | 4.43 | 2.140 | 16.70 | 0 | 1 | 5 | 2 |
| 13 | 30.4 | 4 | 95.1 | 113 | 3.77 | 1.513 | 16.90 | 1 | 1 | 5 | 2 |
| 14 | 21.4 | 4 | 121.0 | 109 | 4.11 | 2.780 | 18.60 | 1 | 1 | 4 | 2 |

Figure 1

## UNIT – III

5. (a) When do you use Naive Bayes, Support Vector Machines and Decision trees for classification. **[5M]**

   (b) Assume that you have been given a wholesale customer database. **[9M]**

```
> data<-read.csv("wholesale customers data.csv",header=T)
> summary(data)
    Channel          Region          Fresh             Milk          Grocery          Frozen        Detergents_Paper  Delicassen
 Min.   :1.000   Min.   :1.000   Min.   :    3   Min.   :   55   Min.   :    3   Min.   :  25.0   Min.   :    3.0   Min.   :    3.0
 1st Qu.:1.000   1st Qu.:2.000   1st Qu.: 3128   1st Qu.: 1533   1st Qu.: 2153   1st Qu.: 742.2   1st Qu.:  256.8   1st Qu.:  408.2
 Median :1.000   Median :3.000   Median : 8504   Median : 3627   Median : 4756   Median :1526.0   Median :  816.5   Median :  965.5
 Mean   :1.323   Mean   :2.543   Mean   :12000   Mean   : 5796   Mean   : 7951   Mean   :3071.9   Mean   : 2881.5   Mean   : 1524.9
 3rd Qu.:2.000   3rd Qu.:3.000   3rd Qu.:16934   3rd Qu.: 7190   3rd Qu.:10656   3rd Qu.:3554.2   3rd Qu.: 3922.0   3rd Qu.: 1820.2
 Max.   :2.000   Max.   :3.000   Max.   :112151   Max.   :73498   Max.   :92780   Max.   :60869.0   Max.   :40827.0   Max.   :47943.0
```

Figure 2

There's obviously a big difference for the top customers in each category (e.g. Fresh goes from a min of 3 to a max of 112,151). Remove the top 5 customers from each category and using custom functions create a new data set called data.rm.top and using this new data set perform cluster analysis using k-means.

6. (a) What is model overfitting? **[4M]**

   (b) What is association rules? Explain association rules mining with a suitable example. **[10M]**

## UNIT – IV

7. (a) Do you think that generally, the more pieces of information (i.e., input dimensions) we add, the greater is the chance that your perceptron can do its task perfectly? Explain your answer, including a geometrical interpretation (one- vs. two- vs. three dimensional input spaces, and so on). Under what conditions does additional information help with the classification, and under what conditions does it not? **[8M]**

   (b) We have a function which takes a two-dimensional input x = (x1, x2) and has two parameters w = (w1, w2) given by f(x, w) = $\sigma(\sigma(x1w1)\,w2 + x2)$ where $\sigma(x) = 11 + e - x$. We use backpropagation to estimate the right parameter values. We start by setting both the parameters to 0. Assume that we are given a training point x1 = 1, x2 = 0, y = 5. Given this information answer the next two questions. **[6M]**

   i. What is the value of $\partial f/\partial w^2$?

   ii. If the learning rate is 0.5, what will be the value of w2 after one update using back propagation algorithm?

8. (a) The chart below shows a set of two-dimensional input samples from two classes: **[10M]**

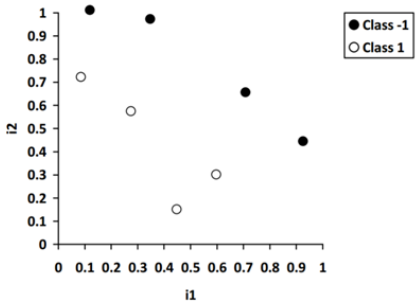



Figure 3

It looks like there exists a perfect classification function for this problem that is linearly separable, and therefore a single perceptron should be able to learn this classification task perfectly. Let us study the learning process, starting with a random perceptron with weights w0 = 0.2, w1 = 1, and w2 = -1, where of course w0 is the weight for the constant offset i0 = 1. For the inputs, just estimate their coordinates from the chart. Now add the perceptron's initial line of division to the chart. How many samples are misclassified? Then pick an arbitrary misclassified sample and describe the computation of the weight update (you can choose  = 1 or any other value; if you like you can experiment a bit to find a value that leads to efficient learning). Illustrate the perceptron's new line of division and give the number of misclassified samples. Repeat this process four more times so that you have a total of six lines (or fewer if your perceptron achieves perfect classification earlier).

(b) W.r.t to question 8(a), let us assume that less information were available about the samples that are to be classified. Let us say that we only know the value for i1 for each sample, which means that our perceptron has only two weights to classify the input as best as possible, i.e., it has weights w0 and w1, where w0 is once again the weight for the constant offset i0 = 1. Draw a diagram that visualizes this one-dimensional classification task, and determine weights for a perceptron that does the task as best as possible (minimum error, i.e., minimum proportion of misclassified samples). Where does it separate the input space, and what is its error? **[4M]**

## UNIT – V

9. (a) Discuss briefly the graphical facilities available in R. **[5M]**

(b) What is knitr? What is its Purpose? Write a code snippet in R to illustrate a simple LaTeX document with knitr chunks. **[9M]**

10. (a) What is the significance of presenting work of data scientists to his/her peer? Discuss the peer presentation structure. **[8M]**

(b) Explain briefly the two functions in R for representing multivariate data. **[6M]**

Hall Ticket No | | | | | | | | | | | Question Paper Code: BCS002

# INSTITUTE OF AERONAUTICAL ENGINEERING

**(Autonomous)**

M.Tech I Semester End Examinations (Regular) - February, 2017

**Regulation: IARE–R16**

## DATA STRUCTURES AND PROBLEM SOLVING

**(Computer Science and Engineering )**

**Time: 3 Hours** **Max Marks: 70**

**Answer ONE Question from each Unit**
**All Questions Carry Equal Marks**
**All parts of the question must be answered in one place only**

### UNIT – I

1. (a) Explain briefly Circular Queue along with algorithm for insert and delete operations. **[8M]**

   (b) Show that, if c is a positive real number, then g(n) $=1+c+c^2+\cdots+c^n is$ : **[6M]**

   i. $\Theta(1)\, if c<1$
   ii. $\Theta(n)\, if c==1$
   iii. $\Theta(c^n)\, if c>1$

2. (a) What is circular linked list? How is different from linear linked list? **[6M]**

   (b) What is the time complexity of the following code snippet? **[8M]**

```
for i : = 1 to n do
        for j : = i + 1 to n do
           for k : = j + 1 to n do
            z = z + 1
```

### UNIT – II

3. (a) What is a dictionary? What are the typical operations that can be performed on dictionary? **[4M]**

   (b) Consider inserting the keys 10, 22, 31, 4, 15, 28, 17, 88, and 59 into a hash table of length m=11 using open addressing with the primary hash function h'(k) = k mod m. Illustrate the result of inserting these keys using linear probing, using quadratic probing with $c_1$ = 1 and $c_2$= 3, and using double hashing with $h_2$(k) = 1 + (k mod (m-1)). **[10M]**

4. (a) Suppose we wish to search a linked list of length n, where each element contains a key k along with a hash value h(k). Each key is a long character string. How might we take advantage of the hash values when searching the list for an element with a given key? **[4M]**

   (b) Suppose a hash table with capacity M=31 gets to be over 3/4ths full. We decide to rehash. What is a good size choice for the new table to reduce the load factor below .5 and also avoid collisions? **[6M]**

   (c) Consider a hash table of size m= 1000 and the hash function h(k)= [m (kA (mod 1))] for A= (sqrt(5)-1)/2; the notation [x] refers to the largest integer at most x. For example [3.14]=3. Of course, x (mod 1) is the fractional part of x. Compute the locations to which the keys 61, 62, 63, 64, 65 are mapped. **[4M]**

## UNIT – III

5. (a) Write recursive functions to **[4M]**
   i. compute the size of a binary tree rooted at node U
   ii. compute the height of a node U

   (b) Bring out the need for threaded binary trees. **[4M]**

   (c) Discuss Graph data structure with suitable example. Explain the term Vertex **[6M]**

6. (a) What is a binary tree? List any four properties of a binary tree? **[6M]**

   (b) Consider the following directed, weighted graph: **[8M]**

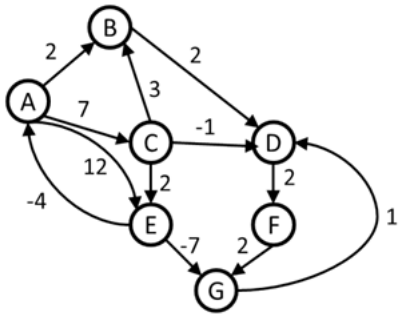



Figure 1

   i. Even though the graph has negative weight edges, step through Dijkstra's algorithm to calculate supposedly shortest paths from A to every other vertex. Show your steps in the table.
   ii. Dijkstra's algorithm found the wrong path to some of the vertices. For just the vertices where the wrong path was computed, indicate both the path that was computed and the correct path.
   iii. What single edge could be removed from the graph such that Dijkstra's algorithm would happen to compute correct answers for all vertices in the remaining graph?

## UNIT – IV

7. (a) Discuss the Binary Search Tree ADT **[6M]**

   (b) What is an AVL tree? Insert the integers 50, 30, 75, 80, 20, 10, 60, 70, 72 to an initially empty AVL tree in order. Draw the state of the AVL tree before and after each necessary rotation. **[8M]**

8. (a) Design appropriate class(es) with suitable methods using C/Java to find the node with minimum value in a Binary Search Tree. Write a test driver for the same. **[10M]**

   (b) List the steps involved in insert an element into AVL tree. **[4M]**

## UNIT – V

9. (a) What is R Tree? When is it preferable over B Tree? **[5M]**

   (b) Consider the following splay tree: **[9M]**

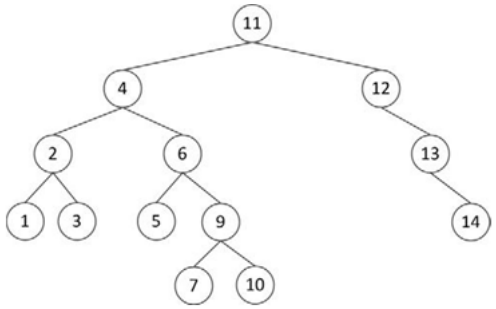



Figure 2

   i. Perform a delete for the key 3 under the assumption that this is a bottom-up splay tree. Show each step

   ii. Perform a split from the tree of Figure 2 (not the resulting tree of part 1)) for the key 6 under the assumption that this is a top-down splay tree.

10. (a) Show the red-black trees that result after successively inserting the keys 5, 10, 15, 25, 20, and 30 into an initially empty red-black tree. **[10M]**

    (b) Discuss the two methods available for splitting the full nodes of R Trees. **[4M]**

Hall Ticket No | | | | | | | | | | | Question Paper Code: BCS003

# INSTITUTE OF AERONAUTICAL ENGINEERING

**(Autonomous)**

M.Tech I Semester End Examinations (Regular) - February, 2017

**Regulation: IARE–R16**

## HIGH PERFORMANCE ARCHITECTURE

**(Computer Science and Engineering)**

**Time: 3 Hours** **Max Marks: 70**

**Answer ONE Question from each Unit**
**All Questions Carry Equal Marks**
**All parts of the question must be answered in one place only**

### UNIT – I

1. (a) Illustrate the primary compiler problem for vector pipelined machines. **[8M]**

   (b) What is Bernstein's condition? Given an example of loop that violates the third Bernstein Condition. **[6M]**

2. (a) Dependences represent two kinds of constraints on program transformations- What are they? Give an example for each. **[6M]**

   (b) Movement of statements must be prohibited from their original iteration vectors to avoid transformations – Justify with a suitable example. **[8M]**

### UNIT – II

3. (a) Test for dependences on S. Write down the subscripts. Which positions are separable, which are coupled? Which dependence test would you apply to each position? **[7M]**

   i.
```
for (k=0; k<100; k++) {
  for (j=0; j<100; j++) {
    for (i=0; i<100; i++) {
S       A[i+1,j+1,k+1] = A[i,j,1] + c;
    }
  }
}
```

   ii.
```
for (k=0; k<100; k++) {
  for (j=0; j<100; j++) {
    for (i=0; i<100; i++) {
S       A[i+1,j+k+1,i] = A[i,j,2] + c;
    }
  }
}
```

   (b) Outline the Subscript Partitioning Algorithm **[7M]**

4. (a) Construct valid breaking conditions for the following **[8M]**

```
for (k=0; k<100; k++) {
        for (j=0; j<100; j++) {
          for (i=0; i<100; i++) {
S               A[i+1,j+1,k+1] = A[i,jx,1] + c;
          }
        }
      }
```

(b) Explain briefly delta test for coupled groups with a suitable example. **[6M]**

## UNIT – III

5. (a) Discuss legality of loop interchange with a suitable example. **[10M]**

(b) Consider the following code **[4M]**

```
DO I = 1, 100
S1        T = A(I) + B(I)
S2        C(I) = T + T
S3        T = D(I) - B(I)
S4        A(I+1) = T * T
     ENDDO
```

What will be the effect of renaming the scalar T

6. (a) What is loop alignment? Explain with a suitable example. **[7M]**

(b) Consider the following loop-nest **[7M]**

```
for i = 1:100 {
        for j = 1:100 {
S1          A(i,j) = B(i,j) + C(i.j);
S2          D(i,j) = A(i-1,j-1)*2.0;
        }
      }
```

Can loop interchange be used here to parallelize or vectorize the loop.

