



## SPRING END SEMESTER EXAMINATION-2018

2<sup>nd</sup> Semester B.Tech

**MATHEMATICS-II**

**MA-1002**

(For 2017 Admitted Batch)

Time: 3 Hours

Full Marks: 50

*Answer any SIX questions including question No. I which is compulsory.*

*The figures in the margin indicate full marks.*

*Candidates are required to give their answers in their own words as far as practicable  
and all parts of a question should be answered at one place only.*

1. (a) Test the convergence of the series

[1 × 10]

$$\sum_{m=1}^{\infty} \frac{(-1)^m}{3^m} (x - 1)^{2m-1}$$

and find the interval of convergence.

- (b) Express the polynomial  $f(x) = 3x^2 - 4x + 5$  in terms of Legendre's polynomials.

- (c) Find Laplace transformation of

$$f(t) = \begin{cases} \sin t & \text{if } \frac{\pi}{2} < t < \pi \\ 0 & \text{otherwise.} \end{cases}$$

- (d) Evaluate  $\int_0^1 \int_{x^2}^x (1 - 2xy) dy dx$ .

- (e) Let  $v = [x, y, -z]$  be the velocity vector of a steady fluid flow. Is the flow irrotational? Incompressible?

- (f) Let  $f(x) = \begin{cases} x^2 & \text{if } -\pi < x < 1 \\ \frac{x}{2} & \text{if } 1 \leq x < \pi \end{cases}$  be periodic with period  $p = 2\pi$  and piecewise continuous in the interval  $-\pi \leq x \leq \pi$ . Then what is the sum of the Fourier series of  $f(x)$  at  $x = 1$ .

- (g) Find the value of  $\beta(3/2, 1/2)$ .  
 (h) Find the directional derivative of

$$f(x, y, z) = x^2 + y^2 - z^2$$

at point  $a = (1, -1, 1)$  in the direction  $\vec{b} = [2, 1, 1]$ .

- (i) Express  $J_3(x)$  in terms of  $J_0(x)$  and  $J_1(x)$  where  $J_v(x)$  is the Bessel function of first kind of order  $v$ .

- (j) Find the inverse Laplace transformation of

$$\ln\left(\frac{s+3}{s+2}\right)$$

2. (a) Show that [4]

$$P_{2n}(0) = (-1)^n \frac{1 \cdot 3 \cdots (2n-1)}{2 \cdot 4 \cdots (2n)}.$$

- (b) Reduce  $x^2y'' + xy' + \left(4x^2 - \frac{9}{4}\right)y = 0$  by taking  $z = 2x$  into Bessel's equation and write the complete solution. [4]

3. (a) Find one of the solutions by Frobenius method of [4]

$$(x^2 + x)y'' + (4x + 2)y' + 2y = 0.$$

- (b) Prove that [4]

$$J_{v-1}(x) + J_{v+1}(x) = \frac{2v}{x} J_v(x).$$

4. (a) Using Laplace transform solve the integral equation [4]

$$y(t) + 2 \int_0^t y(\tau) \cos(t - \tau) d\tau = \cos t.$$

- (b) Using convolution theorem, find [4]

$$L^{-1}\left(\frac{s}{(s^2+4)^2}\right).$$

5. (a) Find the Fourier series of the periodic function  $f(x) = x|x|$ ,  $(-1 < x < 1)$  with period  $P = 2$ . [4]

- (b) Find the Fourier sine series of

[4]

$$f(x) = x^2, \quad 0 < x < 1$$

and prove the series

$$1 - \frac{1}{4} + \frac{1}{9} - \dots = \frac{\pi^2}{12}$$

6. (a) Find the integral value of

[4]

(7,8,0)

$$\int_{(1,0,0)}^{(7,8,0)} (2xy \, dx + x^2 \, dy + \sinh z \, dz).$$

- (b) Find the Fourier transform of

[4]

$$f(x) = e^{-|x|}, -\infty < x < \infty$$

7. (a) Change the order of integration and evaluate

[4]

$$\int_0^1 \int_0^y \sinh(x+y) \, dx \, dy.$$

- (b) Using Green's theorem evaluate

[4]

$$\int_C F(r) \cdot dr$$

counterclockwise around the boundary curve  $C$  of the region  $R$ , where

$$F = [x^2 + y^2, x^2 - y^2], R: 1 \leq y \leq 2 - x^2.$$

8. (a) Using Laplace transform, solve the system of equations

[4]

$$y'_1 = -6y_1 + 4y_2, \quad y'_2 = -4y_1 + 4y_2$$

$$y_1(0) = -2, \quad y_2(0) = -7.$$

(b) Evaluate the integral value of

[4]

$$\iint_S F \cdot n \, dA$$

where  $F = [4x, 3y, 5z]$ ,  $S: \vec{r} = [u, v, 3u - 2v], 0 \leq u \leq 1.5, -2 \leq v \leq 2$  and  $n$  is the unit normal vector on  $S$ .

