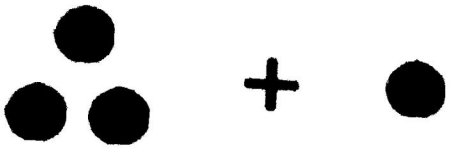
K5 Learning

Adding using pictures

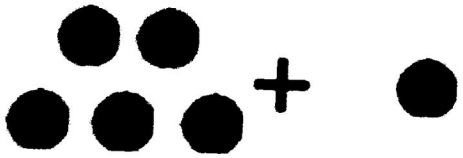
Kindergarten Addition Worksheet

Count the circles. Write the numbers. Find the sum.

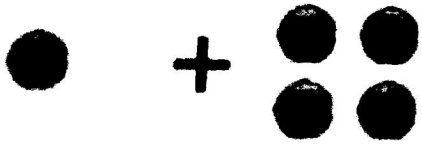


___ + ___ = ___

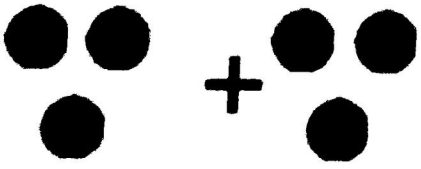
___ + ___ = ___



___ + ___ = ___



___ + ___ = ___



___ + ___ = ___

CBCS SCHEME

USN 21MAT21

Second Semester B.E. Degree Examination, July/August 2022
Advanced Calculus and Numerical Methods

Time: 3 hrs. Max. Marks: 100

Note: Answer any FIVE full questions, choosing ONE full question from each module.

Module-1

1 a. Evaluate $\int_{-c}^{c}\int_{-b}^{b}\int_{-a}^{a}(x^2+y^2+z^2)\,dx\,dy\,dz$. **(06 Marks)**

b. Evaluate $\int_{0}^{4a}\int_{\frac{x^2}{4a}}^{2\sqrt{ax}} xy\,dy\,dx$ by changing the order of integration. **(07 Marks)**

c. Prove that $\beta(m,n)=\dfrac{\Gamma(m)\Gamma(n)}{\Gamma(m+n)}$. **(07 Marks)**

OR

2 a. Evaluate $\int_{0}^{\infty}\int_{0}^{\infty} e^{-(x^2+y^2)}\,dx\,dy$ by changing to polar coordinates. **(06 Marks)**

b. Find the area between the parabolas $y^2=4ax$ and $x^2=4ay$. **(07 Marks)**

c. Prove that $\int_{0}^{\frac{\pi}{2}}\sqrt{\cot\theta}\,d\theta=\dfrac{\pi}{\sqrt{2}}$. **(07 Marks)**

Module-2

3 a. Find the directional derivative of $\phi=\dfrac{xz}{x^2+y^2}$ at the point (1, -1, 1) in the direction of $\hat{i}-2\hat{j}+\hat{k}$. **(06 Marks)**

b. Find $\text{div}\vec{F}$ and $\text{curl}\,\vec{F}$, where $\vec{F}=\text{grad}(xy^3z^3)$. **(07 Marks)**

c. If $\vec{F}=(x+y+az)\hat{i}+(bx+2y-z)\hat{j}+(x+cy+2z)\hat{k}$, find a, b, c such that $\vec{F}$ is irrotational. **(07 Marks)**

OR

4 a. If $\vec{F}=xy\hat{i}+(x^2+y^2)\hat{j}$, evaluate $\int \vec{F}\cdot d\vec{r}$ along the curve $C: y=x^2-4$ in the xy-plane from the point (2, 0) to (4, 12). **(06 Marks)**

b. Using Green's theorem, evaluate $\int_C (y-\sin x)dx+\cos x\,dy$ where C is the triangle in the xy-plane bounded by the lines y = 0, $x=\dfrac{\pi}{2}$ and $y=\dfrac{2x}{\pi}$. **(07 Marks)**

c. Using Stokes theorem, evaluate $\oint_C \vec{F}\cdot d\vec{r}$, where $\vec{F}=(x^2+y^2)\hat{i}-2xy\hat{j}$ taken around the rectangle bounded by x = 0, x = a, y = 0, y = b. **(07 Marks)**

Important Note : 1. On completing your answers, compulsorily draw diagonal cross lines on the remaining blank pages.
2. Any revealing of identification, appeal to evaluator and /or equations written eg, 42+8 = 50, will be treated as malpractice.