## UNIT – IV

7. (a) In general, backward branches are complicated – Justify **[7M]**

(b) Outline the procedure for Strip Mine and Interchange. **[7M]**

8. (a) Exit branches are more complicated to eliminate than are forward branches – Comment. **[6M]**

(b) Illustrate how Simple Blocking algorithm performs on the inner loop of matrix multiplication after loop interchange: **[8M]**

```
DO J = 1, N
      DO K = 1, N
        DO I = 1, N
          C(I,J) = C(I,J) + A(I,K) * B(K,J)
        ENDDO
      ENDDO
ENDDO
```

## UNIT – V

9. (a) Explain how different types of dependences can affect memory hierarchy management. **[8M]**

   (b) Consider the following code **[6M]**

```
DO I = 1, N
      DO J = 1, N
        C(J,I) = 0.0
        DO K = 1, N
          C(J,I) = C(J,I) + A(J,K) * B(K,I)
       ENDDO
      ENDDO
ENDDO
```

   What is the effect of using unroll-and-jam with a factor of 2 to each of the outer loops?

10. (a) Bring out the three-phase for pruning edges. **[9M]**

    (b) What is the impact of loop order on register reuse? **[5M]**

Hall Ticket No | | | | | | | | | | |  Question Paper Code: BCS204

# INSTITUTE OF AERONAUTICAL ENGINEERING

**(Autonomous)**

M.Tech I Semester End Examinations (Regular) - February, 2017

**Regulation: IARE–R16**

**Advanced Web Technologies**

**(Computer Science and Engineering )**

**Time: 3 Hours** **Max Marks: 70**

**Answer ONE Question from each Unit**
**All Questions Carry Equal Marks**
**All parts of the question must be answered in one place only**

## UNIT – I

1. (a) Define the purpose of a Cascading Style Sheet(CSS). What are CSS selectors? **[7M]**
   (b) Write a javascript to display the denomination of the amount deposited in the bank in terms of 100's, 50's, 20's, 10's, 5's & 1's. (Eg: If deposited amount is Rs.272, the output should be 2 Hundreds, 1 Fifties, 1 Twenties, 2 ones) **[7M]**
2. (a) Write a javascript function that finds primes numbers up to a given Integer. **[7M]**
   (b) How web pages can be divided in to horizontal and vertical Frames? Explain the name and Target properties of a Frame Tag? **[7M]**

## UNIT – II

3. (a) With an example explain the XML file representation and navigation process followed by XML DOM. **[7M]**
   (b) With a sample code, illustrate Parameter Request and Response by a servlet? **[7M]**
4. (a) What is AJAX? With a simple program explain the working of AJAX. **[7M]**
   (b) Write short notes on XML HttpRequest Object. **[7M]**

## UNIT – III

5. (a) How JSP allows sharing of data objects among the pages? **[7M]**
   (b) What is a Java bean? How beans are used in a JSP page? **[7M]**
6. (a) Write a simple JSP code to insert and retrieve data from a database. **[7M]**
   (b) Write the syntax of various JSP constructs and explain them. **[7M]**

## UNIT – IV

7. (a) Using struts create the following layout. **[7M]**

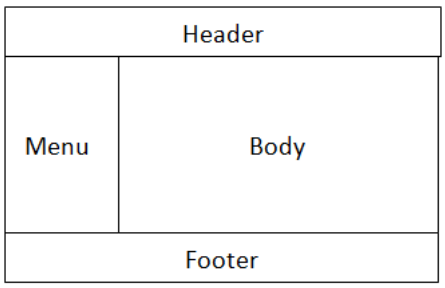



Figure 1

(b) With a neat diagram explain the anatomy of a struts application **[7M]**

8. (a) Using Struts create a login application and with sample data validate login details. **[7M]**

(b) With a neat diagram explain the struts implementation of MVC. **[7M]**

## UNIT – V

9. (a) Describe the structure of a SOAP message and explain each component. **[7M]**

(b) Define a web service? How .NET and J2EE technologies support web services? **[7M]**

10. (a) How web services are installed and deployed on Axis server. **[7M]**

(b) Write a program for a Web Service client which will call the echoString method on the public Axis server at Apache. **[7M]**

Hall Ticket No | | | | | | | | | | |  Question Paper Code: BCS212

# INSTITUTE OF AERONAUTICAL ENGINEERING

**(Autonomous)**

M.Tech I Semester End Examinations (Regular) - February, 2017

**Regulation: IARE–R16**

## BIG DATA ANALYTICS

**(Computer Science and Engineering )**

**Time: 3 Hours** **Max Marks: 70**

**Answer ONE Question from each Unit**
**All Questions Carry Equal Marks**
**All parts of the question must be answered in one place only**

### UNIT – I

1. (a) What is big data analytics? What are the challenges facing big data? **[7M]**
   (b) Describe CAP theorem with illustration. **[7M]**
2. (a) Discuss the elements of big data justifying your answer with example of each element. **[8M]**
   (b) List the differences between parallel and distributed systems. **[6M]**

### UNIT – II

3. (a) Explain the analytic process with illustration. **[8M]**
   (b) SAS is an informtion delivery system which enables transformations of datasets into useful information which helps in taking important decisions. Justify the statement defining various features of SAS. **[6M]**
4. (a) An organization often requires both reporting and analysis to explore new business insights for big data. State the importanceof reporting and analysis. How does both differntiate? **[8M]**
   (b) Define text data analysis. Show some examples of data sources with different data structures typesused in text data analysis. **[6M]**

### UNIT – III

5. (a) List and describe the main features of MapReduce. **[8M]**
   (b) Describe HDFS architecture with illustration. **[6M]**
6. (a) Write a short note on Hadoop ecosystem. **[5M]**
   (b) What is metadata? What information does it provide? **[4M]**
   (c) Discuss the concept of regions in HBase. **[5M]**

## UNIT – IV

7. (a) What is NoSQL? State the features of NoSQL. Why is NoSQL preferred in case of big data? **[8M]**

   (b) Write short notes on NameNode and DataNode illustrating the communication between both the Nodes. **[6M]**

8. (a) What is Hdoop? What are the components of Hadoop? Explain High Level arhitecture of Hadoop. **[8M]**

   (b) Write a brief description on the anatomy of File Read. **[6M]**

## UNIT – V

9. (a) Describe the key elements of social media. **[8M]**

   (b) What is mobile analytics? Differentiate between mobile analytics and web analytics. **[6M]**

10. (a) What do you understand by sentiment analysis? **[6M]**

    (b) What are the types of application considered for mobile analytics? Explain. **[8M]**

Hall Ticket No | | | | | | | | | | |  Question Paper Code: BES001

# INSTITUTE OF AERONAUTICAL ENGINEERING

**(Autonomous)**

M.Tech I Semester End Examinations (Regular) - February, 2017

**Regulation: IARE–R16**

## EMBEDDED C

**(Common to Computer Science and Engineering|Embedded Systems)**

**Time: 3 Hours** **Max Marks: 70**

**Answer ONE Question from each Unit**
**All Questions Carry Equal Marks**
**All parts of the question must be answered in one place only**

### UNIT – I

1. (a) Discuss the classifications of embedded system? Elaborate the process of developing embedded software. **[7M]**
   (b) Write an embedded code for the following **[7M]**
      i. Simple super loop demonstration.
      ii. Simple sentral heating system.

2. (a) Define an embedded system? List out the features of 8051 microcontroller and draw the pin diagram of 8051 microcontroller. **[7M]**
   (b) Explain about memory organization in 8051. **[7M]**

### UNIT – II

3. (a) Write a simple program for counting the number of times that a switch is pressed and released. **[7M]**
   (b) Describe the need for pull up resistors in switches. **[7M]**

4. (a) Develop an embedded C program in order to perform bitwise operations on specified data. **[7M]**
   (b) List out the bitwise operators in C? Develop an embedded C program for super loop application which copies the values from port1 to port2. **[7M]**

### UNIT – III

5. Develop an embedded C program for the following using 8051 microcontroller. **[14M]**
      i. Project header (main.h)
      ii. Port header (port.h)

6. (a) Illustrate the process of goat-counting using switches concept/ develop an embedded C program for restructuring the goat counting? **[7M]**
   (b) Discuss briefly the classification of programming languages into different generations. **[7M]**

## UNIT – IV

7. (a) Explain the creation of hardware delays using Timer 0 and Timer 1. **[7M]**
   (b) Develop an embedded C program for creating hardware delay. **[7M]**

8. (a) Discuss for not using the Timer2. Explain the need for timeout mechanism. **[7M]**
   (b) Develop an embedded C program for testing loop timeouts. **[7M]**

## UNIT – V

9. (a) Write an embedded C program for the intruder alarm system in project header file and port header file. **[7M]**
   (b) Explain the operation of a main control panel for the alarm system. **[7M]**

10. Write an embedded C program for the intruder alarm system in project header file and port header file. **[14M]**

Hall Ticket No | | | | | | | | | | | Question Paper Code: BES002

# INSTITUTE OF AERONAUTICAL ENGINEERING

**(Autonomous)**

M.Tech I Semester End Examinations (Regular) - February, 2017

**Regulation: IARE–R16**

## WIRELESS LANS AND PANS

**(Embedded Systems )**

**Time: 3 Hours** **Max Marks: 70**

**Answer ONE Question from each Unit**
**All Questions Carry Equal Marks**
**All parts of the question must be answered in one place only**

### UNIT – I

1. (a) Discuss about technical issues in wireless communication and explain the drawbacks of first and second generation cellular mobile communication. **[7M]**
   (b) Explain the concept of CSMA in detail. **[7M]**
2. (a) Write a short note of first, second, third and fourth genaration of Wireless communication. **[8M]**
   (b) Briefly explain about ALOHA protocol **[6M]**

### UNIT – II

3. (a) With a neat block diagram, explain frequency hopping concept. **[7M]**
   (b) List out the properties of pseudo noise sequence used in direct sequence spread spectrum system. **[7M]**
4. (a) Explain the Importance of wireless LANS. **[7M]**
   (b) Write a short notes on UHF narrowband technology **[7M]**

### UNIT – III

5. (a) What is IEEE 802.11? Explain the overview of it. **[7M]**
   (b) Discuss in detail about the medium access control layer frame format **[7M]**
6. (a) What is the significance of physical layer? With design flow diagram, explain different sub layers present with- in the sub layer. **[7M]**
   (b) Discuss in detail about control field in MAC frames. **[7M]**

### UNIT – IV

7. (a) With a frame format, explain the different frames available in bluetooth. **[7M]**
   (b) Explain the basic search for paging algorithm in the bluetooth. **[7M]**
8. (a) Explain the interference between Bluetooth and IEEE802.11 **[7M]**
   (b) Discuss in brief about traffic engineering. **[7M]**

## UNIT – V

9. Write a short note on **[14M]**
   i. Physical Layer w.r.t IEEE 802.15.4
   ii. Data Link layer w.r.t IEEE 802.15.4

10. (a) Explain the architecture of Zigbee technology with Zigbee components and network topology. **[7M]**
    (b) Explain the architecture of IEEE 802.15.3 **[7M]**

Hall Ticket No | | | | | | | | | | |  Question Paper Code: BES003

# INSTITUTE OF AERONAUTICAL ENGINEERING

**(Autonomous)**

M.Tech I Semester End Examinations (Regular) - February, 2017

**Regulation: IARE–R16**

## COMPUTER ARCHITECTURE

**(Embedded Systems)**

**Time: 3 Hours** **Max Marks: 70**

**Answer ONE Question from each Unit**
**All Questions Carry Equal Marks**
**All parts of the question must be answered in one place only**

### UNIT – I

1. (a) Explain the rapid changes in implementation technology that computer architecture designer should take care of. How do you evaluate the bandwidth over latency? **[6M]**
   (b) Explain quantitative principles to be followed to improve performance of computer design. **[8M]**
2. (a) Explain different addressing modes for instruction set architecture with an example and its usage. **[7M]**
   (b) List the critical goals in the instruction set architecture from compiler viewpoint and discuss how compiler technology affects the decisions of the architect and how the architect can make it hard or easy for the compiler to produce good code. **[7M]**

### UNIT – II

3. (a) Explain basic compiler techniques for exposing ILP. **[7M]**
   (b) Explain how dynamic scheduling helps to overcome data hazards. **[7M]**
4. (a) Explain the assumptions made for a perfect processor and discuss the limits of instruction level parallelism. **[8M]**
   (b) Explain basic VLIW processor in detail. **[6M]**

### UNIT – III

5. (a) Explain how a protection is achieved via virtual memory. **[8M]**
   (b) Explain six basic cache optimization rules. **[6M]**
6. (a) Explain the impact of virtual machines on virtual memory and input/output. **[7M]**
   (b) Distinguish distributed shared memory and directory based cache coherence protocols with diagram. **[7M]**

## UNIT – IV

7. (a) Clarify the difference between faults, errors and failures explaining their properties. Explain four categories of faults according to Gray and Siewiork. **[7M]**

   (b) Explain steps to be followed in designing input/output system. **[7M]**

8. (a) Explain NetApp FAS6000 filer, a integrated input/output system. **[8M]**

   (b) What is bench marking on a storage device? Distinguish between the cross cutting issues of block servers and filers. **[6M]**

## UNIT – V

9. (a) Write a short note on interconnection network media. **[7M]**

   (b) What are the practical issues faced in interconnecting networks, with an example, explain. **[7M]**

10. (a) Explain designing procedure of a cluster, with an example. **[7M]**

    (b) Illustrate the practical issues in interconnecting networks. How it will effect on a network media. **[7M]**

Hall Ticket No | | | | | | | | | | |  Question Paper Code: BES204

# INSTITUTE OF AERONAUTICAL ENGINEERING
(Autonomous)

M.Tech I Semester End Examinations (Regular) - February, 2017

**Regulation: IARE–R16**

## HARDWARE AND SOFTWARE CO-DESIGN
(Embedded Systems)

**Time: 3 Hours** **Max Marks: 70**

**Answer ONE Question from each Unit**
**All Questions Carry Equal Marks**
**All parts of the question must be answered in one place only**

### UNIT – I

1. (a) In India, railway department has to control trafficin many road track intersection points. As known, the crossing gates are normally installed on the intersection to have appropriate controls. Such a system that is installed for train tracks from Hyderabad to Bengaluru is shown in the figure below that comprises of the following: **[8M]**
   i. There are two sensors Sensor_HY, Sensor_BE that will be asserted (logic high) on detection of train on track.
   ii. The gate is closed when GATE is asserted (logic high)
   iii. The lights have two conditions namely red and green. When LIGHT is asserted (logic high), the light becomes red while if it is not asserted it keeps the normal state that is green.