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## SPRING END SEMESTER EXAMINATION-2018

2<sup>nd</sup> Semester B.Tech

### ENGINEERING MECHANICS

ME-1001

(For 2017 Admitted Batch)

Time: 3 Hours

Full Marks: 50

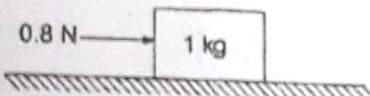
Answer any SIX questions including question No.1 which is compulsory.

The figures in the margin indicate full marks.

Candidates are required to give their answers in their own words as far as practicable and all parts of a question should be answered at one place only.

1. (a) Define free body diagram with example. [1 × 10]  
(b) A 1 kg block is resting on a surface with coefficient of friction  $\mu = 0.1$ . A force of 0.8 N is applied to the block as shown in the figure 1. Determine the friction force?

Fig.1



- (c) What are the conditions of equilibrium of three non parallel forces in a plane?  
(d) Explain moment and couple.  
(e) Using the second theorem of Pappus, calculate the centroid of a quarter circular sector of radius r, if the volume of the hemisphere  $V = \frac{2}{3} \pi r^3$ .  
(f) Explain principle of virtual work.  
(g) State the different methods for analysis of truss. What are the advantages of method of sections over method of joints?  
(h) A body is projected at an angle such that its horizontal range is three times the maximum height. Find the angle of projection.  
(i) Define coefficient of restitution. What is its value for plastic impact?  
(j) Derive impulse-momentum relation.

2. (a) Two smooth spheres, each of radius  $r$  and weight  $Q$ , rest in a horizontal channel having vertical walls, the distance between them is  $b$  as shown in figure 2. Find the reactions at the point of contact A, B and C. Take  $Q = 445 \text{ N}$ ,  $r = 254 \text{ mm}$  and  $b = 914 \text{ mm}$ . [4]

- (b) A prismatic bar AB of weight  $Q = 17.8 \text{ KN}$  is hinged to a vertical wall at A and supported at B by a cable BC. Determine the magnitude and direction of the reaction  $R_A$  at the hinge A and the tensile force  $S$  induced in the cable BC. The directions of the bar and the cable are as shown in the figure 3. [4]

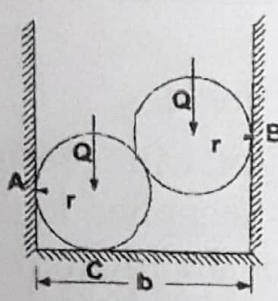


Fig.2

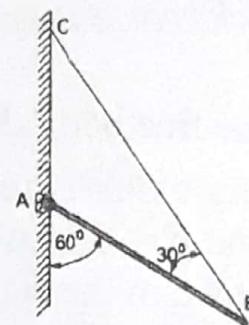


Fig.3

3. Two blocks connected by a horizontal link  $AB$ , are supported on two rough planes as shown in figure 4. The coefficient of friction for block  $A$  on the horizontal plan is  $\mu = 0.45$ . The angle of friction for block  $B$  on the inclined plane is  $\phi = 15^\circ$ . What is the smallest weight  $W$  of block  $A$  for which equilibrium of the system can exist? [8]

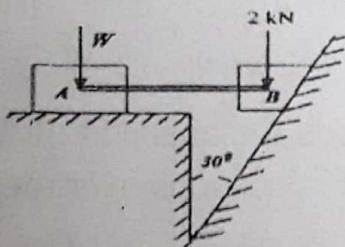


Fig.4

4. (a) Determine the coordinates  $x_c$  and  $y_c$  of the centroid  $C$  of the shaded area as shown in figure 5. [4]
- (b) Compute the reactions at the supports  $A$  and  $B$  of the beam loaded as shown in figure 6 if  $q_a = 100 \text{ N}$  and  $q_b = 200 \text{ N}$ . [4]

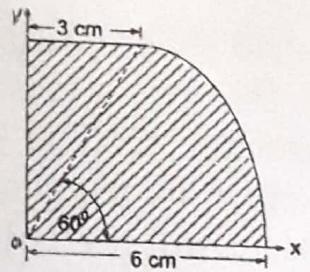


Fig.5

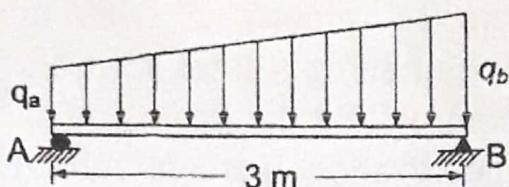


Fig.6

5. (a) Determine the forces in the bars  $BC$  and  $BD$  of the truss shown in figure 7. [4]
- (b) Find the supports reactions at  $A$  and  $B$  of the semi circular three-hinged arc loaded as shown in figure 8. [4]

