L-2/T-1/IPE **Date: 5/04/2022**

BANGLADESH UNIVERSITY OF ENGINEERING AND TECHNOLOGY, DHAKA

L-2/T-1 B. Sc. Engineering Examinations 2020-2021

Sub: **ME 245** (Engineering Mechanics and Theory of Machines)

Full Marks: 280 Time: 3 Hours

USE SEPARATE SCRIPTS FOR EACH SECTION

The figures in the margin indicate full marks

SECTION – A

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

Symbols indicate their usual meaning.

1. (a) A truss supports the three loads shown in Fig. for Q1(a). Determine the forces in the members BD and CD. **(23 2/3)**

   (b) Locate the x- and y-coordinates of the center of mass of the homogeneous block assembly shown in Fig. for Q1(b). **(23)**

2. (a) Determine by direct integration the moment of inertia of the area shown in Fig. for Q2(a) with respect to the x- and y-axes. **(23 2/3)**

   (b) The slender rod AB as shown in Fig. for Q2(b) of length l = 600 mm is attached to a collar at B and rests on a small wheel located at a horizontal distance a = 80 mm from the vertical road on which the collar slides. Knowing that the coefficient of static friction between the collar and the vertical rod is 0.25 and neglecting the radius of the wheel, determine the range of values of P for which equilibrium is maintained when Q = 100 N and $\theta = 30°$. **(23)**

3. (a) Two shafts, whose centers are 1 m apart, are connected by an open V-belt drive. The driving pulley is supplied with 100 kW and has an effective diameter of 300 mm. It runs at 1000 rpm while the driven pulley runs at 375 rpm. The angle of groove on the pulleys is 40°. The permissible tension in 400 mm^2 cross-sectional area belt is 2.1 MPa. The density of the belt is 1100 kg/m^3. The coefficient of friction between the belt and the pulley is 0.28. **(23)**

   Estimate the number of belts required.

   (b) An epicyclic train is shown in Fig. for Q3(b). Ring gear A is keyed to the driving shaft and has 30 teeth. Compound wheel C and D of 20 and 22 teeth respectively are free to rotate on the pin fixed to the arm P which is rigidly connected to the driven shaft. Internal gear B which has 32 teeth is fixed. If the driving shaft runs at 60 rpm clockwise, determine the speed of the driven shaft. What is the direction of rotation of driven shaft with reference to driving shaft? **(23 2/3)**

Contd P/2

ME 245

4. Draw the profile of the cam when the roller follower moves with cycloidal motion during rise and return strokes as given below: **(46 2/3)**

(a) Rise with maximum displacement of 31.4 mm during 180° of cam rotation.
(b) Return stoke for the next 150° of cam rotation.
(c) Dwell for the remaining 30° of cam rotation.
The minimum radius of the cam is 15 mm and the roller diameter of the follower is 10 mm. The axis of the roller follower is offset by 10 mm towards right from the axis of the cam shaft.

SECTION – B

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

5. (a) The spring shown in Fig. for Q5(a) has a constant k (4 kN/m) and is held by cables so that it is initially compressed **300** mm. Given, a block of mass 50 kg pushes the spring so that it has an additional deformation of **300** mm. The block is then released from rest so that the spring pushes and sets it into motion upward along the plane. Also, given that coefficients of static and kinetic friction are 0.2 and 0.1 respectively. **(26 2/3)**

(i) Draw the free body diagram of the block when its motion starts and hence, determine the acceleration of the block.
(ii) Find the maximum distance travelled by the block in upward direction.

(b) (i) 'Mechanism is a constrained kinematic chain' – explain with necessary sketches. **(20)**
(ii) With neat sketches describe the motion of inversion of slider crank mechanism when the connecting rod is fixed.

6. (a) As shown in Fig. 6 (a), a drum of 60-mm radius is attached to a disk of 120-mm radius. The disk and the drum have a total mass of 6 kg and a combined radius of gyration of 90 mm. A cord is attached as shown and pulled with a force **P** of magnitude 20 N. Knowing that the disk rolls without sliding, determine (i) the angular acceleration of the disk and the acceleration of G, (ii) the minimum value of the coefficient of static friction compatible with this motion. **(23 1/3)**

(b) As shown in Fig Q6(b) a uniform slender rod of length L = 900 mm and mass m = 4 kg is suspended from a hinge at one end. A force P of magnitude 75 N is applied at the other end as shown. P makes an angle of 45° with the horizontal axis. Determine (i) the angular acceleration of the rod, (ii) the components of the reaction at the hinge support. **(23 1/3)**

Contd P/3

ME 245

7. (a) (i) With neat sketches show how amplitude of a vibrating body decreases with time for viscous damping and dry friction damping.

(ii) Calculate the first critical speed of a shaft that has following data: **(23 1/3)**

l = 1 m, e = 0.2 mm, q = 400 N/m, EI = 10^5 Nm^2

Also find the deflection from static elastic curve when ω tends to 99% of the critical speed. Assume the shaft as a simple beam.

