BANGLADESH UNIVERSITY OF ENGINEERING AND TECHNOLOGY, DHAKA

L-1/T-2   B. Sc. Engineering Examinations 2010-2011

Sub : **ME 171** (Computer Programming Language)

Full Marks: 210   Time : 3 Hours

The figures in the margin indicate full marks.

USE SEPARATE SCRIPTS FOR EACH SECTION

SECTION – A

There are **FOUR** questions in this Section. Answer any **THREE**.

1.   (a) Write a code segment to find the number of prime numbers residing in between 1000 and 5000.   **(18)**

(b) Write the output of the following code: **(10)**

```
int i,j;
for(i=0;i<=4;i++){
    if(i==0 || i==4){
        for(j=0;j<18;j++) printf("*");
        printf("\n");
    }
    else
        printf("*\t\t*\n");
}
```

(c) How does *do-while* loop differ from *for* and *while* loops?   **(7)**

2.   (a) Write the output of the following code: **(15)**

```
int a=10;
int calc(int,int&);

void main(void){
    int x=5,y=8,z;
    z = calc(x,y);
    printf("%d\t%d\t%d\t%d",a,x,y,z);
}

int calc(int a,int& b){
    int p,q;
    p = a*b;
    b = b+p;
    q = a+b;
    return q;
}
```

(b) Write a macro function that will return the absolute value of a given integer number.   **(10)**

(c) While doing a calculation you need to save few data in an output file. Consider the output file to be *grades_me171.dat* and data to be the student number and grade point average of 60 students stored in two arrays. Write the necessary code to accomplish the job.   **(10)**

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3. (a) You have grade point average (GPA) of 60 students in an array according to their student number. Write a function that will sort the array according to their merit in descending order (highest GPA at the beginning). The function should also calculate average GPA and standard deviation of GPA values of 60 students in such a way that the calling function can use them. **(25)**

(b) Write the code to define necessary arrays and print an augmented matrix as shown below **(10)**

$$1\ 2\ 3\ |\ 10$$
$$4\ 5\ 6\ |\ 11$$
$$7\ 8\ 9\ |\ 12$$

$$where\ A = \begin{bmatrix} 1 & 2 & 3 \\ 4 & 5 & 6 \\ 7 & 8 & 9 \end{bmatrix} and\ B = \begin{Bmatrix} 10 \\ 11 \\ 12 \end{Bmatrix}$$

4. (a) Write a function that can determine the length of a given string. **(10)**

(b) Explain **(*ptr)++** and ***ptr++** where *ptr* is a pointer to integer. **(8)**

(c) Define a structure named *StudentInfo* having the following information: name of a student (e.g. Asif Ahmed), student number (e.g. 1010101), department code (e.g. 10 for ME), level and term (e.g. L1/T2), and cumulative grade point average (e.g. 3.42). **(10)**

(d) Write the output of the following code:

```
typedef float distance;
float speed, duration;
distance ShahbagKakoli = 7.2, NilkhetShaymoli = 5.9, max;
speed = 12.7;
max = (ShahbagKakoli > NilkhetShaymoli) ? ShahbagKakoli : NilkhetShaymoli;
duration = (max / speed) * 60;
printf("Maximum time taken %5.2f min", duration);
```

SECTION – B

There are **FOUR** questions in this Section. Answer any **THREE**.

5. (a) List all the main components of a personal computer. **(7)**

(b) Name and differentiate the two main categories of computer memory. **(7)**

(c) What are the advantages of LCD monitors compared to CRT monitors? **(5)**

(d) What are the four phases of information processing cycle? Explain briefly. **(5)**

(e) What is a data bus? Write down the differences between RAM and Cache. **(8)**

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6. (a) Convert the following numbers as indicated: **(10)**

    (i)   octal '703' to decimal

    (ii) hexadecimal '1AF' to binary

    (iii) decimal '29.8' to binary.