Method 1 :- The Syntax is

```
typedef struct
{
 type 1 member 1;
 type 2 member 2;
} TYPE-ID;
```

Note TYPE-ID is not a variable, instead it is a user-defined data type.

Example :-

```
typedef struct
{
 char name[10];
 int roll-number;
 float average-marks;
} STUDENT;
```

Method 2 :- Syntax :-

```
struct student          /* structure definition */
{                       Note :- student is the tag name
 char name[10];
 int roll number;
 float average marks;
};                      /* No memory is allocated for structure */
```

The user-defined data type can be obtained using typedef.

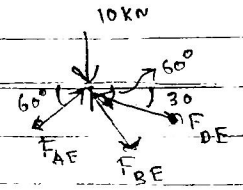
```
typedef struct student STUDENT;   /* STUDENT is user-defined
                                     data type */
```

using user defined data type STUDENT declare the variables

```
STUDENT cse, ece;      /* structure declation */

                       /* Memory is allocated for the variables */
```

At point E



$\Sigma F_x = 0$

$-F_{DE}\cos 30° - F_{BE}\cos 60° + F_{AE}\cos 60° = 0$

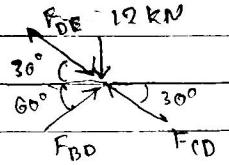
$-0.866 F_{DE} - 0.5 F_{BE} + 0.5 F_{AE} = 0$

$\Sigma F_y = 0$

$-10 + F_{DE}\sin 30° + F_{BE}\sin 60° + F_{AE}\sin 60° = 0$

$0.5 F_{DE} + 0.866 F_{BE} + 0.866 F_{AE} = 10$

At Poin D



$\Sigma F_x = 0$

$-F_{CD}\cos 30° + F_{BD}\cos 60° + F_{DE}\cos 30° = 0$

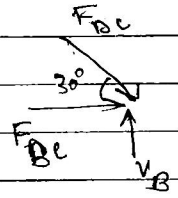
$-F_{CD} 0.866 + 0.5 F_{BD} + 0.866 F_{DE} = 0$

$\Sigma F_y = 0$

$-12 - F_{DE}\sin 30 + F_{CD}\sin 30° + F_{BD}\sin 60° = 0$

$-F_{DE} 0.5 + 0.5 F_{CD} + 0.866 F_{BD} = 0$

At Point C



$\Sigma F_x = 0$

$F_{BC} + F_{DC}\cos 30 = 0$

$F_{BC} = -0.866 F_{DC}$

$\Sigma F_y = 0$

$V_B - F_{DC}\sin 30 = 0$

$F_{DC} 0.5 = 10$

$F_{BC} = -17.32$ KN

$F_{DC} = 20$ KN

$-F_{DE} 0.5 + 10 + 9.0064 = 0$

$F_{DE} = 38$ KN

$F_{AB} = -6.92$ KN

$F_{AE} = 13.85$ KN

$F_{BE} = -10.4$ KN

$F_{BD} = 10.4$ KN

$F_{BC} = -17.32$ KN

$F_{DC} = 20$ KN

$F_{DE} = 38$ KN

Pole

Pole core, basically carries a field winding which is necessary to produce the flux

Field winding

The field winding is wound on the pole core with a definite direction

Armature

It is further divided into two parts

i) Armature core and

ii) Armature winding

commutator

The basic nature of Emf induced in the armature conductors is alternating.

Brushes and brush gear

To collect current form commutator and make it available to the stationary external circuit.

2] Explain about the working principle of a DC generator.

=> working principle of DC machine as a generator.

→ whenever a coil is rotated in a magnetic field an Emf will be induced in this coil and is given by $e = Blv \sin\theta$ volts/coil side.

where B = The flux density in Tesla, l = the active length of the coil side in meters

v = the velocity with which the coil is moved in meters/sec and θ is the angle between the direction of the flux and the direction of rotation of the coil side

The direction of the induced voltage can be ascertained by applying Fleaming's right hand rule.