(b) A shaft carries two unbalanced revolving masses at two different planes 1 and 2. Given m_1 = 1.8 kg, r_1 = 0.55 m, m_2 = 3kg, r_2 = 0.35 m, $\Theta_1 = 0°$, $\Theta_2 = 45°$ (angles measured ccw with reference to positive x-axis). Location of planes l_1 = 0.25 m, l_2 = 0.4 m, (length measured from the left bearing). Two correction masses are in planes 3 and 4 for dynamic balance of the shaft. Given, m_3 = 2 kg, r_3 = 0.7 m, m_4 = 1.5 kg, r_4 = 0.8 m. Calculate, for the correction masses, the angles Θ_3, Θ_4 and the location of planes l_3, l_4. (2

8. As shown in Fig. Q8, the quick return mechanism has a rotating link OA that rotates at a constant speed with the block A. Again block A slides on a link AB. For different value of the crank angle Θ (made with the horizontal axis), the velocity and acceleration diagrams are to be drawn. Consider, OA = 0.6 m, distance between O and B = 2.4 m, crank OA rotates at 12 rad/s counter clockwise. **(46 2/3)**

(a) Considering $\Theta = 0°$, neatly draw the velocity diagram and find all components of velocity of block A.

(b) Neatly draw the acceleration diagram and find all components of acceleration for block A considering $\Theta = 0°$.

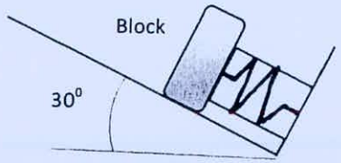

Fig. for Q 5 (a)

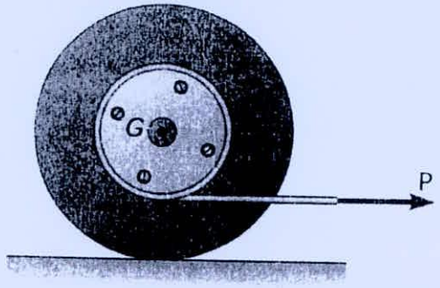

Fig. for Q 6(a)

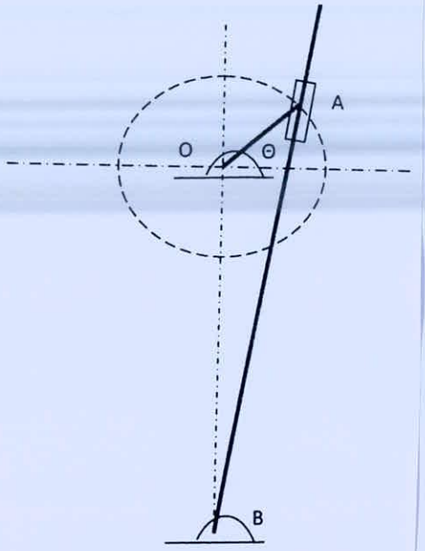

Fig. for Q 8

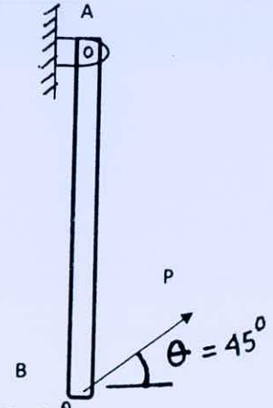

Fig. for Q 6 (b)

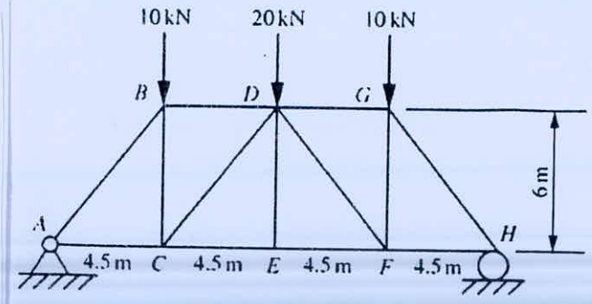

Fig. for Q1(a)

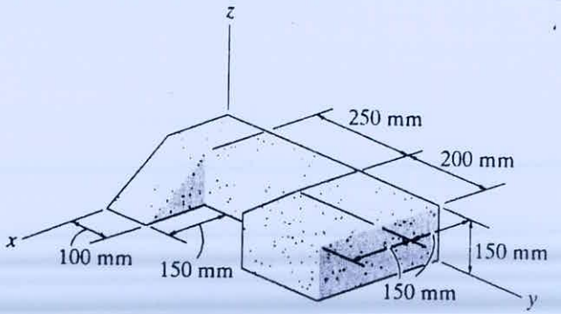

Fig. for Q1(b)