   (b) What is the value of 'k', 'M', and 'G' in bytes? **(2)**

   (c) Show, how an integer and a float number are stored in computer memory. **(8)**

   (d) Perform the bitwise operation on the following expressions: **(10)**

    (i)   104 & (~(13<<3))

    (ii) 187 | (15^(127>>2))

   (e) What does the following statement do? Explain. **(5)**

      #define FAILED (1<<3)

      status &= ~ FAILED;

7. (a) Develop a flowchart to compute the roots of a Quadratic equation $AX^2 + BX + C = 0$. Allow the possibility that $(B^2 - 4AC) <= 0$. **(15)**

   (b) Develop an algorithm to do bubble sorting. **(15)**

   (c) Mention the similarities between the computer Programming languages C and C++. **(5)**

8. (a) Which of the following switch statements are not valid to print "RED" if a character variable 'color' has value 'R' or 'r'? **(5)**

    (i)   switch (color) { case 'R': case 'r': printf("RED"); break; }

    (ii) switch (color) { case 'R': printf("RED"); break; case 'r': printf("RED"); break; }

    (iii) switch (color) { case 'R' || 'r': printf("RED"); break; }

   (b) What will be the output of the following code segment, if the function is called as larger(10,20)? **(7)**

```
int max = x;
if(max<y) {
      max = y;
      return y; }
else
return x;
printf("Larger of %d and %d is %d,x,y,max); }
```

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(c) What will be the output of the following code?　　　　　　　　　　**(5)**

```
main() {
int a='A';
printf("%d", a);}
```

(d) What is the output of the following program segment?　　　　**(10)**

```
#include<stdio.h>
main() {
int i=10,m=10;
printf("%d", i>m?i*i:m/m,20); }
```

(e) What will be the final value of z? Given-　　　　　　　　　　**(8)**

int z, x=5, y=–10, a=4, b=2; z=x++ - --y * b / a;

BANGLADESH UNIVERSITY OF ENGINEERING AND TECHNOLOGY, DHAKA

L-1/T-2   B. Sc. Engineering Examinations 2010-2011

Sub : **MATH 183** (Coordinate Geometry and Ordinary Differential Equation)

Full Marks: 210   Time : 3 Hours

The figures in the margin indicate full marks.

USE SEPARATE SCRIPTS FOR EACH SECTION

SECTION – A

There are **FOUR** questions in this Section. Answer any **THREE**.
Symbols have their usual meanings.

1. (a) Transform the equation   **(17)**
$12x^2 - 10xy + 2y^2 + 11x + 5y + 2 = 0$ to one in which there is no term involving x, y and xy.

(b) If by change of axes, without change of origin, the expression $ax^2 + 2hxy + by^2$ becomes   **(18)**
$a'(x')^2 + 2h'x'y' + b'(y')^2$, prove that
$a + b = a' + b'$ and $ab - h^2 = a'b' - (h')^2$

2. (a) Show that the equation   **(17)**
$2x^2 + 7xy + 3y^2 + 8x + 14y + 8 = 0$
represents a pair of straight lines and find them. Find also their point of intersection.

(b) If the equation $ax^2 + 2hxy + by^2 + 2gx + 2fy + c = 0$ represents two straight lines, prove that the square of the distance of their point of intersection from the origin is   **(18)**

$$\frac{c(a+b) - f^2 - g^2}{ab - h^2}$$

3. (a) Find the direct and transverse common tangents to the circles   **(17)**
$x^2 + y^2 - 22x + 4y + 100 = 0$ and
$x^2 + y^2 + 22x - 4y - 100 = 0$

(b) Find the equation of the pair of lines joining the origin to the points of intersection of

the line $\dfrac{x}{a} + \dfrac{y}{b} = 1$ with the circle $x^2 + y^2 = c^2$ and hence deduce that if the line is a tangent

to the circle, then   **(18)**

$$\frac{1}{a^2} + \frac{1}{b^2} = \frac{1}{c^2}$$

4. (a) Show that the tangents at the extremities of a focal chord of the parabola $y^2 = 4ax$

intersect at right angles on the directrix.   **(10)**

(b) Show that the polar equation of an ellipse whose focus in taken as pole and major axis

is taken as initial line is represented by   **(8)**

$$r = \frac{l}{1 - e\cos\theta}$$

where l is the semi-latus rectum.