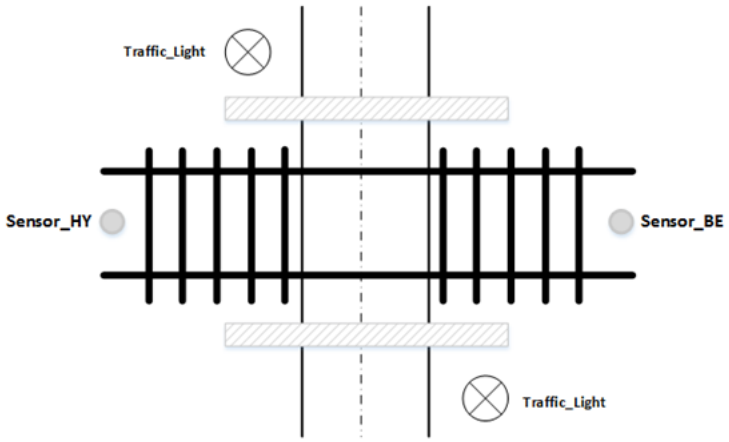



Figure 1

Build a state based FSM model for the controller that performs the following:
   i. When no trains are detected, the gates remain open and lights are green.
   ii. When train arrivals are detected, the gates must close and light is red.When a train arrives on either side, the gate is closedfor sensor assertion. The red light is switched ON as soon as the arrival is confirmed by sensor de-assertion on that side. When the train departs from other side, the moment other side sensor detects the train (assertion), the lights are turned green and gate is opened only after the sensor de-asserts (meaning a confirmation of training going away).

It can be assumed that is no possibility of trains to arrive in both directions and also at no instance of time two trains will be in the section between two sensors.

(b) The micro-controllers are available following RISC and CISC architecture. For example: 8051 is CISC based while ARM is RISC based. Bring out three differences and substantiate the same using the diagrams. **[6M]**

2. (a) What is the need of Hardware-Software Co-synthesis? Describe one Architecture model considering an example. **[6M]**

(b) What is the fundamental difference between Vulcan and Coysma methodologies for hardware/software partitioning? Considering COYSMA strategy, show a mathematical analysis on how we could make an estimation of decrease in execution time. Assume the time parameters needed for this strategy. **[8M]**

## UNIT – II

3. (a) What is the necessity of emulation and prototyping?Brief the future developments in emulation and prototyping of the hardware software co-design with specifications. **[8M]**

(b) Explain the steps of FPGA configuration process and modes of simulation modes available. **[6M]**

4. (a) List out any three techniques of component specialisation which is one of the architecture specialisation techniques. Briefly explain them with concept and an example. **[6M]**

(b) The popular microcontroller 8051 is a classic example that represents many generic microcontrollers. Illustrate how specialisation for instruction set, data path and memory architecture are applied in 8051 microcontroller. **[8M]**

## UNIT – III

5. (a) What do we mean by compilation of a source code? Explain with a diagram the traditional steps in this compilation? List down any three challenges encountered by such traditional compilation model to embedded processors? **[8M]**

(b) 'C' is considered to be most popular languages for embedded programming. However, there are certain limitations of 'C' as an embedded system programming. List any three limitations. **[6M]**

6. (a) When the programmer uses high level coding, does he/she need to understand the embedded hardware? Substantiate your answer. What is the need of other levels of coding like – mid, low and assembly? **[8M]**

(b) Which technique of source-level debugging will you try out first to debug scenarios below? **[6M]**

i. A function implemented returns wrong values and not as expected.

ii. The event is handled as per the needed timing on Simulator run while it very much delayed than expected when it is run on hardware.

iii. LED is connected to GPIO but does not get switched ON as expected even though it seems the code looks fine when walked through.

## UNIT – IV

7. (a) Consider a TV system that is remote controlled wirelessly by two different remote controllers – One via Infra-Red (IR) remote that is normally used by layman while the second remote control from Android phone used by tech-savvy person that works via WiFi?For eg: Volume increase/decrease can be done from either Android phone or IR remote.Introduce concurrency and comment about the need of following concurrent computation for this scenario of processing user events: **[8M]**

i. non-determinant
ii. simultaneity
iii. multiprocessing?

Bring out proper rationale.

(b) Explain the need of co-ordinating concurrent computation or process with a practical example and how the implementation of the same is achieved with one approach? **[6M]**

8. (a) There are two processes running on embedded systems. One process ProcessRead reads the sensors via Analog to Digital Converter of processor while another process ProcessMain is responsible for other functionalities of system with one of the functions to processes the sensor values and takes necessary actions. Propose possible mechanisms of sharing sensor data between ProcessRead and ProcessMain and make a recommendation of one mechanism reasoning it out. **[8M]**

(b) If there is an interface for copying source string pointed by source to destination string pointed by destination with a return to character array, how do you verify the interface – static and safety? The interface in 'C' will be: **[6M]**

**char* strcpy(char* destination, const char* source);**

## UNIT – V

9. (a) Explain the scheme of homogeneous and heterogeneous specifications for system level specifications. Also bring out the key issues with each of these schemes to provide insights into these schemes. **[8M]**

(b) Below is the program that finds the greatest number among a, b and c. Draw the control flow graph that is considered to be language oriented intermediate form. **[6M]**

```
inta,b,c ;
if ( a>b && a > c)
printf(" The greatest number is: %d ", +a);
else if ( b>c)
printf(" The greatest number is: %d", +b);
else
printf(" The greatest number is: %d", +c);
```

Figure 2

10. (a) List any three criteria for guiding the selection of specification language and briefly explain each of them. **[6M]**

(b) These days, the car's door is locked and unlocked using RF based controls. The RFtransmitter is part of door key that sends signals on key presses. The receiver is designed as part of embedded system design in car that receives the RF signals and the controller in the system opens and closes the doors using motor controls. Assuming the needed data, illustrate the design of car controller using multi-way partitioning for heterogeneous system based on COSYMA. Hints are to include RF bus signal, processes for bus interface control, message passing and motor control and timings that are needed. **[8M]**

Hall Ticket No | | | | | | | | | | | Question Paper Code: BES209

# INSTITUTE OF AERONAUTICAL ENGINEERING

**(Autonomous)**

M.Tech I Semester End Examinations (Regular) - February, 2017

**Regulation: IARE–R16**

## EMBEDDED NETWORKING

**(Embedded Systems)**

**Time: 3 Hours** **Max Marks: 70**

**Answer ONE Question from each Unit**
**All Questions Carry Equal Marks**
**All parts of the question must be answered in one place only**

### UNIT – I

1. (a) What is an embedded system? List protocols in embedded networking for bridges and routers. **[6M]**

   (b) Discuss serial peripheral interface and compare serial communication protocols RS 232 and RS 485 standards. **[8M]**

2. (a) Explain about inter integrated circuit (I2C) signals ,addressing and its transactions. **[7M]**

   (b) Draw and explain IEEE 1394 ( Fire Wire) protocol architecture. **[7M]**

### UNIT – II

3. (a) Explain data flow types in USB. **[7M]**

   (b) Explain the block Diagram of Receiver buffer of CAN. **[7M]**

4. (a) Draw and explain with neat diagram of USB interface with PIC 18 micro controller. **[8M]**

   (b) Calculate the timing parameters of CAN Bus with Oscillator clock rate is 20 MHz and CAN bit rate is 125 KHz. **[6M]**

### UNIT – III

5. (a) Define Media system in IEEE 802.3 standard and explain Fibre – Optic Media systems. **[7M]**

   (b) Define IP address? Describe the Internet protocol layer in the Network protocol stack with a neat diagram. **[7M]**

6. (a) Explain fibre optic Transmitter and Receiver modules with neat diagrams. **[7M]**

   (b) Explain the following URL specifies a Resources **[7M]**
   http://www.example.com:80/data/testdata.htm

## UNIT – IV

7. (a) Describe following functions with syntax related with UDP protocol **[6M]**
   i. udp_open( )
   ii. send_packet( )
   (b) List and discuss the four Rules for securing the devices and local network. **[8M]**

8. (a) Describe how the TCP is supported in Embedded system **[6M]**
   (b) Explain how embedded system sends and receives E-Mail , exchange file with (FTP) server. **[8M]**

## UNIT – V

9. (a) Explain different topologies and list advantages and disadvantages of each topologies. **[7M]**
   (b) Define localization? Explain any two techniques to find node localization based on minimal information. **[7M]**

10. (a) Describe the MAC protocols are energy efficient. **[6M]**
    (b) Explain any two data centric routing protocols. **[8M]**

Hall Ticket No | | | | | | | | | | |  Question Paper Code: BCC001

# INSTITUTE OF AERONAUTICAL ENGINEERING

**(Autonomous)**

M.Tech I Semester End Examinations (Regular) - February, 2017

**Regulation: IARE–R16**

## ADVANCED CAD
## (CAD/CAM)

**Time: 3 Hours** **Max Marks: 70**

**Answer ONE Question from each Unit**
**All Questions Carry Equal Marks**
**All parts of the question must be answered in one place only**

### UNIT – I

1. Summarize the following transformation Geometric models with mathematical representations. **[14M]**
   i. Translation
   ii. Scaling

2. (a) Given a hermite cubic spline, show that its point wise translation and translating its geometric representation are identical. **[7M]**
   (b) Rotate a triangle with verticies (10,20), (10,10), (20,10) about the origin by 30 degrees and translate it by $t_x$=5,$t_y$=10. **[7M]**

### UNIT – II

3. Find the equivalent bi-cubic formulation of a cubic Bezier surface patch **[14M]**

4. (a) The non parametric implicit equation of a circle with centre at the origin and radius r is given by $x^2 + y^2 = r^2$.Generate the parametric equation. **[7M]**
   (b) Discuss the need for concatenation of transformation. Explain the necessary care to be taken. **[7M]**

### UNIT – III

5. (a) Determine the minimum distance between a point in space and a plane surface. **[7M]**
   (b) Explain the concept of ruled surface. **[7M]**

6. (a) Write short notes on : Surface of revolution **[7M]**
   (b) Write short notes on : Tabulated cylinder **[7M]**

## UNIT – IV

7. (a) What you mean by Blending surface? Explain. **[7M]**

   (b) Explain different types of surface manipulation techniques with neat sketches . **[7M]**

8. (a) Write short notes on following **[7M]**

      i. Segmentation

      ii. Displaying

   (b) Differentiate between interpolation and approximate approaches used in design of surfaces. **[7M]**

## UNIT – V

9. (a) Discuss the steps involved in finite element analysis. **[7M]**

   (b) Explain the importance of B-representation in construction of solid models. **[7M]**

10. (a) Explain evolution of data exchange format. **[7M]**

    (b) Discuss CSG representation and its importance in solid modelling. **[7M]**

Hall Ticket No | | | | | | | | | | |

Question Paper Code: BCC002

# INSTITUTE OF AERONAUTICAL ENGINEERING

**(Autonomous)**

M.Tech I Semester End Examinations (Regular) - February, 2017

**Regulation: IARE–R16**

## NUMERICAL METHODS FOR PARTIAL DIFFERENTIAL EQUATIONS (CAD/CAM)

**Time: 3 Hours** **Max Marks: 70**

**Answer ONE Question from each Unit**
**All Questions Carry Equal Marks**
**All parts of the question must be answered in one place only**

### UNIT – I

1. (a) Solve the heat conduction equation $\frac{\partial u}{\partial t} = \frac{\partial^2 u}{\partial x^2}$ subject to the initial and boundary conditions $u(x,0) = sin\pi x, 0 \leq x \leq 1$ *and* $u(0,t) = u(1,t) = 0$ using Crank-Nicolson method for $h = \frac{1}{3}$ and $k = \frac{1}{36}$ Integrate upto two time levels. **[7M]**

   (b) Explain Stability and Convergence analysis of difference schemes **[7M]**

2. (a) Discuss the classification of second order partial differential equations . **[7M]**

   (b) Show that the Crank-Nicolson method is unconditionally stable. **[7M]**

### UNIT – II

3. (a) Explain five point formula for finite difference **[7M]**

   (b) Discuss the stability of heat equation using Von Neumann method. **[7M]**

4. (a) Explain conditions for one dimensional diffusion equation in cylindrical and spherical coordinates. **[7M]**

   (b) Explain Alternating Direction Implicit (ADI) methods. **[7M]**

### UNIT – III

5. (a) Find the solution of the initial-boundary value $u_{tt} = u_{xx}$ $0 \leq x \leq 1$ subject to the initial and boundary conditions $u(x,0) = sin\pi x, 0 \leq x \leq 1$ *and* $u(0,t) = u(1,t) = 0, t > 0$ using explicit scheme for $h = \frac{1}{4}$ and $r = \frac{3}{4}$. Integrate upto two time levels. **[7M]**

   (b) Prove that the Wenderoff's scheme is unconditionally stable. **[7M]**

6. (a) ) Find the solution of the differential equation $\frac{\partial u}{\partial t} + \frac{\partial}{\partial t}\left(\frac{u^2}{2}\right) = 0$ subject to conditions $u(0,t) = 0, u(x,0) = x, 0 \leq x \leq 1$ Using the Lax-Wenderoff's formula h=0.2 ,r=0.5 and integrate for one time step. **[7M]**

   (b) Derive Wenderoff's formula. **[7M]**

## UNIT – IV

7. (a) Solve the mixed boundary value problem $\nabla^2 u = 0,\ 0 \leq x, y \leq 1$, u=2x ,u=2x-1,y=0,y=1 $,0 \leq x \leq 1,,\ u_x + u = 2 - y, u = 2 - y, x = 0, x = 1, 0 \leq y \leq 1$, using five point formula with h=k=1/3. **[7M]**

   (b) Solve the boundary value problem $u_{xx}+u_{yy}-5u\,(u_x - u_y) = -5e^{2x}cosy\,(cosy + siny)$,$0 \leq x, y \leq 1$ using second order method with $h = \frac{1}{2}$ **[7M]**

8. (a) Solve the boundary value problem **[7M]**
   $u_{rr} + \frac{1}{r}u_r + u_{zz} = -1$,$0 \leq r \leq 1, -1 \leq z \leq 1$
   u=0, on the boundary.
   Using five point formula with h=k=1/2.