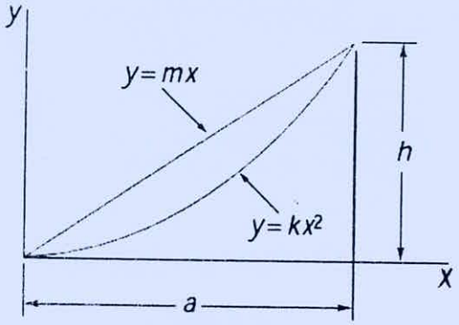

Fig. for Q2(a)

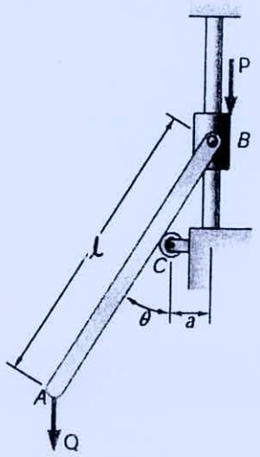

Fig. for Q2(b)

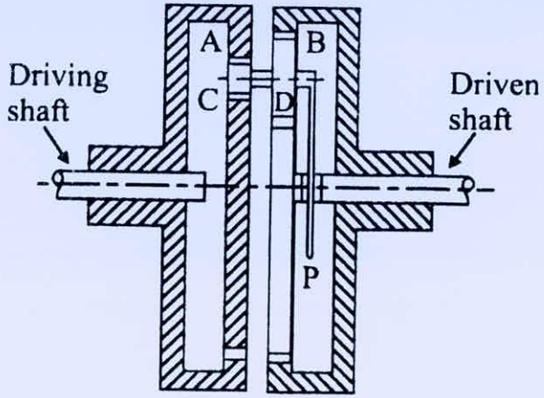

Fig. for Q3(b)

BANGLADESH UNIVERSITY OF ENGINEERING AND TECHNOLOGY, DHAKA

L-2/T-1 B. Sc. Engineering Examinations 2020-2021

Sub : **EEE 271** (Electrical Machines and Electronics)

Full Marks : 210 Time : 3 Hours

The figures in the margin indicate full marks.

All the symbols have their usual meanings.

USE SEPARATE SCRIPTS FOR EACH SECTION

SECTION – A

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

1. (a) A 1500-VA, 230/115 V single phase transformer has been tested to determine the equivalent circuit. The results of the tests are shown below – (20)

Open circuit test	Short circuit test
$V_{OC} = 230$ V	$V_{SC} = 29$ V
$I_{OC} = 0.45$ A	$I_{SC} = 8.2$ A
$P_{OC} = 32$ W	$P_{SC} = 42$ W

All data given were taken from the primary side of the transformer.

(i) Calculate the equivalent circuit parameters of this transformer referred to the high-voltage side of the transformer. Draw the equivalent circuit with numerical values.

(ii) Calculate the transformer's voltage regulation at the rated conditions and 0.8 p.f. lagging.

(iii) Determine the transformer's efficiency at the rated conditions and 0.8 p.f. lagging.

(b) A simple power system is shown in Fig. for Q. 1(b). This system contains a 480-V generator connected to an ideal 1 : 20 step-up transformer, a transmission line, an ideal 10 : 1 step-down transformer, and a load. The impedance of the transmission line is $20 + j\,60\ \Omega$, and the impedance of the load is $10\angle 30°$. (15)

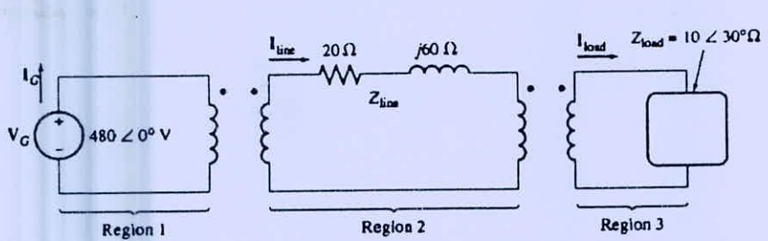

Fig. for Q. 1(b)

(i) Find the power supplied to the load in this system.

(ii) Find the power consumed by the line.

Contd P/2

EEE 271/IPE

2. (a) Draw the equivalent circuit of an induction motor and a synchronous motor. What are the basic differences between them? (15)

(b) A 460-V, 25-hp, 50 Hz four-pole, 3-ϕ, Y-connected induction motor has the following impedances in ohms per phase referred to the stator circuit – (20)

$R_1 = 0.641\ \Omega$

$X_1 = 1.106\ \Omega$

$R_2 = 0.332\ \Omega$

$X_2 = 0.464\ \Omega$

$X_M = 26.3\ \Omega$

The total rotational losses are 1100 W and are assumed to be constant. The core loss is lumped in with the rotational losses. For a rotor slip of 2 percent at the rated voltage and rated frequency, find the motor's –

(a) Speed

(b) Stator current

(c) Power factor

(d) P_{conv} and P_{out}

(e) τ_{ind} and τ_{load}

(f) Efficiency

3. (a) Describe the effect of field current change in a synchronous motor with necessary diagrams. Also draw the V curves of a synchronous motor. (12)