3] Derive the EMF equation of D.C generator.

=> For one revolution of the conductor

Let, ϕ = Flux produced by each pole in weber (wb) and

P = number of pole in the DC generator. Therefore

Total flux produced by all the parts = $\phi \times P$

Time taken to complete one revolution = $\frac{60}{N}$

where N = Speed of armature conductor in rpm

Now, according to faraday's law of induction, the induced emf of the armature conductor is denoted by e which is equal to rate of cutting the flux

Therefore

$$e = \frac{d\phi}{dt} \quad \text{and} \quad e = \frac{\text{total flux}}{\text{time take}}$$

Induced emf of one conductor is Induced emf of one conductor is $e = \frac{\phi P}{\frac{60}{N}} = \frac{\phi PN}{60}$

for $\frac{Z}{A}$ number of conductor

The emf is

$$e = \frac{\phi PN}{60} \times \frac{Z}{A}$$

Induced Emf of DC generator is

$$e = \frac{\phi PN}{60} \times \frac{Z}{A} \text{ volts}$$

4] The armature of a 6-pole, wave wound DC generator has 604 conductors calculate the generated EMF when the flux per pole is 60 mwb and the speed is 250 rpm At the speed the armature to be driven in order to generate an EMF of 550V, if the flux per pole is reduced to 58 mwb.

⇒ P = 6 A = 2 z = 604

ϕ per pole = 60 mwb and N = 250 rpm

E_g = 550V ϕ per pole = 58 mwb

$$E_g = \frac{\phi PNz}{60A} = \frac{60 \times 10^{-3} \times 6 \times 250 \times 604}{60 \times 2}$$

$E_g = 453$ V

$$E_g = \frac{\phi PNz}{60A}$$

$$N = \frac{E_g 60A}{\phi P z}$$

$$N = \frac{550 \times 60 \times 2}{58 \times 10^{-3} \times 6 \times 604}$$

$$N = \frac{66000 \times 10^3}{210192}$$

N = 313.79 rpm

5] List the various types of DC Generators and Explain in detail?

⇒ Types of DC generators

Separately Excited Generator

In separately excited dc machines the field winding is supplied form a separate power source. That means the field winding is electrically separated from the armature circuit.

Self excited Field Generator

This type of generator has produced a magnetic field by itself without DC source form an external The electromotive force that procedured by generator at armature winding is supply to a field winding (shunt field) instead of DC source from outside of the generator.

classified as a) DC Shunt generator

b) DC Series generator

c) DC compound generator

a) Shunt generator

This generator, Shunt field winding and armature winding are connected in parallel through commutator and carbon brush

b] Series generator

The field winding and armature winding is connected in series There is different from a shunt motor due to field winding is directly connected to the electric application (load)

c) compound generator

There are two type

i) Long Shunt compound generator

ii) Short Shunt compound generator.

~~Long Shunt compound generator~~

6] A 4-pole armature of DC generator has 624 lap connected conductors and is driven at 1200rpm calculate the useful flux per pole required to generate an emf of 250V.

⇒ P=4=A Z=624 N=1200rpm

$\phi_{per\ pole}$ $E_g = 250V$

$$E_g = \frac{\phi PNZ}{60A}$$

$$\phi = \frac{E_g 60A}{PNZ}$$

$$\phi = \frac{250 \times 60 \times 4}{4 \times 1200 \times 624}$$

$$\phi = \frac{60000}{2995200} = 0.020 wb$$

$\phi_{per\ pole} = 0.20 wb$

$\phi_{per\ pole} = 0.020 wb$

$\phi_{per\ pole} = 0.020 wb$

ϕ per pole $= 0.020 wb$

7] A 4-pole ~~armature of DC generator~~ motor is fed at 440v and takes an armature current of 50A The resistance of the armature circuit is 0.28Ω the armature winding is wave connected with 888 conductors and useful flux per pole is 0.023wb calculate back emf and speed