(c) Show that the equation   **(17)**
$9x^2 - 16y^2 + 72x - 32y - 16 = 0$
represents a hyperbola. Find its centre, foci, directrices and latus rectum.

MATH 183

There are **FOUR** questions in this Section. Answer any **THREE**.
Symbols used have their usual meanings.

5. (a) Find the differential equation of least order of the family of circles having their centers on the y-axis. **(15)**

    (b) Solve the following differential equations:

    (i) $\sqrt{1+x^2+y^2+x^2y^2} + xy\dfrac{dy}{dx} = 0$, $y(1) = 0$. **(10)**

    (ii) $\left(x^3 + y^2\sqrt{x^2+y^2}\right)dx - xy\sqrt{x^2+y^2}\,dy = 0$ **(10)**

6. (a) Solve the following Ordinary Differential Equations:

    (i) $(x + 2y - 4)dx + (2x + y - 6)dy = 0$. **(10)**

    (ii) $(10 - 6y + e^{-3x})dx - 2dy = 0$. **(10)**

    (b) An electromotive force E(t) = $\begin{cases} 20\sin 10t, & 0 \le t \le 10 \\ 0 & t > 10 \end{cases}$ is applied to an LR series circuit

    in which the inductance is 20 henries and the resistance is 2 ohms. Find the current at any time t > 0, if initial current on the circuit is zero. **(15)**

7. Find the general solution of the following differential equations:

    (i) $(D^2 + 4D + D)y = 2x^2e^{-2x}\cos 3x$. **(15)**

    (ii) $\dfrac{d^2y}{dx^2} + a^2y = \sec ax$. **(10)**

    (iii) $x^2y'' - 4xy' + 6y = \ln x^2$. **(10)**

8. (a) solve $y'' + 3y' + 2y = \dfrac{1}{1+e^x}$. **(15)**

    (b) Given that y = e^{2x} is a solution of $(2x+1)\dfrac{d^2y}{dx^2} - 4(x+1)\dfrac{dy}{dx} + 4y = 0$. Find a linearly independent solution by reducing the order and hence write the general solution. **(10)**

    (c) Solve: $\dfrac{dy}{dx} + y = xy^3$. **(10)**

BANGLADESH UNIVERSITY OF ENGINEERING AND TECHNOLOGY, DHAKA

L-1/T-2   B. Sc. Engineering Examinations 2010-2011

Sub : **PHY 107** (Wave and Oscillation, Geometrical Optics and Wave Mechanics)

Full Marks : 210   Time : 3 Hours

The figures in the margin indicate full marks.

USE SEPARATE SCRIPTS FOR EACH SECTION

SECTION – A

There are **FOUR** questions in this section. Answer any **THREE**.

1. (a) What do you mean by the power of a lens.   **(5)**

    (b) Derive an expression for the power of a combination of two co-axial thin lenses of power P_1 and P_2 placed at a distance d apart.   **(20)**

    (c) A co-axial lens system placed in air has two lenses of focal lengths 3F and F separated by a distance 2F. Find the position of the principal points.   **(10)**

2. (a) What is spherical aberration for a lens? Discuss how spherical aberration can be minimized using a crossed lens and two convergent lenses.   **(25)**

    (b) Calculate the shape and shape factor of a lens to exhibit minimum spherical aberration when the lens material has a refractive index 1.5.   **(10)**

3. (a) What is chromatic aberration in a lens? Find the expression for the chromatic aberration in a lens.   **(15)**