(b) Draw the torque-speed characteristic of a synchronous motor. What will happen if the torque on the shaft of a synchronous motor exceeds the pull out torque? (8)

(c) A 480 V, 100 kW, 50 Hz, four pole, 3-ϕ, Y-connected synchronous motor has a rated power factor of 0.8 lagging. At full load, the efficiency is 85 percent. The armature resistance is 0.2 Ω and the synchronous reactance is 2.0 Ω. Find the following quantities for this machine when it is operating at full load – (15)

(i) Shaft speed

(ii) Output torque

(iii) Input power

(iv) I_A and E_A

(v) P_{conv}

(vi) $P_{mech} + P_{core} + P_{stray}$

4. (a) On which sides of the transformer open circuit tests and short circuit tests are performed and why? (5)

(b) "A set of balanced 3φ currents can generate a rotating magnetic field" – explain with necessary diagrams. (12)

Contd P/3

EEE 271/IPE

Contd... Q. No. 4

(c) A 208-V, 45-kVA, 0.8 p.f. leading, Δ-connected, 3-ϕ, 60-Hz synchronous motor has a synchronous reactance of 2.50 Ω and a negligible armature resistance. Its friction and windage losses are 1.5 kW, and its core losses are 1.0 kW. The shaft is supplying a 15-hp load, and the motor's power factor is 0.80 leading. (18)

(i) Find the values of I_A, I_L and E_A.

(ii) Assume that the shaft load is now increased to 25 hp. Find the value of I_A, I_L and E_A after the load change. What is the new power factor of the motor?

SECTION – B

There are **FOUR** questions in this section. Answer any **THREE**.
Assume reasonable values for missing data.

5. (a) You have to design a controller for a 10-hp, 120-V, 1000 r/min shunt dc motor that can control the speed in a range of 100 – 4000 rpm. Mention which speed control method/s you will use along with their operating speed range. Summarize the cause-and-effect behavior in these methods with torque speed characteristics. Also mention the maximum power and maximum torque constrain in the entire speed range. (18)

(b) A 15-hp, 120-V series dc motor has an armature resistance of 0.1 Ω and a series field resistance of 0.08 Ω. At full load, the current input is 50 A. Its magnetization curve is shown in Fig. for Q. 5(b). The core losses are 420 W, and the mechanical losses are 460 W at full load. (17)

(i) What is the speed, induced torque, and efficiency of the motor at full load?

(ii) What is the speed of the motor if it is operating at an armature current of 20 A?

(iii) Comment on its no load speed and related safety requirement.

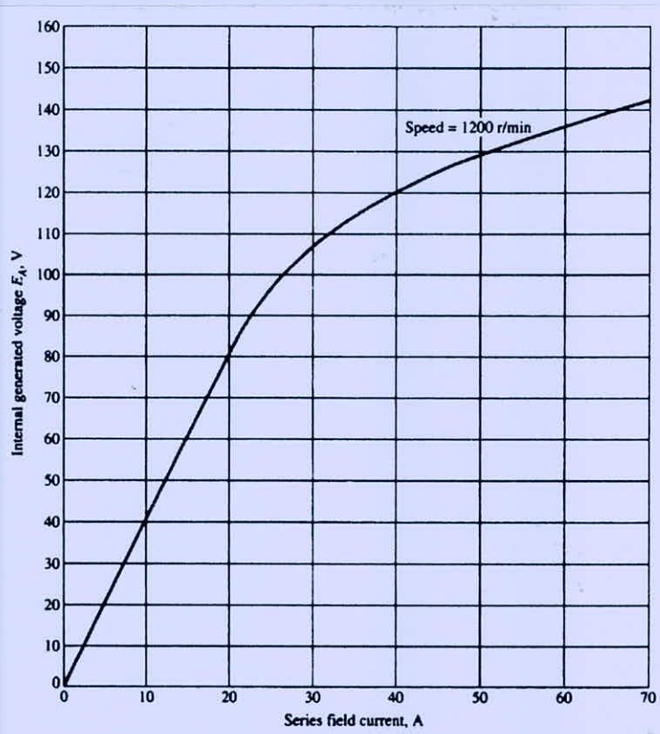

Fig. 5(b): The magnetization curve for the series motor in Q. 5(b), taken at 1200 r/min.