   (b) Explain Weighted Residual Methods **[7M]**

## UNIT – V

9. (a) Discuss Variation methods, least square method and Galerkin method . **[7M]**

   (b) Obtain a one parameter approximate solution of the boundary value problem **[7M]**
   $\nabla^2 u = 0$,$|x| \leq 1, |y| \leq 1$
   u=0 ,on the boundary using Galerkin method.

10. (a) Discuss Finite element method. **[7M]**

    (b) Find a one parameter Galerkin solution of the boundary value problem **[7M]**
    $\nabla^2 u = 0$,$|x| \leq 1, |y| \leq \frac{1}{2}$
    u=0 , On the boundary.

Hall Ticket No | | | | | | | | | | |  Question Paper Code: BCC003

# INSTITUTE OF AERONAUTICAL ENGINEERING

**(Autonomous)**

M.Tech I Semester End Examinations (Regular) - February, 2017

**Regulation: IARE–R16**

## RAPID PROTOTYPE TECHNOLOGIES
## (CAD/CAM)

**Time: 3 Hours** **Max Marks: 70**

**Answer ONE Question from each Unit**
**All Questions Carry Equal Marks**
**All parts of the question must be answered in one place only**

### UNIT – I

1. (a) Explain the fundamentals of the Rapid prototype. **[7M]**
   (b) Briefly discuss the historical development of Rapid Prototyping. **[7M]**
2. (a) Discuss the differences between Rapid prototype technology and numerical control technology. **[7M]**
   (b) Describe the advantages and applications of Rapid prototype. **[7M]**

### UNIT – II

3. (a) Explain with neat sketch laminated object manufacturing. **[7M]**
   (b) State the merits and demerits of FDM. **[7M]**
4. (a) Explain the working principle of SGC and list out any four advantages. **[7M]**
   (b) Explain the basic principle of stereo litho sintering process and discuss the materials used in stereo litho sintering process. **[7M]**

### UNIT – III

5. (a) Discuss the working principle of selective laser sintering and list out any four advantages. **[7M]**
   (b) Discuss the merits and de-merits of powder based rapid prototype system. **[7M]**
6. (a) What is Rapid tooling. Give a brief classification of rapid tooling. **[6M]**
   (b) Explain any two methods of rapid tooling. **[8M]**

### UNIT – IV

7. (a) Discuss SH file creation and errors in SH file . **[7M]**
   (b) What are the features of RP software and explain briefly solid view, view expert, 3D view. **[7M]**

8. (a) Explain STL format. Discuss the generic and dedicated solution with an example. **[6M]**

   (b) Write short notes on **[8M]**

   i. Influence of building orientation.

   ii. Part building errors.

## UNIT – V

9. (a) Explain briefly the applications of the RP in jewel industry and coin making. **[7M]**

   (b) With a case study explain the applications of RP in automotive industry. **[7M]**

10. Explain with an example / case study. Discuss the application of RP in following industries **[14M]**

    i. Aerospace industry.

    ii. Medical application.

Hall Ticket No | | | | | | | | | | | Question Paper Code: BCC201

# INSTITUTE OF AERONAUTICAL ENGINEERING

(Autonomous)

M.Tech I Semester End Examinations (Regular) - February, 2017

**Regulation: IARE–R16**

## PRECISION ENGINEERING
## (CAD/CAM)

**Time: 3 Hours** **Max Marks: 70**

**Answer ONE Question from each Unit**
**All Questions Carry Equal Marks**
**All parts of the question must be answered in one place only**

### UNIT – I

1. (a) Discuss the various errors in machine tools **[7M]**
   (b) Explain the concept of accuracy of machine tool **[7M]**
2. (a) Explain about spindle rotation accuracy **[7M]**
   (b) Discuss the significance of spindle rotation error for machine tools. **[7M]**

### UNIT – II

3. (a) Discuss about grouped datum system with spigot and recess. **[8M]**
   (b) Differentiate between datum and datum systems **[6M]**
4. (a) Explain grouped datum plane with pins and holes with neat sketch. **[8M]**
   (b) Discuss about degrees of freedom for datum systems **[6M]**

### UNIT – III

5. (a) Explain about process capability. **[8M]**
   (b) Distinguish between $C_p$ and $C_{pk}$. **[6M]**
6. (a) Define fits. Describe the various types of fits in brief. **[10M]**
   (b) Differentiate between **[4M]**
      i. tolerance and allowance
      ii. maximum and minimum metal conditions

### UNIT – IV

7. Determine the tolerances on the hole and the shaft for a precision running fit designated by $50H_7g_6$. 50mm lies between the range 30-50mm **[14M]**

   The fundamental deviation of g shaft $=-2.5D^{0.34}$

   The multipliers for grades 7 and 6 are 16i and 10i

   State the actual maximum and minimum size of the hole and shaft and maximum and minimum clearances

8. (a) What is meant by datum feature? and How single and two datum features are indicated on drawing? **[8M]**

   (b) What are the uses of tolerance chart? **[6M]**

## UNIT – V

9. (a) Write a brief note on laser as a means of alignment testing. **[6M]**

   (b) Sketch and describe the optical system of the N.P.L flatness interferometer. **[8M]**

10. (a) Describe briefly about co-ordinate measuring machine (CMM). **[8M]**

    (b) State the advantages and possible sources of errors in CMM. **[6M]**

Hall Ticket No | | | | | | | | | | |

Question Paper Code: BCC206

# INSTITUTE OF AERONAUTICAL ENGINEERING

**(Autonomous)**

M.Tech I Semester End Examinations (Regular) - February, 2017

**Regulation: IARE–R16**

## ADVANCED MECHANICS OF SOLIDS
## (CAD/CAM)

**Time: 3 Hours** **Max Marks: 70**

**Answer ONE Question from each Unit**
**All Questions Carry Equal Marks**
**All parts of the question must be answered in one place only**

### UNIT – I

1. (a) A cantilever beam of rectangular section is subjected to a load of 1000N which is inclined at an angle of 30o to the vertical. Determine the stress produced due to bending at point D. **[7M]**

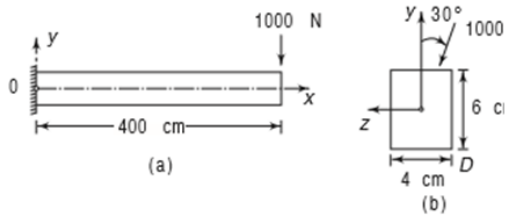



Figure 1

(b) A beam of length 5 m and of uniform rectangular section is supported at its ends and carries uniformly distributed load over the entire length, calculate the depth of the section if the maximum permissible bending stress is 8 $N/mm^2$ and central deflection is not to exceed 10 mm. Take the value of E = 1.2 x 104 $N/mm^2$. **[7M]**

2. (a) Determine the shear stress distribution in a channel section of a cantilever beam subjected to a load F, as shown in figure 2. Also, locate the shear centre of the section. **[7M]**

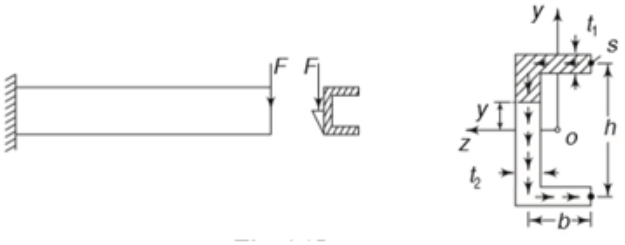



Figure 2

(b) For a simply supported beam of length 5 m, which is carrying a point load of 5 kN at a distance of 3 m from the left end. Determine **[7M]**

i. slope at the left support,

ii. deflection under the load

iii. maximum deflection Take E = 2x 105 $N/mm^2$ and I = 1 x 108$mm^4$

## UNIT – II

3. (a) Determine the maximum tensile and maximum compressive stresses across the sec. AA of the member loaded, as shown in figure 3 load P= 19620 N **[7M]**

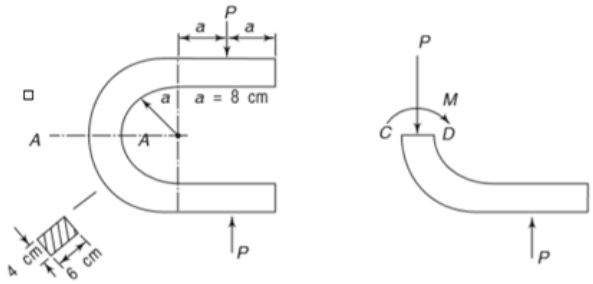



Figure 3

(b) Determine the stress at point D of a hook having a trapezoidal section with following dimensions: $b_1$= 4 cm, $b_2$ = 1 cm, $r_1$= 3 cm, $r_2$ = 10 cm, h = 7 cm, force P = 29400 N. **[7M]**

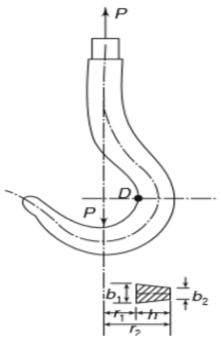



Figure 4

4. (a) The open link shown in Figure 5 below loaded by forces P, each of which is equal to 14700 N. Find the maximum tensile and compressive stresses in the curved end at section AB. **[7M]**

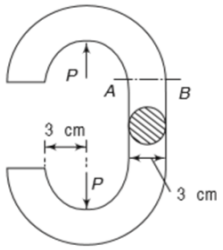



Figure 5

(b) Derive an equation for the value of $p^2$ of a trapezoidal section. **[7M]**

## UNIT – III

5. (a) Derive an expression for torque transmitted by a thin tubular section **[7M]**

   (b) The two tubular sections shown in figure 6 have the same wall thickness t and same circumference. Neglecting stress concentration, find the ratio of the shear stresses for **7M]**

   i. Equal twisting moments in the two cases

   ii. Equal angles of twist in the two cases

   **[7M]**

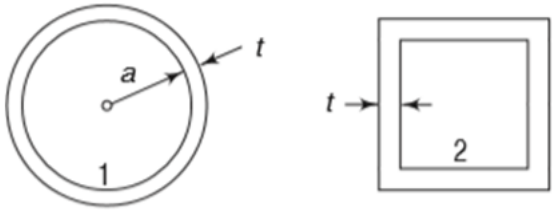



Figure 6

6. (a) For figure 7 given below a two cell tubular section whose wall thicknesses are as shown. If the member is subjected to a torque T, determine the shear flows and the angle of twist of the member per unit length. **[10M]**

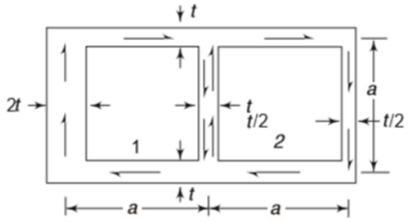



Figure 7

   (b) A thin walled rectangular tube $30 \times 60mm$ is subjected to torque of 10Nm.The thickness of all wall is 2mm.Determine the angle of twist per metre.Take G=80GPa **[4M]**

## UNIT – IV

7. (a) A solid flat circular plate of 800mm diameter and 15mm thickness is acted upon by a concentrated load of 40KN at the centre of the plate. Determine the central deflection and maximum radial stresses at the edge .E = 207GPa, and v = 0.292 **[7M]**

   (b) A square door has a side of 1.8m and thickness 15mm. The plate is simply supported and subjected to uniform pressure. Determine the yield pressure.E = 200 GPa, and v = 0.29 **[7M]**

8. A plate made of mild steel (E = 200 GPa, v = 0.29, and Yield stress= 315 MPa) has a thickness h = 10 mm and cover a circular opening having a diameter of 200 mm. The plate is fixed at the edges and is subjected to a uniform pressure p. **[14M]**

   i. Determine the magnitude of the yield pressure $P_y$ and deflection $w_{max}$ at the centre of the plate when this pressure is applied.

   ii. Determine a working pressure based on a factor of safety of SF = 2.00 relative to $P_y$

## UNIT – V

9. (a) A 20 mm long cast iron rod of 25 mm diameter is pressed on to a thick copper plate with a force of 20N. Determine the width of the contact area, the maximum pressure at the centre of the contact area. The elastic constants for the materials are Cast iron E = 41.4 GPa, v = 0.211, Copper E = 44.7 GPa, v = 0.326 **[7M]**

   (b) Derive an expression for contact pressure of ball bearing **[7M]**

10. Carbon steel balls, each 25 mm in diameter is pressed by a flat carbon plate force F= 18N at the centre of the area of contact. For carbon steel E = 207 GPa , and v = 0.292 **[14M]**

    i. Determine the values of the principal stresses

    ii. Determine the maximum shear stress. At what distance from the contact surface do they occur.