    (b) Derive an expression of achromatism for two lenses in contact. "Dispersive power of a lens is a positive quantity" – Explain. Why you use two different refractive index material lenses for finding the achromatism condition of contact lenses?   **(20)**

4. (a) What is a stationary wave? Explain analytically the formation of stationary wave. Derive an expression for the distance between two consecutive nodes and antinodes.   **(25)**

    (b) A wave given by   **(10)**

$$Y_1 = A \sin(\omega t - kx)$$

is sent down in a string. Upon reflection it becomes

$$Y_2 = \frac{A}{2} \sin(\omega t + kx)$$

Show that the resultant of these two waves on the string can be written as a combination of a stationary wave and a progressive wave.

SECTION – B

There are **FOUR** questions in this section. Answer any **THREE**.

5. (a) Define forced vibration. In this vibration what happens when the natural frequency of the particle is equal to the frequency of the applied force.   **(5)**

    (b) If the mass of a spring m_s is not negligible but small compared to the mass m of the object suspended from it, then show that the time period of the simple harmonically oscillating spring is $T = 2\pi \sqrt{\dfrac{m + m_s}{k}}$, where the symbols have their usual meanings.   **(20)**

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(c) If an ideal spring is cut in half, what is the force constant of each half? How would the frequency of simple harmonic motion using a half spring differ from that using same mass (load) and the full spring? **(10)**

6. (a) Explain the term wave motion and discuss the different types of waves. **(5)**

(b) Obtain the general equation for a plane progressive wave and hence show that **(20)**

$$\frac{d^2y}{dt^2} = v^2 \frac{d^2y}{dx^2}$$

where the symbols have their usual meanings.

(c) A sinusoidal wave travelling along a string is described by **(10)**

$$y = 0.1 \sin 2\pi (640t - 2x)$$

where x and y are in meter and t is in seconds.

Calculate (i) the amplitude of the wave, (ii) wave velocity, (iii) wave length, (iv) frequency and (v) time period.

7. (a) What is meant by 'phase space'? Derive Boltzmann's equation connecting entropy and thermodynamic probability. **(17)**

(b) In a system, in thermal equilibrium at absolute temperature T, two states with energy difference 4.83×10^{-21} Joule occur with relative probability e^2. Find the temperature. ($k = 1.38 \times 10^{-23}$ Joule/K) **(6)**

(c) What are Fermions? Find the expression for the energy of a Fermi gas at absolute zero. **(12)**

8. (a) Define the following terms: **(7)**

(i) Degenerate eigenfunctions (ii) Simultaneous eigenfunctions

(b) Suppose a particle is confined in a one dimensional box of length 'L'. The potential energy of the particle is given by **(18)**

$$V(x) \quad = 0, \qquad 0 \le x \le L$$
$$= \infty, \qquad x < 0, x > L$$

Determine the energy eigenvalues and normalized wavefunctions for the particle in this box.

(c) Show that the ground state energy for one-dimensional harmonic oscillator is

$E = \frac{1}{2} t\omega_0$, where the symbols have their usual meanings. **(10)**

BANGLADESH UNIVERSITY OF ENGINEERING AND TECHNOLOGY, DHAKA

L-1/T-2   B. Sc. Engineering Examinations 2010-2011

Sub : **CHEM 141** (Chemistry of Engineering Materials)

Full Marks: 210   Time : 3 Hours

The figures in the margin indicate full marks.

USE SEPARATE SCRIPTS FOR EACH SECTION

SECTION – A

There are **FOUR** questions in this Section. Answer any **THREE**.