EEE 271/IPE

6. (a) Determine the output voltage v_0 as a function of v_1, v_2, v_3 and v_4 for the circuit shown in Fig. for Q. 6(a). (20)

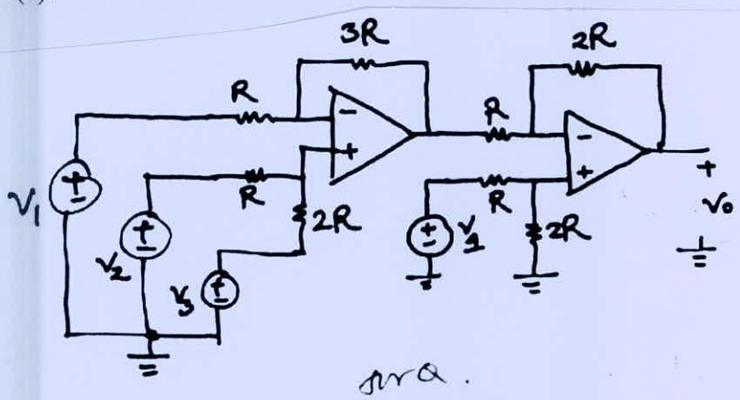

Fig. ~~2(b)~~ 6(a)

(b) Design a circuit using OpAmps to implement the following function: (15)

$$V_0 = 7V_1 - 8V_2 + 9V_3 - 7V_4$$

Suppose your designed OpAmp circuit is biased with ± 15 V. Calculate the output voltage if the input voltages are the following:

$V_1 = 1V$; $V_2 = 2V$; $V_3 = 3V$ and $V_4 = 6V$

7. (a) Design an active bandpass filter with the magnitude response shown in Fig. for Q. 7(a). (18)

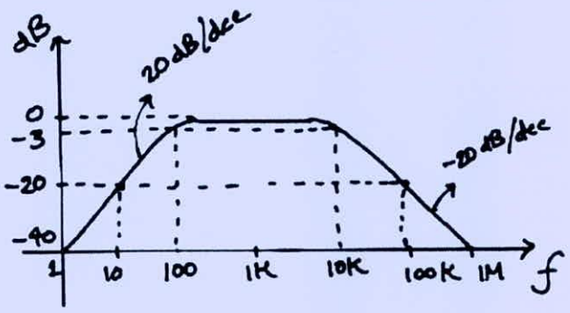

Fig. 7(a)

(b) Discuss the working principle of a strain Gauge resistive transducer. Show that, (17)

$$G_f = 1 + \gamma$$

Where, G_f = gauge factor, γ = Poisson's coefficient

8. (a) Draw the I-V curve of SCR and point out different regions. What is holding current? Explain the two-transistor model of SCR. (18)

(b) Suppose you want to design a single-phase half wave controlled rectifier that takes a 230 V rms 50 Hz ac input and supplies 77 V average output to a purely resistive load using an SCR. Calculate the firing angle α. (17)

L-2/T-1/IPE **Date: 13/4/2022**

BANGLADESH UNIVERSITY OF ENGINEERING AND TECHNOLOGY, DHAKA

L-2/T-1 B. Sc. Engineering Examinations 2020-2021

Sub: **MATH 291** (Differential Equation, Vector Calculus and Laplace Transform)

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** questions.

Symbols used have their usual meanings.

1. (a) Find the differential equation corresponding to the family of parabolas having foci at the origin and axis along x-axis. **(10)**

   (b) Solve $(2x+2y+3)dy=(x+y+1)dx$ **(12)**

   (c) Solve $(x^2+y^2+x)dx+xydy=0$ with the help of Integrating Factor. **(13)**

2. (a) Solve $y(1-\log y)\frac{d^2y}{dx^2}+(1+\log y)\left[\frac{dy}{dx}\right]^2=0.$ **(18)**

   (b) Solve $\frac{d^2y}{dx^2}+3\frac{dy}{dx}+2y=2\sin 3x$ by the method of undetermined coefficients. **(17)**

3. (a) Find the singular points of the ODE $(x^2-x-20)y''-(x+4)y'-(x-5)y=0$. Classify each singular point as regular or irregular. Hence for the singular points, find the indicial roots. **(25)**

   (b) Express x^8 as a series in Legendre's polynomial. **(10)**

4. (a) Use Bessel's function to prove that $J_0'(x)=-J_1(x)$. **(10)**

   (b) Apply Rodrigues formula to find $P_4(x)$. **(12)**

   (c) Use generating function of Legendre polynomials to show that $\int_{-1}^{1}[P_n(x)]^2dx=\frac{2}{2n+1}$. **(13)**

SECTION – B

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

5. (a) If $\mathbf{A}=(3x^2+6y)\underline{i}-14yz\,\underline{j}+20xz^2\,\underline{k}$, evaluate $\int_c \mathbf{A}\cdot d\mathbf{r}$ from (0,0,0) to (1,1,1) along the paths C given by (i) $x=t, y=t^2, z=t^3$, (ii) the straight lines from (0,0,0) to (1,0,0) then to (1,1,0) then to (1,1,1). **(17)**

Contd P/2

MATH 291/IPE

Contd... Q. No.5

(b) Evaluate $\iint_S \mathbf{A}\cdot\underline{n}\,dS$, where $\mathbf{A}=18z\underline{i}-12\underline{j}+3y\underline{k}$ and S is that part of the plane $2x+3y+6z=12$ which is located in the first octant. **(18)**