Hall Ticket No | | | | | | | | | | | Question Paper Code: BPE001

# INSTITUTE OF AERONAUTICAL ENGINEERING

**(Autonomous)**

M.Tech I Semester End Examinations (Regular) - February, 2017

**Regulation: IARE–R16**

**Power Electronics and Electric Drives**

**(POWER ELECTRONIC CONTROL OF DC DRIVES)**

**Time: 3 Hours** **Max Marks: 70**

**Answer ONE Question from each Unit**
**All Questions Carry Equal Marks**
**All parts of the question must be answered in one place only**

## UNIT – I

1. (a) Draw and explain the power circuit of semi-converter feeding a separately excited D.C motor. Explain with typical voltage and current waveforms the operation in both continuous and discontinuous armature current modes. [7 M]

   (b) A 220V, 1200 rpm, 15A, separately excited dc motor has armature resistance and inductance of 1.8 Ω and 32mH respectively. This motor is controlled by a single phase fully controlled rectifier with an ac source voltage of 230V, 50Hz. Identify the modes and calculate the developed torque for $\alpha = 60^\circ$ and speed = 450 rpm. [7 M]

2. (a) A 220V, 1500 RPM, 10A separately excited D.C motor has an armature resistance of 0.1 ohms if it is fed from a single phase fully controlled bridge rectifier with an A.C source voltage of 230V, 50 Hz. Assuming continuous load current compute:
   i. firing angle for rated motor torque at 600 rpm.
   ii. firing angle for rated motor torque at (-500) rpm. [7 M]

   (b) Explain the multi-quadrant operation of D.C of separately excited dc motor using Single phase fully controlled rectifier with a reversing switch. [7 M]

## UNIT – II

3. (a) The speed of a 125 HP, 600V, 1800 rpm separately dc motor is controlled by a $3-\Phi$ full converter. The converter is operated from a $3-\Phi$, 480V, 60Hz supply. The rated armature current of the motor is 165A.The motor parameters are Ra= 0.0874Ω, La= 6.5mH and $Ka-\Phi = 0.33V/rpm$. The converter and ac supply are considered to be ideal . Find No load speeds at firing angles $\alpha = 00$ and $\alpha = 300$. Assume that at no load the armature current is 10% of the rated current and is continuous. [7 M]

   (b) Draw the block diagram of the closed loop speed control scheme for control below and above base speed. [7 M]

4. (a) A 220V, 750 rpm, 200A, separately excited motor has an armature resistance of 0.05 ohms. Armature is fed from a three phase non circulating current dual converter consisting of fully controlled rectifiers A and B. Rectifier A provides motoring operation in the forward direction and B in reverse direction. line voltage of the ac source is 400V. Calculate the firing angles of the rectifiers for the following assuming continuous conduction.

i. Motoring operation at rated torque and 600 rpm.

ii. Regenerative braking operation at rated torque and 600 rpm. [7 M]

(b) Explain the operation of a three phase fully controlled rectifier control of dc separately excited motor in motoring and braking operation. [7 M]

## UNIT – III

5. (a) A 230V, 960 rpm , and 200A dc separately excited dc motor has an armature resistance of 0.02 ohms. It is driving an overhauling load whose torque may vary from zero to rated motor torque. field flux may be changed and field saturates at 1.2 times the rated flux. Calculate the speed range in which motor can hold the load by regenerative braking without exceeding twice the rated current. [7 M]

(b) Draw the block diagram for design of speed control loop and resulting transfer function. [7 M]

6. (a) Discuss the effect of harmonics, power factor and ripple in motor current on a dc drive. [7 M]

(b) A 230V, 1000rpm, 105A separately excited dc motor has an armature resistance of 0.06 ohms. Calculate the value of flux as a percent of rated flux for motor speed of 1500rpm when load is such that the developed motor power is maintained constant at rated value for all speeds above rated speed. [7 M]

## UNIT – IV

7. (a) A step down chopper supplied from dc source of 200V. The load parameter are $R = 6\Omega$, $L = 10m\ H$ & $E = 60V$. The chopper is operating with chopping frequency of 1200Hz & duty cycle of 0.6. Assuming continuous conduction. Determine.

i. average load current

ii. current ripple [7 M]

(b) Draw the block diagram and explain the speed controlled drive system for a dc drive. [7 M]

8. (a) Draw and explain the circuit for regenerative braking using chopper, for a separately excited dc motor relevant equations. Draw the speed torque charavteristics. [7 M]

(b) The speed of a separately excited dc motor is controlled by a chopper. The dc supply Voltage is 120V, armature circuit resistance is 0.5Ω, armature circuit inductance is 20mH and motor constant is $Ka - \Phi = 0.05V/rpm$. The motor drives a constant torque load Requiring an average armature current of 20A. Assume that motor current is continuous. Determine

i. The range of speed control.

ii. The range of duty cycle $\alpha$. [7 M]

## UNIT – V

9. (a) Discuss the dynamic simulation of the speed controlled dc motor drives. [7 M]

(b) The buck regulator has an input voltage of Vs=12V. the required average output voltage Va= 5V at R=500 ohms and the peak to peak output ripple voltage is 20mV. The switching frequency is 25K Hz. If the peak to peak ripple current of inductor is limited to 0.8A determine

i. Duty cycle K

ii. Filter inductance L

iii. Filter capacitor C [7 M]

10. (a) Develop the flow-chart for simulation of a single-quadrant phase controlled DC motor drive. Discuss about the expected simulation results, harmonic and associated problems. [7 M]

(b) A buck regulator has an input voltage of Vs=12V. the required average output voltage is Va=5V at R=500 ohms and the peak to peak output ripple voltage of 20 mV. The switching frequency is 25kHz. If the peak to peak ripple current of inductor is limited to 0.8A, determine

i. The duty cycle k

ii. The filter inductance L

iii. The filter capacitor C

iv. The critical values of L and C [7 M]

Hall Ticket No | | | | | | | | | | |  Question Paper Code: BPE002

# INSTITUTE OF AERONAUTICAL ENGINEERING

**(Autonomous)**

M.Tech I Semester End Examinations (Regular) - February, 2017

**Regulation: IARE–R16**

## AC TO DC CONVERTERS

**(Power Electronics and Electrical Drives )**

**Time: 3 Hours** **Max Marks: 70**

**Answer ONE Question from each Unit**
**All Questions Carry Equal Marks**
**All parts of the question must be answered in one place only**

### UNIT – I

1. (a) Explain the V-I characteristics of thyristor circuit. **[7M]**
   (b) The capacitance of reverse biased junction J2 in a thyristor is Cj2=20pf and can be assumed to be independent of offset voltage. The limiting value of the charging current to turn on the thyristor is 16mA. Determine the critical value of dv/dt. **[7M]**

2. (a) Discuss the process of commutation and explain the different commutation techniques used for the thyristors along with circuit diagram and waveforms. **[7M]**
   (b) Describe the basic structure of MOS controlled thyristor and give its equivalent circuit. **[7M]**

### UNIT – II

3. (a) Explain the operation of three phase full converters. **[7M]**
   (b) Write a short note on shunt capacitor compensation. **[7M]**

4. A three phase full converter is operated from a three phase star connected 208V,60HZ supply and the load resistance is R=10Ω. If it is required to obtain an average output voltage of 50% of the maximum possible output voltage, calculate **[14M]**
   i. the delay angle
   ii. the RMS and output currents.
   iii. the average and RMS thyristor currents.
   iv. the rectification efficiency
   v. TUF
   vi. input PF

### UNIT – III

5. (a) Explain the operation of AC voltage controller with resistive, inductive and EMF loads along with neat circuit diagram, input and output waveforms. **[7M]**
   (b) Discuss about the application of single phase AC voltage controller and compare the advantages and disadvantages of single phase AC voltage controller **[7M]**

6. (a) A single phase unidirectional AC voltage controller is connected with a load of R=20Ω with an input voltage of 230V, 50 HZ. If the firing angle of thyristor is $90^0$. Determine, **[7M]**
   i. RMS value of output voltage
   ii. Power delivered to load.
   (b) Explain the operation of cyclo-inverters in detail. **[7M]**

**UNIT – IV**

7. (a) Explain the operation of single phase half wave converter drives. **[8M]**
   (b) Write a short notes on, **[6M]**
   i. 3-phase half wave converter drives.
   ii. 3-phase full converter drives.

8. (a) Explain the operation of single phase series converter with neat diagrams. **[7M]**
   (b) Derive the expressions for performance factors of single phase fully converted bridge converter.
   i. Input displacement factor **[7M]**
   ii. Input power factor
   iii. Voltage ripple factor.

**UNIT – V**

9. (a) Explain about the step down DC to DC convertes with resistive and inductive loads with neat circuit diagrams and waveforms. **[7M]**
   (b) Explain the working of current commutated chopper with the aid of diagram & waveforms. **[7M]**

10. Discuss the operation following power electronics converters along with circuit and waveforms. **[14M]**
   i. BUCK and BOOST regulators.
   ii. CUK regulators and multi output boost. converters.

Hall Ticket No | | | | | | | | | | | Question Paper Code: BPE003

# INSTITUTE OF AERONAUTICAL ENGINEERING

(Autonomous)

M.Tech I Semester End Examinations (Regular) - February, 2017

**Regulation: IARE–R16**

## SPECIAL MACHINES AND CONTROLLERS

**(Power Electronics and Electric Drives)**

**Time: 3 Hours** **Max Marks: 70**

**Answer ONE Question from each Unit**
**All Questions Carry Equal Marks**
**All parts of the question must be answered in one place only**

### UNIT – I

1. (a) Describe the constructional features of axial and radial flux synchronous reluctance motor with their operating characteristics. **[7M]**

   (b) Derive the voltage and torque equations of synchronous reluctance motor. **[7M]**

2. (a) Differentiate between axial and radial air gap synchronous motors. Compare the performance of synchronous reluctance motor with switched reluctance motor **[7M]**

   (b) Draw and discuss the torque – speed characteristics of synchronous reluctance motor. Explain in detail the construction and operation of Vernier motor and draw its phasor diagram. **[7M]**

### UNIT – II

3. (a) A 3-phase, 3 stack variable reluctance stepper motor has 20 poles on each rotor and stator stack. Compute the step angle of the stepper motor. Assume double layer winding. **[7M]**

   (b) Discuss the static and dynamic characteristics of stepper motor with a neat diagram. **[7M]**

4. (a) Discuss the dual voltage driver circuit for 2- phase on drive of a 4 - phase stepper motor and explain the nature of current build up in dual drive. **[7M]**

   (b) Explain the constructional features and operation of a hybrid motor. Describe step position error and holding torque resulting from load torque $T_L$. Draw the torque-angle curve. **[7M]**

### UNIT – III

5. (a) Illustrate the various modes of operation of switched reluctance motor with relevant plots. **[7M]**

   (b) With a neat block diagram explain the closed loop speed control of a switched reluctance motor. **[7M]**

6. (a) Enumerate the procedure for the prediction of torque and control mechanism with relevant voltage and flux waveforms for switched reluctance motor in single pulse mode. **[7M]**

   (b) Discuss the various converter topologies for a 3-phase switched reluctance motor with merits and de-merits. **[7M]**

## UNIT – IV

7. (a) Draw and explain the operation of electronic commutators. **[7M]**

   (b) Derive the torque and emf equations of a permanent magnet brushless DC motor. **[7M]**

8. (a) Explain the magnetic circuit analysis of brushless DC motor on open circuit. **[7M]**

   (b) Sketch the structure of controller for PMBLDC motor and explain the functions of various blocks. **[7M]**

## UNIT – V

9. (a) Derive the expression for power input and torque of a permanent magnet synchronous motor. Explain how its torque – speed characteristics are obtained? **[7M]**

   (b) Draw the equivalent circuit and vector diagram of a permanent magnet synchronous motor with relevant voltage equations and flux linkage components. **[7M]**

10. (a) Explain how a smooth torque is ensured in a permanent magnet synchronous motor. Draw the phasor diagram corresponding to leading power factor operation. **[7M]**

    (b) Discuss the different current control schemes in permanent magnet synchronous motor and mention the effects of demagnetizing mmf. **[7M]**

Hall Ticket No | | | | | | | | | | |  Question Paper Code: BPE203

# INSTITUTE OF AERONAUTICAL ENGINEERING

**(Autonomous)**

M.Tech I Semester End Examinations (Regular) - February, 2017

**Regulation: IARE–R16**

## PROGRAMMABLE LOGIC CONTROLLERS AND THEIR APPLICATIONS

**(Power Electronics and Electrical Drives)**

**Time: 3 Hours** **Max Marks: 70**

**Answer ONE Question from each Unit**
**All Questions Carry Equal Marks**
**All parts of the question must be answered in one place only**