1. (a) What are the different available forms of plastics?   **(8)**

    (b) Describe the preparation of the following plastics with reactions (any three). Mention their uses.   **(15)**

    (i) Polyvinylchloride   (ii) Polyethylene

    (iii) Bakelite   (iv) Epoxyresin

    (c) Describe the following properties of plastics . (i) physical   (ii) Optical   and (iii) electrical   **(12)**

2. (a) Give the classification of fibres.   **(6)**

    (b) Describe the manufacturing process of Terylene giving flow chart and reactions.   **(10)**

    (c) Classify the different types of Nylon with their monomer.   **(9)**

    (d) Write short notes on the following fibers (any two).   **(10)**

    (i) Acrylic fibres (ii) Modacrylic fibres (iii) Spandex.

3. (a) What are the source of Natural Rubber?   **(7)**

    (b) Write the chemical constituent and chemical composition of Natural Rubber Latex.   **(8)**

    (c) Describe the properties of rubber and their uses.   **(10)**

    (d) Discuss the manufacturing process of styrene-butadiene rubber (SBR) with flow-chart.   **(10)**

4. (a) What are the glass formers? Why fluxes are used alone with glass formers? Discuss the chemical properties of glasses.   **(3+3+4=10)**

    (b) What do you mean by annealing? Why annealing is required for almost all glass wares and how it can be done? Mention the industrial uses of the following type of glasses.   **(2+6+6=14)**

    (i) Optical glass   (ii) Opal glass   (iii) Photosensitive glass

    (c) What are the basic raw materials of ceramic wares?   **(3+8=11)**

    Discuss the main steps of the industrial manufacturing process of ceramic wares.

CHEM 141

SECTION – B

There are **FOUR** questions in this Section. Answer any **THREE**.

5. (a) What are the important properties of refractories which differentiate it from other engineering materials? Write the name of the instruments which are constructed by the refractory materials. **(11)**

(b) Why the refractory materials do not have sharp fusion temperature? Discuss the following properties of the refractories mentioning their important applications. **(14)**

    (i) Porosity (ii) Spalling (iii) Thermal conductivity

(c) What are the different types of chemical changes occur during firing of ceramic wares? Describe the process of firing of ceramic wares using Down Draught Kiln. **(10)**

6. (a) Explain the different forms of amorphous carbon mentioning their common uses in our daily life. Describe the industrial manufacturing process of lamp-black. **(10)**

(b) Discuss the uses of industrial diamond. **(07)**

(c) What are the major troubles arise in the boiler due to use of impure water? Describe them giving emphasis to their causes and prevention. **(18)**

7. (a) Define corrosion and distinguish between corrosion and erosion with suitable examples. **(05)**

(b) Discuss the effect of different factors on the rates of atmospheric and under-water corrosion with the help of suitable diagrams. **(8+12=20)**

(c) Classify under-water corrosion and describe these with suitable chemical reactions. **(06)**

(d) Write the symbols and full names of units of rate corrosion. **(04)**

8. (a) Describe different methods in brief used for application of metallic coatings. **(15)**

(b) Write the names of at least two important inorganic non-metallic coatings. Describe the preparation and application of any one of them on the metal surface. **(10)**

(c) Write notes any two of the following **(10)**

    (i) Weld decay (ii) Cathodic control of prevention of corrosion (iii) Localized corrosion

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BANGLADESH UNIVERSITY OF ENGINEERING AND TECHNOLOGY, DHAKA

L-1/T-2   B. Sc. Engineering Examinations 2010-2011

Sub : **MATH 163** (Integral Calculus and Differential Equations)

Full Marks : 280   Time : 3 Hours

The figures in the margin indicate full marks.

Symbols used have their usual meanings.

USE SEPARATE SCRIPTS FOR EACH SECTION

SECTION – A

There are **FOUR** questions in this section. Answer any **THREE**.

1. Workout the following:

   (a) $\int \dfrac{dx}{\cos(2x - a)\cos(2x + a)}$ **(15)**

   (b) $\int (x - 3)^3 \sqrt{6x - x^2}\ dx$ **(15)**

   (c) $\int \dfrac{2}{(2 - x)^2} \sqrt[3]{\dfrac{2 - x}{2 + x}}\ dx$ **($16\frac{2}{3}$)**

2. (a) Obtain a reduction formula for   **(16)**

   $\int x \sin^n x\ dx$.