6. (a) Find the work done in moving a particle once around a circle C in the xy plane, if the circle has center at the origin and radius 3 and if the force field is given by $\mathbf{F}=(2x-y+z)\underline{i}+(x+y-z^2)\underline{j}+(3x-2y+4z)\underline{k}$. **(17)**

(b) Use Divergence Theorem to find the outward flux of $\mathbf{F}=x^3\underline{i}+y^3\underline{j}+z^2\underline{k}$ across the surface of the solid bounded by, $x^2+y^2=9$, $z=0$, and $z=2$. **(18)**

7. (a) Find (i) $L\{\sin at\}$ and then find (ii) $L\left\{\frac{\sin t}{t}\right\}$ and $L\left\{\int_0^t \frac{\sin u}{u}\,du\right\}$. **(17)**

(b) Show that (i) $L\left\{\sin\sqrt{t}\right\}=\frac{\sqrt{\pi}}{2s^{3/2}}e^{-\frac{1}{4s}}$ and (ii) Find the value of $L\left\{\frac{\cos\sqrt{t}}{\sqrt{t}}\right\}$. **(18)**

8. (a) State convolution theorem and use it to evaluate $L^{-1}\left\{\frac{1}{s^2(s^2+4)}\right\}$. **(10)**

(b) Solve the following using Laplace transform and its inverse

(i) $Y''+2Y'+5Y=e^{-t}\sin t$, $Y(0)=0$, $Y'(0)=1$; **(12)**

(ii) $tY''+2Y'+tY=0$, $Y(0)=1$, $Y(\pi)=0$. **(13)**

L-2/T-1/IPE **Date: 30/03/2022**

BANGLADESH UNIVERSITY OF ENGINEERING AND TECHNOLOGY, DHAKA

L-2/T-1 B. Sc. Engineering Examinations 2020-2021

Sub: **CSE 295** (Computer Programming Techniques)

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** questions.

1. (a) Write a C program that takes an integer number n as input and outputs the 2's complement of that number. Your program must use bitwise operation. **(12)**

   (b) Write a C program that takes a decimal positive integer n as input and outputs the binary equivalent of that number using a recursive function ***findBinary*** that takes an integer m as parameter and returns void. **(17)**

   (c) Write two disadvantages of using recursive functions. **(6)**

2. (a) Write a C program that takes a positive integer (not greater than 9) as input and outputs a specific triangular number pattern as demonstrated in the Table of Sample Input and Output. Your program must use a function TriPattern that takes an integer parameter and outputs a specific triangular number pattern as demonstrated in the Table. The function TriPatterns void. **(15)**

Sample Input	Output
3	123 12 1
4	1234 123 12 1

   (b) Write a C Program that takes two integer arrays P, Q of size m, n respectively as input. For each array, you have to take the size of the array as input and then enter the elements of that array as inputs. You need to dynamically allocate memory for these arrays. **(20)**

   Now write a function **int *fn(int *A, int m, int *B, int a)** that will take the two arrays as pointer parameters, merge them in another array C and return C as a pointer. You must print the elements of C in the main function. After printing the output you have to free the allocated memory properly. You are not allowed to use any bracket [ ] in your program.

Contd P/2

CSE 295/IPE

Contd... Q. No. 2(b)

Sample Input	Output
5 1 2 3 5 –1 3 2 1 3	1 2 3 5 –1 2 1 3

3. (a) Using bitwise operation write a code fragment showing how the values of two variables *p* and *q* can be swapped without using any additional variable. **(10)**

(b) Write the output of the following C program. Justify your answer. **(10)**

```
#include<stdio.h>
void fn1()
{
  static int u=100;
  int v=75;
  printf("%d \t %d\n",u++,v++);
 }
```

```
void main()
{
    int j;
    for(j=5;j>0;j--)
        fn1();
}
```

(c) Rewrite the following code fragment by converting the while loop into a for loop preserving its functionality. **(8)**

```
scanf("%d", &z);
result=0;
m=0;
while(m<=z)
{
  result +=m;
  m++;
}
```

(d) Write the general form of define an enumeration. Show how to create an enumeration for the primary colors (Red, Green, Blue) and declare primaryColor as a variable of this type of enumeration. **(7)**

Contd P/3

CSE 295/IPE

4. (a) Write the output of the following C program. Justify your answer. **(6+4=10)**

```
#include <stdio.h>
#define mult1(x,y) x*y
#define mult2(x,y) (x)*(y)

int main()
{
   int a=5, r1,r2;
   r1=mult1(a+1,a+1);
   r2=mult2(a+1,a+1);
   printf("%d\t %d",r1,r2);
   return 0;
}
```

(b) What is a bit-field variable? Give an example. Can the address of a bit-field variable be obtained? Justify your answer. Write the advantages of using bit-field variable. **(3+3+5+5=16)**