### UNIT – I

1. (a) Describe some of the main features of programmable controller. **[6M]**
   (b) Describe some of the benefits on using programmable controller. **[8M]**
2. (a) Illustrate a typical ASCII transmission by transmitting character Z. **[6M]**
   (b) Explain components of a modularized PLC. **[8M]**

### UNIT – II

3. (a) Examine the principles of programming adopted while using Ladder Diagrams (LD) to control programmable logic controllers. **[6M]**
   (b) Explain the operation of the following input devices, stating the form of the signal being sensed and the output **[8M]**
      i. reed switch
      ii. incremental shaft encoder
      iii. photoelectric transmissive switch
      iv. diaphragm pressure switch
4. (a) Briefly explain the architecture of a programmable logic controller. **[6M]**
   (b) Determine the memory requirements for an application with the following specifications: **[8M]**
   - 70 outputs, with each output driven by logic composed of 10 contact elements
   -11 timers and 3 counters, each having 8 and 5 elements, respectively
   -20 instructions that include addition, subtraction and comparison, each driven by 5 contact elements
   Table given below provides information about the applications memory utilization requirements

| Instruction | Words of memory required |
|---|---|
| Examine ON or OFF (contacts) | 1 |
| Output coil | 1 |
| Add/subtact/compare | 1 |
| Timer/counter | 3 |

## UNIT – III

5. (a) Draw the ladder diagram for a T flip flop CR1 which will toggle only when IN1 and IN2 are both off. **[7M]**

   (b) Explain branching and convergence in sequential function chart with an example. **[7M]**

6. (a) Write a sequential function chart program for traffic lamp sequence controller controlling green and red light. **[6M]**

   (b) Draw the ladder rungs represented by the boolean equations **[8M]**

   i. $Q = (A.B + C).\bar{D}.E.\bar{F}$

   ii. $Q = A + \bar{B}$

   iii. $Q = \bar{A}.B.\bar{C} + D$

   iv. Q = A.B + C.D

## UNIT – IV

7. (a) List the various steps in commissioning programmable logic controller based system. **[7M]**

   (b) Explain the specifications of IEC 1131 standard. **[7M]**

8. (a) Explain in detail about documentation of a PLC system. **[7M]**

   (b) Explain hardware and software to implement a water level controller with pump motor control using four switches. **[7M]**

## UNIT – V

9. (a) Explain how ladder diagram is created from process control descriptions. **[7M]**

   (b) Demonstrate with an example, the hardware and software design to implement any application of your own. **[7M]**

10. (a) Explain PLC applications in detail. **[7M]**

    (b) Specify how rotor-resistance cutting method of starting induction motor is implemented using programmable logic controller. **[7M]**

Hall Ticket No | | | | | | | | | | |

Question Paper Code: BPE208

# INSTITUTE OF AERONAUTICAL ENGINEERING

**(Autonomous)**

M.Tech I Semester End Examinations (Regular) - February, 2017

**Regulation: IARE–R16**

## MULTI LEVEL INVERTERS

**(Power Electronics and Electric Drives)**

**Time: 3 Hours** **Max Marks: 70**

**Answer ONE Question from each Unit**
**All Questions Carry Equal Marks**
**All parts of the question must be answered in one place only**

### UNIT – I

1. (a) Explain the principle of operation of a single phase full bridge inverter circuit with the help of a neat circuit diagram and necessary waveforms. **[7M]**

   (b) A single phase full bridge inverter is operated from a 48Vbattery and is supplying power to a pure resistive load of 10Ω. Determine **[7M]**

   i. The fundamental output voltage and first five harmonics
   ii. RMS value by direct integration method,
   iii. Output power

2. (a) What is meant by Pulse Width Modulation. Explain any two modulation techniques for an inverter circuit. **[7M]**

   (b) What is the function of a drive circuit. Explain about an Optocoupler isolated drive circuit suitable for IGBT's and MOSFET. **[7M]**

### UNIT – II

3. (a) Explain the concept of Multilevel Inverters. **[7M]**

   (b) Explain the effect of Multilevel operation on the harmonic content and switching stress. **[7M]**

4. (a) Explain the principle of operation of SVPWM technique in linear modulation region. **[7M]**

   (b) What are the various topologies of Multilevel inverters. Explain the advantage of each type. **[7M]**

### UNIT – III

5. (a) Explain the principle of operation of a cascaded Multilevel Inverter with a neat circuit diagram. **[7M]**

   (b) Consider the output phase voltage waveform for m= 6 (including 0-level) cascaded MLI, find the generalized Fourier series of the phase voltage waveform obtained. **7M]**

6. (a) Distinguish between NPC and Cascaded H-bridge Multi level inverters. **[7M]**

   (b) Describe how high level inverters can be constructed employing capacitors and compare its cost and reliability aspects. **[7M]**

## UNIT – IV

7. (a) Explain the principle of operation of a flying capacitor MLI. **[7M]**
   (b) Explain about a generalized MLI topology with self voltage balancing. **[7M]**

8. (a) Explain the cascading of two level inverter concept. **[7M]**
   (b) Explain about a higher level inverter by using an open end induction machine with MLI on each side. **[7M]**

## UNIT – V

9. (a) Explain about the issues in capacitor voltage Balancing. **[7M]**
   (b) What are hybrid inverters. List the latest topologies available in MLI configurations. **[7M]**

10. (a) Explain the principle of operation of a 12 sided polygon voltage space vector generation with step by step procedure for generating space vectors. **[7M]**
    (b) What is meant by common mode voltage. Explain any method to eliminate such a voltage in an induction motor drive. **[7M]**

Hall Ticket No | | | | | | | | | | |  Question Paper Code: BAE701

# INSTITUTE OF AERONAUTICAL ENGINEERING

**(Autonomous)**

M.Tech I Semester End Examinations (Regular) - February, 2017

**Regulation: IARE–R16**

## INTRODUCTION TO AEROSPACE ENGINEERING

**(Power Electronics and Electrical Drives)**

**Time: 3 Hours** **Max Marks: 70**

**Answer ONE Question from each Unit**
**All Questions Carry Equal Marks**
**All parts of the question must be answered in one place only**

### UNIT – I

1. (a) What are the effects that the spacecraft may experience in the space? Briefly explain those effects? **[10M]**
   (b) What are hot air balloons? How they changed the face of the aeronautical history? **[4M]**
2. (a) What are the different steps involved in wind tunnel testing? Explain each step briefly? **[10M]**
   (b) What are the parameters that affect aerodynamic forces? **[4M]**

### UNIT – II

3. (a) Explain Bernoulli's principle on airflow and pressure distribution flow over wing section with a neat sketch? **[10M]**
   (b) Explain the significance of speed of sound in air? **[4M]**
4. Consider the isentropic air flow over the airfoil sketched in the following figure 1. The free stream pressure, velocity and density are 1.013 bar, 804.7 kmph and $1.23 kg/m^3$ respectively. At a given point "A" on the airfoil the pressure is 0.7167 bar. What are the Mach number and the velocity at point "A"? **[14M]**

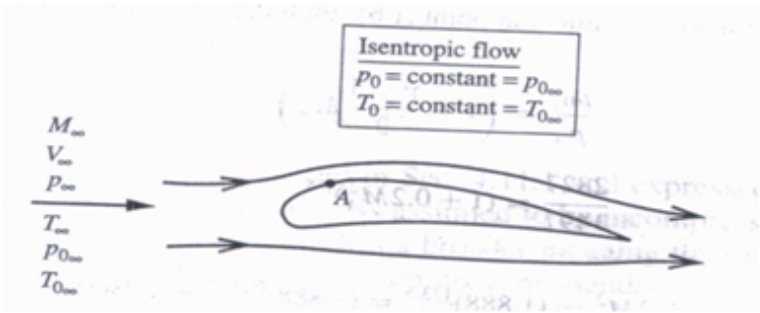



Figure 1

## UNIT – III

5. (a) Briefly describe about various types of drag acting on aircraft? **[8M]**

   (b) What is meant by compressibility drag and explain the prediction of drag divergence Mach number? **[6M]**

6. Consider a thin supersonic airfoil with chord length c = 1.524m in a Mach 3 free stream at a standard altitude of 6096m. The airfoil is at an angle of attack of $5^0$. **[14M]**

   (At 6096m, $\rho_\infty = 0.654\, kg/m^3$ , T=248.6K)

   i. Calculate the lift and wave drag coefficients and the lift and wave drag per unit span

   ii. Compare these results with the same airfoils at the same conditions, except at Mach 2.

## UNIT – IV

7. (a) Explain the criteria for longitudinal static stability of an aircraft? **[10M]**

   (b) Determine the performance parameters of aircraft in accelerated aircraft? **[4M]**

8. Explain the mechanism of a typical Ramjet engine with a neat sketch and draw the pressure – specific volume diagram for an ideal ramjet. **[14M]**

## UNIT – V

9. (a) Explain about fatigue life analysis implemented to aircraft structural design? **[8M]**

   (b) Explain about various size effects in conventional aircraft design? **[6M]**

10. (a) Explain the working of various types of rocket propellants? **[8M]**

    (b) Differentiate between a single stage rocket and a multi stage rocket? **[6M]**

Hall Ticket No | | | | | | | | | | | Question Paper Code: BST001

# INSTITUTE OF AERONAUTICAL ENGINEERING

**(Autonomous)**

M.Tech I Semester End Examinations (Regular) - February, 2017

**Regulation: IARE–R16**

**Theory of Elasticity and Plasticity**

**(STRUCTURAL ENGINEERING)**

**Time: 3 Hours** **Max Marks: 70**

**Answer ONE Question from each Unit**
**All Questions Carry Equal Marks**
**All parts of the question must be answered in one place only**

## UNIT – I

1. (a) The state of stress at a point with respect to the xyz system is

$$\begin{bmatrix} 3 & 2 & -2 \\ 2 & 0 & -1 \\ -2 & -1 & 2 \end{bmatrix} kN/m^2$$

Determine the stress tensor relative to the x'y'z' coordinate system obtained by a rotation through 30° about the z - axis. [7 M]

(b) The state of stress at a particular point relative to the xyz coordinate system is given by the stress matrix

$$\begin{bmatrix} 15 & 10 & -10 \\ 10 & 10 & 0 \\ -10 & 0 & 40 \end{bmatrix} MPa$$

Determine the normal stress and the magnitude and direction of the shear stress on a surface intersecting the point and parallel to the plane given by the equation 2x-y+3z = 9 [7 M]

2. (a) For the stress tensor given below, determine the principal stresses and the direction cosines associated with the normal to the surface of each principal stress. [7 M]

$$\begin{bmatrix} 3000 & 1000 & 1000 \\ 1000 & 0 & 2000 \\ 1000 & 2000 & 0 \end{bmatrix} N/m^2$$

(b) The state of stress components at a point are given by the following array;

$$\begin{bmatrix} 10 & 5 & 6 \\ 5 & 8 & 10 \\ 6 & 10 & 6 \end{bmatrix} MPa$$

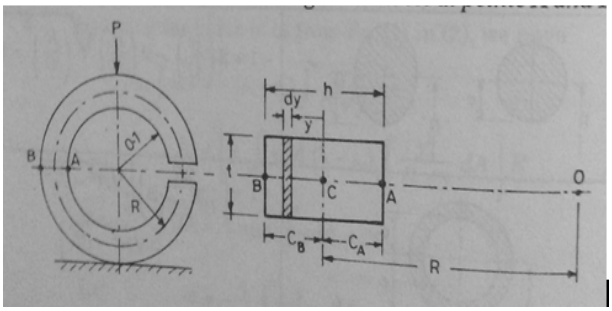
Calculate the principal stresses and principal planes. [7 M]

## UNIT – II

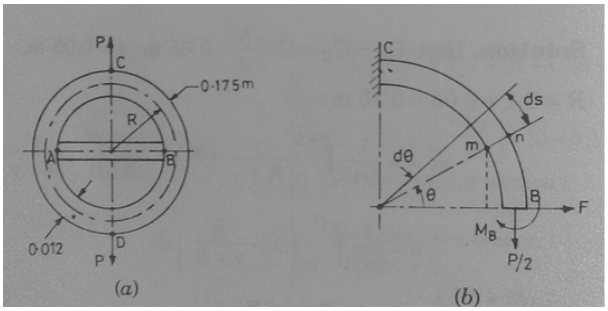
3. (a) Prove that the following are Airy's Stress functions and examine the stress distribution represented by them;
   i. $\varphi = Ax^2 + By^2$
   ii. $\varphi = Bx^3$
   iii. $\varphi = A(x^4 - 3x^2y^2)$

   (b) Show that the Airy's stress function $\phi = \left(xy^3 - \frac{3}{4}xyh^2\right)$ represents stress distribution in a cantilever beam loaded at the free end with load P. Find the value of A if $\tau_{xy} = 0$ at $y = \pm\frac{h}{2}$ where $b$ and $h$ are width and depth respectively of the cantilever. [7 M]

4. (a) A load P = 70 kN is applied to the circular steel frame shown in fig below. The rectangular cross section is 0.1 m wide and 0.05m thick. Determine the Tangential stress at points A and B. [7 M]




   (b) A Steel ring of 0.35 m mean diameter and of uniform rectangular section 0.06m wide and 0.012m thick is shown in fig below. A rigid bar is fitted across diameter AB, and a tensile force P applied to the ring as shown. Assuming an allowable stress of 140 MPa, determine the maximum tensile force that can be carried by the ring. [7 M]