   (b) Find the value of the following series: **($12\frac{2}{3}$)**

   $$\lim_{n \to \infty} \left[\frac{1^2}{n^3 + 1^3} + \frac{2^2}{n^3 + 2^3} + \frac{3^2}{n^3 + 3^3} + \ldots\ldots\ldots + \frac{n^2}{n^3 + n^3} \right]$$

   (c) Find the value of $\displaystyle\int_0^1 \dfrac{dx}{(1 + x)(2 + x)\sqrt{x(1 - x)}}$.   **(18)**

3. (a) Evaluate: $\displaystyle\int_0^\pi \dfrac{x^3 \cos^4 x \sin^2 x}{\pi^2 - 3\pi x + 3x^2}\ dx$ **($15\frac{2}{3}$)**

   (b) Prove that $\Gamma\left(\dfrac{1}{2}\right) = \sqrt{\pi}$ **(13)**

   (c) Find the area common to the two curves: $y^2 = ax$ and $x^2 + y^2 = 4ax$.   **(18)**

4. (a) Apply Simpson's rule to calculate an approximate value of $\displaystyle\int_{-3}^3 x^4 dx$ by taking seven

   equidistant ordinates. Compare it with exact value.   **(16)**

   (b) Find the perimeter of the loop of the curve $9ay^2 = (x - 2a)(x - 5a)^2$.   **(17)**

   (c) Find the area of the surface of revolution formed by revolving the curve $r = 2a\cos\theta$

   about the initial line.   **($13\frac{2}{3}$)**

MATH 163

SECTION – B

There are **FOUR** questions in this section. Answer any **THREE**.

5. (a) Find the differential equation from the relation by eliminating A and B **(12)**

$$y = Ae^{3x} + Be^{-2x} + \sin 5x$$

where A and B are arbitrary constants.

(b) Solve: $(4x - y + 7)\,dx - (2x + y - 1)\,dy = 0$. **(20)**

(c) Solve: $2x\,dy - 2y\,dx - \sqrt{x^2 + 4y^2}\; dx = 0$. **($14\frac{2}{3}$)**

6. Solve the following differential equations:

(a) $x(1 - x^2)\,dy + y(2x^2 - 1)\,dx - ax^3 dx = 0$ **($16\frac{2}{3}$)**

(b) $(3x^2 y^4 + 2xy)\,dx + (2x^3 y^3 - x^2)\,dy = 0$ **(15)**

(c) $x\dfrac{d^2 y}{dx^2} + x\left(\dfrac{dy}{dx}\right)^2 - \dfrac{dy}{dx} = 0$ **(15)**

7. Find the general solution of the following differential equations:

(a) $\dfrac{d^3 y}{dx^3} - 7\dfrac{dy}{dx} - 6y = e^{2x} x^2$ **($16\frac{2}{3}$)**

(b) $\dfrac{d^2 y}{dx^2} - 6\dfrac{dy}{dx} + 13y = 8\sin 2x\, e^{3x}$ **(15)**

(c) $x^3 \dfrac{d^3 y}{dx^3} + 3x^2 \dfrac{d^2 y}{dx^2} + x\dfrac{dy}{dx} + y = x\log x$ **(15)**

8. (a) Solve: $[xD^2 + (x - 1)D - 1]\,y = x^2$ by the method of factorization of the operator. **($16\frac{2}{3}$)**

(b) Test for convergence of the series $\displaystyle\sum_{n=1}^{\infty} \frac{4.7.10\ldots\ldots\ldots\ldots(3n + 1)}{1.2.3\ldots\ldots\ldots\ldots n}\, x^n$ **(18)**

(c) Solve: $y = -px + x^4 p^2$; $\quad p = \dfrac{dy}{dx}$ **(12)**