(c) Write the output of the following C program. Justify your answer. **(9)**

```
#include<stdio.h>
void fnCall(int p, int q, int *r)
{
  *r*=70;
  q*=*r;
  p*=q;
}
```

```
void main()
{
   int u=100, v=75, w=5;
   fnCall(u,v,&w);
   printf("%d \t %d \t %d \n",
u,v,w);
}
```

SECTION – B

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

5. (a) What is the output of the following program? Briefly explain your answer. **(10)**

```
#include<stdio.h>
int main(){
    int a,b,c,d;
    double e,f,g,h;

    a = 5>7;
    b = (1 && 0) || (5 && 6);
    e = 11/5;
    f = 7%5;
    printf("%d %d %.2lf %.2lf\n",--a,b++,e,f);

    return 0;
}
```

CSE 295/IPE

Contd... Q. No. 5

(b) Write a C program to determine whether a point (p, q) is inside, on or outside a circle with center (x, y) and radius r. **You cannot use any built-in math function for this task.** (10)

The program will take as input 5 floating point values p, q, x, y r. It will output "Inside", "On" or "outside" depending on whether the point is inside, on or outside the circle.

(c) Write a C program that takes a student's examination score as input and outputs the grade obtained. **You have to solve the problem using nested switch statements. You cannot use any if-else statements, loops or ternary operators for this task.**

The input will be a double value *score* between 0.0 to 100.0 inclusive. The corresponding grades for a *score* are as follows: **(15)**

Score	Grade
Equal or Above 80.0	A
60.0 <= *score* <80.0	B
40.0 <= *score* <60.0	C
Below 40.0	F

6. (a) Write a C program that takes two strings *orgstr* and *substr* respectively as input and removes the first occurrence of *substr* in *orgstr*. The program prints the modified string as output. **You cannot use any built-in string library function to perform this task.** (18)

The program will first take *orgstr* as input, followed by *substr*. Both *orgstr* and *substr* will consist of small letters 'a' to 'z' and would not contain any whitespaces. Both would be of at most 50 characters, and the length or *substr* will be less than or equal to the length of *orgstr*.

Sample Input	Sample Output
`abcxyzdef` `xy`	`abcdzef`
`dpqefrpqrghpqrrq` `pqr`	`dpqefrghpqrrq`
`agtcxyzab` `pqrs`	`agtcxyzab`

(b) Suppose there are two text files named "input1.txt" and "input2.txt" which contains integers. Write a C program that takes all the integers from both the files as input and writes them in ascending order in a file named "sorted.txt" The value of the integers would be between –1000 to 1000, and each input file will contain at most 500 integers. **(17)**

Contd P/5

CSE 295/IPE

Contd... Q. No. 6(b)

Sample input1.txt	Sample sorted.txt
-5 7 7 12 2 -3	-6 -5 -3 1 2 4 7 7 12
Sample input2.txt	
1 4 -6	

7. (a) Consider a cylinder whose circular base is on the XY plane. A circle in the XY plane can be represented by its center (a point in the XY plane) and radius. A cylinder whose base is on the XY plane can be represented by it's height and a circle on the XY plane. **(16)**

Now, observe the following code. Complete the following two functions:

(i) `void setvalues(cylinder *c, double height, point center, double radius)` sets the height of the cylinder and the circular base of the cylinder using the *center* and *radius* parameters of its circular base.

(ii) `double volume (cylinder c)` outputs the volume of the cylinder *c*. The volume of a cylinder is $\pi r^2 h$, where r is the radius of the circular base and h is the height of the cylinder. The value of π is 3.1416.

```
#include<stdio.h>

struct point{
    double x;
    double y;
};

struct circle{
    struct point center;
    double radius;
};

struct cylinder{
    double height;
    struct circle circular_base;
};

void setvalues(struct cylinder * c, double height, struct point center, double radius){
    // Complete this function
}

double area(struct cylinder c){
    // Complete this function
}

int main(){
    struct point p = {1.0,2.0};
    struct cylinder c;
    setvalues(&c, 3.0, p, 2.0);
    printf("%.4lf\n",area(c));
    return 0;
}
```

The expected output of the program is 37.6992. Only write down the `setvalues` and `volume` functions in your answer script.

Contd P/6

CSE 295/IPE

Contd... Q. No. 7

(b) Write down the usage of the following functions with an example for each: **(4×3=12)**

(i) char* fgets(char* str, int n, FILE* stream)

(ii) int fscanf(FILE *stream const char *format, ...)

(iii) char *gets(char *str)

(c) What is the purpose of using the typedef keyword in C? Explain with an example. **(7)**

8. (a) Execute *binary search* and *linear search* on the following array to search for the values **83, 1 & 8**: **(6×2=12)**

int arr[11] = {1, 3, 5, 17, 31, 46, 57, 83, 99, 111, 112};

For each case, write down the total number of array elements accessed and the order in which they are accessed.