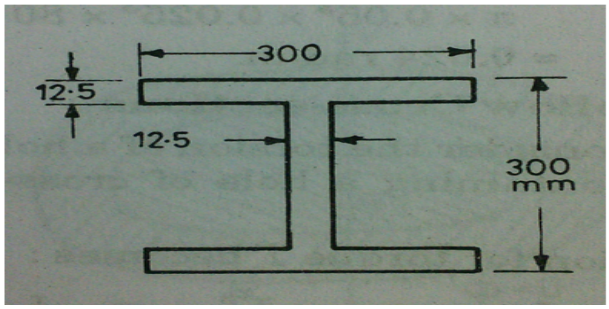
## UNIT – III

5. (a) Derive the conditions of compatibility in three dimensional stress strain system. [7 M]
   (b) Explain Principle of superposition in three dimensional stress strain system. [7 M]

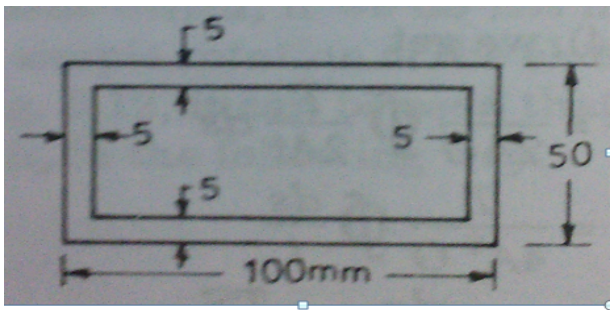
6. (a) Show that if the rotation is zero throughout the body then the displacement vector is the gradient of a scalar potential function. Give an example for each irrotational deformation. [8 M]
   (b) Explain reciprocal theorem for three dimensional stress strain system. [6 M]

## UNIT – IV

7. (a) A Square shaft rotating at 250 rpm, transmits torque to a crane which is designed to lift maximum load of 150 kN at a speed of 10 m / min. If the efficiency of crane gearing is 65 %, estimate the size of the shaft for the maximum permissible shear stress of 35 MPa. Also calculate the angle of twist of the shaft for a length of 3m. Take G = 100 GPa. [7 M]
   (b) A 300 mm steel I-beam shown in fig below flanges and web 12.5 mm thick is subjected to a torque of 4 kN.M find the maximum shear stress and angle of twist per unit length G = 100 GPa. [7 M]




8. (a) An elliptical shaft of semi axes a = 0.05 m , b = 0.0025 m, and G = 80 GPa is subjected to a twisting moment of $1200\pi$ N.m. Determine the maximum shearing stress and the angle of twist per unit length. [7 M]
   (b) A hollow aluminium section is designed as shown in fig below for a maximum shear stress of 35 MPa. Find maximum permissible twisting moment for this section and the angle of twist under this moment per meter length G = 28 GPa. [7 M]




## UNIT – V

9. (a) Explain the mechanism of plastic deformation. [7 M]
   (b) Explain the yield criteria and flow rules for perfectly plastic and strain hardening materials. [7 M]

10. (a) Explain St. Venant's Theory of plastic flow. [7 M]
    (b) Discuss the mathematical formulation of plastic potential. [7 M]

Hall Ticket No | | | | | | | | | | |

Question Paper Code: BST002

# INSTITUTE OF AERONAUTICAL ENGINEERING

**(Autonomous)**

M.Tech I Semester End Examinations (Regular) - February, 2017

**Regulation: IARE–R16**

## ADVANCED REINFORCED CONCRETE DESIGN

**(Structural Engineering)**

**Time: 3 Hours** **Max Marks: 70**

**Answer ONE Question from each Unit**
**All Questions Carry Equal Marks**
**All parts of the question must be answered in one place only**

### UNIT – I

1. (a) Define Diagonal tension. How can we prevent diagonal tension in reinforced concrete beams? What are the conditions in which we design a doubly reinforced beam? **[8M]**

   (b) A rectangular simply supported beam 300 mm x 500 mm, spanning over 5 m is subjected to a maximum moment of 150 kN-m at the mid-span. The beam is reinforced with four bars of 25 mm diameter, on the tension side at an effective depth of 450 mm. The bars are spaced at 50 mm center to center. Check the beam for serviceability limit state of cracking if M20 concrete and Fe 415 steel are used **[6M]**

2. (a) Explain the terms short term and long term deflection in a beam. Explain the method of calculating long term deflection? **[7M]**

   (b) Design a rectangular beam 230 mm x 600 mm over an effective span of 5m. The superimposed load on the beam is 50 kN/m. Effective cover to reinforcement is taken as 50 mm. Use M20 concrete and Fe 415 steel. **[7M]**

### UNIT – II

3. (a) Explain yield line formulation in Two-way slabs? List the guidelines for Yield Line Patterns. **[6M]**

   (b) Draw the bending moment diagram for a beam, fixed at ends and carrying total uniformly distributed load $w_u$, after 20% redistribution. Determine the magnitude by the point of contraflexure is shifted. **[8M]**

4. (a) Explain the bases underlying the various limitations imposed by the Code with regard to moment redistribution. **[6M]**

   (b) Apply yield line theory to estimate the collapse load of an isotropically reinforced circular slab of radius R, simply supported on the periphery, and subject to **[8M]**

   i. a uniformly distributed load of intensity $w_u$ per unit area and

   ii. a concentrated load $P_u$ at the centre.

## UNIT – III

5. (a) Explain the geometry, behavior and design considerations for a waffle slab? **[6M]**

   (b) How is the positive and negative bending moments distributed in the column and middle strips in the interior span in the Direct Design method of Flat Slabs? How is the effect of pattern load considered in Direct Design method as per IS 456 code? **[8M]**

6. (a) List a few factors that affect the punching shear strength of flat slabs. How is a flat slab designed for punching shear? State the equations for nominal shear stress and design shear stress. **[6M]**

   (b) Design the interior panel of a large single-storey warehouse flat slab roof with a panel size of 6 m x 6 m supported by columns of size 500 mm x 500 mm. The height of the columns is 5m. Take live load as 3.0 $kN/m^2$ and the weight of finishes including waterproof treatment as 2.5 $kN/m^2$. Use M25 concrete and Fe 415 steel. Assume mild environment. **[8M]**

## UNIT – IV

7. (a) Describe the detailing to be adopted in simply supported deep beams according to IS 456: 2000. How are bearing stresses checked in deep beams? **[4M]**

   (b) Design a corbel to support a factored vertical load of 300 kN, applied at a distance of 350mm from the column face. The column is 300 mm x 500 mm in plan. Assume M30 concrete, Fe 415 steel, and moderate environment. **[10M]**

8. (a) Why is anchoring of main bar important in corbels? What are the methods suggested in IS 456 for anchoring the main bars of corbels? **[4M]**

   (b) Design a simply supported, 300 mm thick RC vertical deep beam of height 4.0 m, which is supported over 500 mm wide piers having a clear spacing of 5m. The beam carries a service superimposed load of 200 kN/m. Assume M20 grade concrete and steel of grade Fe 415 **[10M]**

## UNIT – V

9. (a) What are the variables that affect the strength and behavior of slender columns? Differentiate the behavior of a slender column from that of a short column. **[4M]**

   (b) Design a rectangular combined footing to support two columns of size 300 mm x 300 mm (with six 16mm bars) and 400 mm x 400 mm (with six 20mm bars), carrying 800 kN and 1200 kN (service + dead loads), respectively. These columns are located 3.6 m apart and the column carrying 800 kN is flush with the property line. Assume SBC of 200 $kN/m^2$. Assume M25 concrete in columns and M20 concrete in the footing and Fe 415 steel in the columns as well as footing. **[10M]**

10. (a) Explain the behavior of combined two-column footing. **[4M]**

    (b) Design the reinforcement of a short column of size 300 mm x 500 mm and unsupported length of 3m subjected to a factored axial load $P_u$ of 1400 kN and factored moment $M_{ux}$ about major axis of 130 kNm and $M_{uy}$ about minor axis of 60 kNm. Adopt M30 concrete and Fe 500 grade steel and assume moderate environment. **[10M]**

Hall Ticket No | | | | | | | | | | | Question Paper Code: BST003

# INSTITUTE OF AERONAUTICAL ENGINEERING

**(Autonomous)**

M.Tech I Semester End Examinations (Regular) - February, 2017

**Regulation: IARE–R16**

## COMPUTER ORIENTED NUMERICAL METHODS

**(Structural Engineering)**

**Time: 3 Hours** **Max Marks: 70**

**Answer ONE Question from each Unit**
**All Questions Carry Equal Marks**
**All parts of the question must be answered in one place only**

### UNIT – I

1. (a) Solve the following system of linear equations with partial pivoting **[7M]**

$$x_1 - x_2 + 3x_3 = 3$$
$$2x_1 + x_2 + 4x_3 = 7$$
$$3x_1 + 5x_2 - 2x_3 = 6$$

(b) Use Householder's method to convert the matrix $\begin{bmatrix} 4 & 1 & -2 & 2 \\ 1 & 2 & 0 & 1 \\ -2 & 0 & 3 & -2 \\ 2 & 1 & -2 & -1 \end{bmatrix}$ into tridiagonal form. **[7M]**

2. (a) Solve the following linear system of equations using by Jacobi method rounded to four decimal places. **[7M]**

$$10x_1 - x_2 + 2x_3 = 6$$
$$-x_1 + 11x_2 - x_3 + 3x_4 = 25$$
$$2x_1 - x_2 + 10x_3 - x_4 = -11$$
$$3x_2 - x_3 + 8x_4 = 15$$

(b) Find the largest eigen value and corresponding eigen vector of the matrix $\begin{bmatrix} 1.5 & 0 & 1 \\ -0.5 & 0.5 & -0.5 \\ -0.5 & 0 & 0 \end{bmatrix}$ by using power method. **[7M]**

## UNIT – II

3. (a) Using Newton divided differences, construct the interpolating polynomial for the data set given below **[7M]**

| i | 1 | 2 | 3 | 4 | 5 |
|---|---|---|---|---|---|
| x | 0 | 5 | 7 | 8 | 10 |
| y | 0 | 2 | -1 | -2 | 20 |

(b) The upward velocity of a rocket is given as a function of time in the following Table. **[7M]**

| t(s) | 0 | 10 | 15 | 20 | 22.5 | 30 |
|---|---|---|---|---|---|---|
| v(t)(m/s) | 0 | 227.04 | 362.78 | 517.35 | 602.97 | 901.67 |

Determine the value of the velocity at t=16 seconds with third order polynomial interpolation using Lagrangian polynomial interpolation.

4. Construct the free cubic spline to approximate $f(x) = \cos \pi x$ by using the values given by $f(x)$ $at\, x = 0, 0.25, 0.5, 0.75$ and 1.0 **[14M]**

## UNIT – III

5. (a) Using the formula $f'(x) = \frac{f(x+h)-f(x-h)}{2h}$ and Richardson extrapolation find $f'(3)$from the following table values. **[7M]**

| x | -1 | 1 | 2 | 3 | 4 | 5 | 7 |
|---|---|---|---|---|---|---|---|
| f(x) | 1 | 1 | 16 | 81 | 256 | 625 | 2401 |

(b) Given the values of $f(x) = \ln x$ , find the approximate values of $f'(2.0)$ $and\, f''(2.0)$ using quadratic interpolation and also obtain an upper bound on the error. **[7M]**

| x | 2.0 | 2.2 | 2 .6 |
|---|---|---|---|
| f(x) | 0.69315 | 0.78846 | 0.95551 |

6. Find the maximum and minimum values from the following table **[14M]**

| x | -2 | -1 | 0 | 1 | 2 | 3 | 4 |
|---|---|---|---|---|---|---|---|
| f(x) | 2 | -0.25 | 0 | -0.25 | 2 | 15.75 | 56 |

## UNIT – IV

7. (a) Estimate the values of $\frac{\delta f}{\delta x}$at $(0.2, 0.1)$ , $\frac{\delta f}{\delta y}$ at $(0.2, 0.2)$ using first order formula and $\frac{\partial^2 f}{\partial x \partial y}$at $(0.2, 0.2)$ using second order formula from the following table values. **[7M]**

| $x \rightarrow / y \downarrow$ | 0.1 | 0.2 | 0.3 |
|---|---|---|---|
| 0.1 | 2.02 | 2.0351 | 2.0403 |
| 0.2 | 2.0351 | 2.0801 | 2.1153 |
| 0.3 | 2.0403 | 2.1153 | 2.1803 |

(b) For the method $f'(x_0) = \frac{-3f(x_0)+4f(x_1)-f(x_2)}{2h} - \frac{h^2}{3} f'''(\zeta)\,;\ x_0 < \zeta < x_2$ determine the optimum value of h , using the criteria $|RE| = |TE|$. **[7M]**

8. Evaluate the integral $\int_1^2 \int_1^2 \frac{dxdy}{x+y}$ using trapezoidal rule with $h = k = 0.5$ *and* $h = k = 0.25$. Improve the estimate using Romberg Integration. **[14M]**

## UNIT – V

9. (a) Apply Euler's method with step sizes $h = 0.3, 0.2$ *and* $0.15$ to compute approximations to y(0.6) by solving ordinary differential equation $y' = x(y + x),\ y(0) = 2$ **[7M]**

   (b) Using RK method of order 2 compute $y(2.5)$ from $y' = \frac{(y+x)}{x},\ y(2) = 2$, taking $h = 0.25$ **[7M]**

10. (a) Solve boundary value problem $u'' = u + x;\ u(0) = 0, u(1) = 0$ with $h = 1/4$ **[7M]**

    (b) Solve by Taylor's series method the equation $y' = \log(xy)$ ; $y(1) = 2$ for $y(1.1)$ and $y(1.2)$ **[7M]**

Hall Ticket No | | | | | | | | | | |  Question Paper Code: BST201

# INSTITUTE OF AERONAUTICAL ENGINEERING

**(Autonomous)**

M.Tech I Semester End Examinations (Regular) - February, 2017

**Regulation: IARE–R16**

## MATRIX METHOD OF STRUCTURAL ANALYSIS

**(Structural Engineering)**

**Time: 3 Hours** **Max Marks: 70**

**Answer ONE Question from each Unit**
**All Questions Carry Equal Marks**
**All parts of the question must be answered in one place only**

### UNIT – I

1. (a) Differentiate between static indeterminacy and kinematic indeterminacy with examples. [8 M]
   (b) Determine the degree of static indeterminacy of the pin-jointed plane frame shown in Figure 1. [6 M]

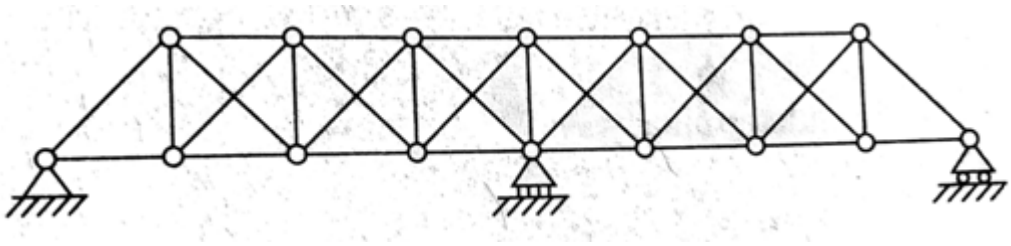


Figure 1

2. (a) Develop the flexibility matrix for prismatic member AB with hinged support at A and roller support at B as shown in Figure 2. [7 M]

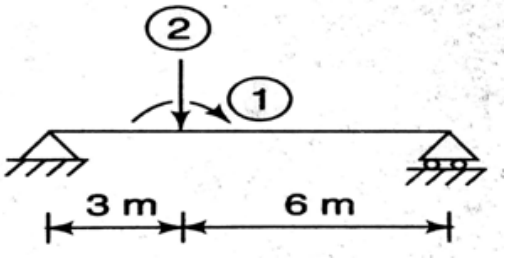



Figure 2

   (b) Develop the stiffness matrix for prismatic member AB with hinged support at A and roller support at B as shown in figure 3. [7 M]

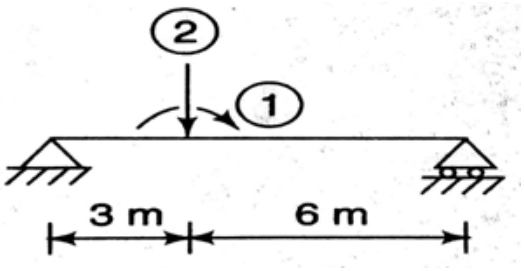



Figure 3

**UNIT – II**

3. (a) Determine the degree of static and kinematic indeterminacies of the beam shown in Figure 4. [6 M]

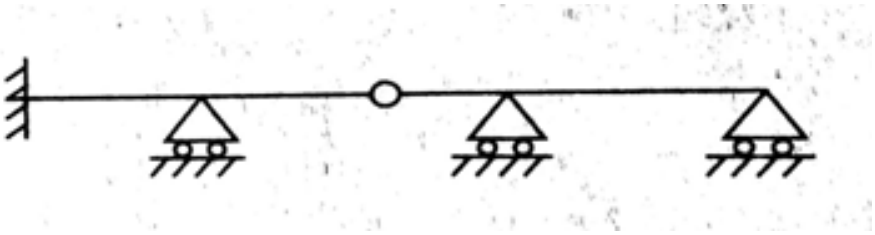


Figure 4

(b) Using the stiffness method, calculate the end deflection and rotation of a cantilever beam loaded uniformly as shown in Figure 5. EI is constant. [8 M]

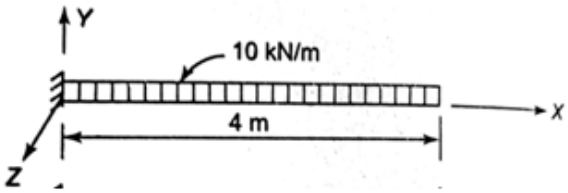



Figure 5

4. (a) Explain the step by step procedure for stiffness matrix method. [12 M]

(b) Determine the degree of freedom for the beam given in Figure 6. [2 M]

Figure 6

## UNIT – III

5. Analyse the continuous beam shown in Figure 7 using flexibility method. [14 M]

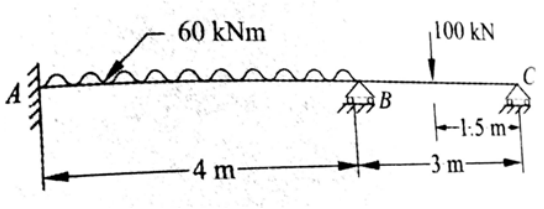



Figure 7

6. Analyse the pin-jointed structure shown in Figure 8 by using flexibility method. The cross sectional area of ach member is 2000 $mm^2$. Take $E = 200\ kN/mm^2$. [14 M]

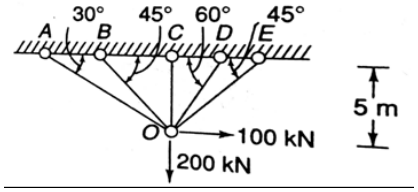



Figure 8

## UNIT – IV

7. Analyse the continuous beam shown in Figure 9 using stiffness method. [14 M]

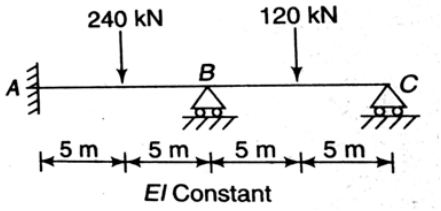



Figure 9

8. Analyse the frame shown in Figure 10 using stiffness method. [14 M]

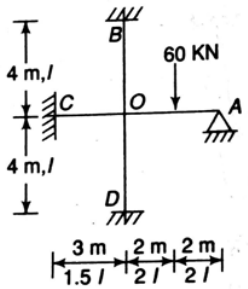



Figure 10

## UNIT – V

9. Describe briefly about the behavior of large frames shear walls. [14 M]

10. Analyse the frame shown in Figure 11 and draw the B.M.D. Consider EI as constant. [14 M]

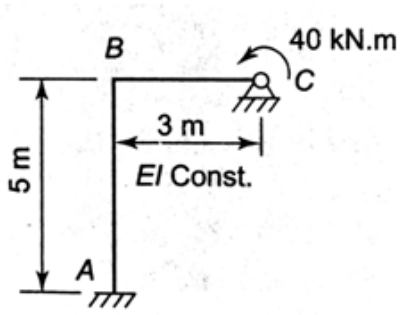



Figure 11

Hall Ticket No | | | | | | | | | | | Question Paper Code: BST205

# INSTITUTE OF AERONAUTICAL ENGINEERING

**(Autonomous)**

M.Tech I Semester End Examinations (Regular) - February, 2017

**Regulation: IARE–R16**

## ADVANCED CONCRETE TECHNOLOGY

**(Structural Engineering)**

**Time: 3 Hours** **Max Marks: 70**

**Answer ONE Question from each Unit**
**All Questions Carry Equal Marks**
**All parts of the question must be answered in one place only**

### UNIT – I

1. (a) Discuss the manufacturing process of Portland cement in wet and dry method. **[7M]**
   (b) Explain Bogue's compounds and explain in detail the four major Bogue's compounds. **[7M]**
2. (a) Explain in detail the hydration of cement and heat of hydration. **[7M]**
   (b) Explain influence of rate of cooling on the compressive strength of cement. **[7M]**

### UNIT – II

3. (a) Discuss the factors affecting the workability of concrete and the tests commonly employed to measure the workability of concrete. **[7M]**
   (b) Explain in detail the slump cone test and also the various patterns of the slump. **[7M]**
4. (a) Discuss the process of manufacture of concrete and various curing methods of concrete. **[7M]**
   (b) Explain the significance of water/cement and the gel/space ratio in the compressive strength of concrete. **[7M]**

### UNIT – III

5. (a) Discuss the methods of making high strength concrete in detail. **[7M]**
   (b) Explain the attributes specifically when a high performance concrete is known as the high strength concrete. **[7M]**
6. (a) Discuss the techniques used for producing ultra high strength concrete in detail. **[7M]**
   (b) Explain the factors when a concrete is known as a high strength concrete comparing with the ordinary concrete. **[7M]**

### UNIT – IV

7. (a) Explain the classification of the light weight aggregates used in light weight concrete. **[7M]**
   (b) Explain the design of light weight aggregate concrete mix. **[7M]**

8. (a) Explain briefly about the aerated concrete and the no fines concrete and there advantages. **[7M]**

   (b) Discuss the concept of the drying shrinkage of no fines concrete in comparison the Conventional concrete. **[7M]**

## UNIT – V

9. (a) Describe the procedure in adopting the IS and DOE methods. **[7M]**

   (b) Design the concrete mix for grade M40 with suitable conditions using the IS code. **[7M]**

10. (a) design the concrete mix for the following data using IS code: **[7M]**
   Characteristic compressive strength=30MPa
   Maximum size of aggregate=20mm (angular)
   Degree of workability = 0.8CF
   Degree of quality control = good
   Type of exposure = very severe
   Water absorption by CA = 1.5%
   Moisture content of FA = 2.0%
   Assume any suitable missing data.

   (b) Design the concrete mix for the grade M25 with suitable conditions using ACI method. **[7M]**
   Find the quantities of constituents of the mix for a bag of cement.

Hall Ticket No | | | | | | | | | | | Question Paper Code: BPE701

# INSTITUTE OF AERONAUTICAL ENGINEERING

**(Autonomous)**

M.Tech I Semester End Examinations (Regular) - February, 2017

**Regulation: IARE–R16**

## RENEWABLE ENERGY SYSTEMS
## (Common to ES|(CAD/CAM)|STE)

**Time: 3 Hours** **Max Marks: 70**

**Answer ONE Question from each Unit**
**All Questions Carry Equal Marks**
**All parts of the question must be answered in one place only**

### UNIT – I

1. (a) Define solar radiation and electromagnetic spectrum. Explain how a solar cell works. **[7M]**

   (b) Taking a solar power content of 1 $W/cm^2$ at the space-station location, calculate the area of solar panels required at 20 efficiency of conversion for powers of 2000 MW, 2400 MW, 35000 MW and 70000 MW. **[7M]**

2. (a) Write about reflection and anti-reflection coating. **[7M]**

   (b) The reflection coefficients of some semiconductors are: Te = 0.28, CdTe = 0.19. Calculate the indices of refraction for them. **[7M]**

### UNIT – II

3. (a) Write elaborately on Magneto Hydro Dymanic (MHD) generator, explaining its parts. **[7M]**

   (b) An MHD duct has the dimensions, w=0.59m, h=0.34m and l=1.69m (Volume = $0.339m^3$). The magnetic field strength is B=3.9T along h, and the gas velocity is u=550/s along l. At a performance coefficient of K=0.60, calculate: **[7M]**

      i. Generated voltage and its gradient $E_1$ inside the duct;

      ii. Load voltage and the gradient E caused by it inside the duct.

4. (a) Write in detail types of wind turbines highlighting their classification. **[7M]**

   (b) The undisturbed wind speed at a location is $v_i$=35 mile/hr, the speed at turbine rotor is 65% of this value and the speed at exit is 32% of $v_i$. The rotor diameter is 10m.$\rho = 1.297kg/m^3$. Calculate: **[7M]**

      i. $v_i$ in m/s.

      ii. Power available in undisturbed wind at the turbine rotor

      iii. Power in the wind at outlet

      iv. Power developed by turbine

      v. the value of $C_p$.

## UNIT – III

5. (a) What are the generating modes with respect to a tidal project? **[7M]**

   (b) A tidal project has installed capacity of 3000MW in 64 units each of 34MW rated output. The head at rated output is 5.52m. The embankment is 4 miles long = 6.4km. Again assume 95% efficiency for both turbine and generator. The generation is 5 hours twice a day. Calculate **[7M]**

   i. The quantity of water flowing through each turbine & total flow out of the tidal basin.

   ii. The surface area of the reservoir behind the embankment and the wash.

   iii. Energy produced in TW-h per year.

6. (a) Write short notes on following types of Open Thermal Energy Conversion Schemes: **[7M]**

   i. Closed-Cycle System

   ii. Open Cycle System

   (b) A tidal power station has 34 generators each of 10 MW operating at a maximum head of 13.5 m. It generates for two 6-hour periods per day. Calculate the basin capacity in $m^3$, and annual energy production. Again assume 93% efficiencies. **[7M]**

## UNIT – IV

7. (a) Write about coal gasification with special reference to Lurgi's coal gasification. **[7M]**

   (b) What is meant by thermo-chemical gasification and list out gasification steps. **[7M]**

8. (a) Discuss about Global Energy Position. **[7M]**

   (b) Write briefly about the pollution-free energy systems. **[7M]**

## UNIT – V

9. (a) After listing the types of fuel cells write about: **[7M]**

   i. Polymer Electrolyte Membrane Fuel Cells (PEMFC)

   ii. Direct Methanol Fuel Cells (DMFC)

   (b) Explain Hydrogen-Oxygen Fuel cells with the help of a neat and labeled diagram. **[7M]**

10. (a) Write about the various applications of fuel cells with respect to their power. **[7M]**

    (b) Discuss Li-ion batteries as a feasible ones for large scale power application and briefly write about its disadvantages. **[7M]**