(b) Write a C program that takes as input N integers and outputs the mode of the N integers (that is, the integer appearing the highest number of times). It also prints the number of occurrences of the mode. **(15)**

The first line of input is the integer N (1<=N<=100), the second line contains the N integers. All values would be within the integer range. If there are more than one integer with the highest number of occurrences, you may print any one of them.

Sample Input	Sample Output
8 1 3 3 3 2 -4 2 3	Mode: 3 Occurrences: 4
9 -25636 2 4 1 -7 -7 -25636 9 8	Mode: -25636 Occurrences: 2 [Mode: -7 would be correct too]

(c) Write down a C program that takes three integers as **command-line argument** and prints them in ascending order. **(8)**

You must take the three integers as command-line argument. Also, you cannot use any loop, ternary operator or switch statement. Use if-else statements to complete the task.

[Note that, to convert a string representation of integral number to an integer you can use the library function `int atoi (const char *str)` which takes the string as input and returns the corresponding integer value. You must include the header file `stdlib.h` in your program if you use this function.]

L-2/T-1/IPE **Date: 20/03/2022**

BANGLADESH UNIVERSITY OF ENGINEERING AND TECHNOLOGY, DHAKA

L-2/T-1 B. Sc. Engineering Examinations 2020-2021

Sub: **MME 295** (Engineering Materials II)

Full Marks: 140 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** questions.

1. (a) Explain how degree of crystallinity is affected by rate of cooling, molecular structure and chain configuration. Also, correlate the physical properties of polymeric materials with degree of crystalinity in polymers. **(9)**

   (b) What is glass transition temperature (T_g)? What are the factors that influence T_g of polymeric materials? **(6 ⅓)**

   (c) What is vulcanization? Write down the effect of vulcanization on properties of polymer. **(8)**

2. (a) Explain the toughening mechanism of glass. Mention some of the important applications of tempered glasses. **(9 ⅓)**

   (b) Compare common methods of joining of high-performance ceramics and polymeric materials. **(7)**

   (c) What is crazing? How does molecular weight tailor various properties of polymeric materials? **(7)**

3. (a) How does the stress-strain curve for polymers differ from that of metals? Draw a schematic stress-strain curve for a plastic polymer showing the important tensile properties on the curve. **(9 ⅓)**

   (b) Mention the criteria that must be met for a polymer to be elastomeric. **(6)**

   (c) Discuss the effect of degree of crystallinity and annealing heat treatment on the mechanical properties of semi-crystalline polymers. **(8)**

4. (a) For an application requiring high-strength material where cost-issue can be compromised, which one would you choose between fiber reinforced composite and particle-reinforced composite? Justify your choice. **(4 ⅓)**

   (b) Explain with necessary figures, how does fiber length influence the mechanical properties of a fiber reinforced composite? **(7)**

   (c) For a continuous and aligned fiber-reinforced composite, derive the expression for (i) modulus of elasticity in the direction of alignment, (ii) the ratio of load carried by fibers and the matrix phase in the direction of alignment. **(12)**

Contd P/2

SECTION – B

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

5. (a) List the types of ceramics, using classification of ceramics based on applications, to be used for each of these purposes: (i) cutting tools, (ii) tiles, and (iii) bones. **(6 ⅓)**

   (b) Briefly explain the function of SiO_2, Al_2O_3 and Na_2O as ingredients of glass. **(6)**

   (c) With suitable example validate the statement that "It is not only the chemical formula which determines the crystal structure but also the relative sizes of the cations and anions". **(11)**

6. (a) Predict the coordination numbers for pure copper and pure iron. Also describe their crystal structures. **(6 ⅓)**

   (b) Atomic radius of sodium and chloride ions are 0.102 nm and 0.181 nm, respectively. Calculate the theoretical density of NaCl. Also given, atomic weight of sodium and chlorine are 22.99 g/mol and 35.45 g/mol, respectively. **(6)**

   (c) Distinguish between the fluorite and antifluorite crystal structures with neat sketches and examples for each type. **(11)**

7. (a) Discus show MO/SiO_2 ratio formulates crystal structure of silicates. **(6 ⅓)**

   (b) Write a short note on tri-axial composition to design body system of traditional ceramics. **(6)**

   (c) Discuss and contrast between solid casting and drain casting processes using Plaster of Paris mold. **(11)**

8. (a) Analyse and relate how type of bonding in a material determines its yielding behaviour. **(9 ⅓)**

   (b) Find a suitable recipe for the glaze using the following segar formula of the glaze body: 0.3 K_2O, 0.1 MgO, 0.6 CaO, 0.4 Al_2O_3, 4.0 SiO_2. As raw materials use the following ceramics only: Orthoclass ($K_2O.Al_2O_3.6SiO_2$), Dolomite ($CaO.MgO.CO_2$), Whiting ($CaO.CO_2$), China clay ($Al_2O_3.2SiO_2.2H_2O$) and Flint (SiO_2). **(14)**