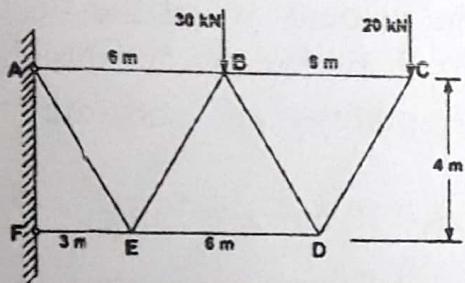


Fig.7

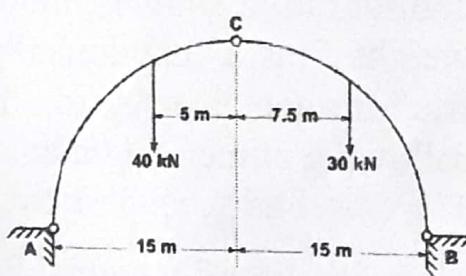


Fig.8

- ~~6.~~ (a) Find the polar moment of inertia of the shaded area about origin as shown in figure 9. [4]
- ~~(b)~~ Using the principle of virtual work, find the value of the angle defining the configuration of equilibrium of the system shown 10 in the fig. The balls D and E can slide freely along the bars AC and BC but the string DE connecting them is inextensible. [4]

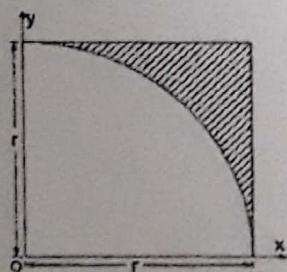


Fig.9

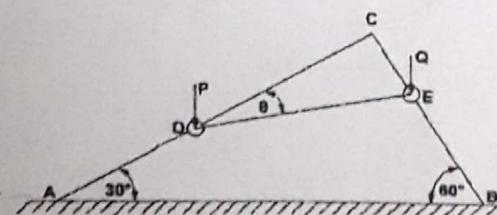


Fig.10

7. (a) A gun weighing 667.5 kN fires a 4.45 kN projectile with a muzzle velocity of 1080 m/s. The gun is nested in springs having a total spring constant  $k = 26,700$  kN/m. Assuming that the explosion is over before the gun has a chance to move perceptively, how far will it recoil after the explosion? [4]

(b) A golf ball dropped from the rest on to a cement sidewalk rebounds eight-tenths of the height through which it fell. Neglecting air resistance, determine the coefficient of restitution. [4]

8. (a) If the system in figure 11 is released from rest in the configuration shown, find the velocity 'v' of the falling weight  $P$  as a function of its displacement 'x'. Neglect friction and inertia of the pulleys and assume the following numerical data: [4]

$$P = Q = 44.5 \text{ N}, r_1 = 15 \text{ cm}, r_2 = 10 \text{ cm}, x = 3 \text{ m.}$$

(b) Two blocks of weights  $P$  and  $Q$  are connected by a flexible but inextensible cord and supported shown in figure 12. If the coefficient of friction between the block  $P$  and the horizontal surface is  $\mu = 0.33$  and all other friction is negligible, Find (a) the acceleration of the system and (b) tensile force  $S$  in the cord. Take  $P = 100 \text{ N}$  and  $Q = 50 \text{ N}$ . [4]

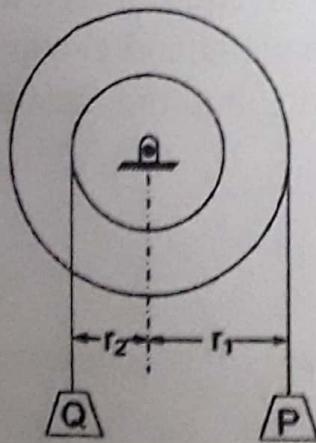


Fig. 11

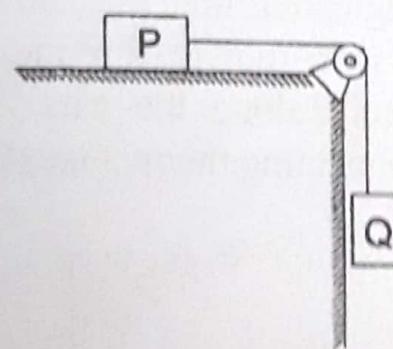


Fig. 12

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**SPRING END SEMESTER EXAMINATION-2018**  
**2<sup>nd</sup> Semester B.Tech**

**OBJECT ORIENTED PROGRAMMING**  
**IT-1002**

**(For 2017 Admitted Batch)**

Time: 3 Hours

Full Marks: 50

*Answer any SIX questions including question No.1 which is compulsory.*

*The figures in the margin indicate full marks.*

*Candidates are required to give their answers in their own words as far as practicable  
and all parts of a question should be answered at one place only.*

1. Answer all the questions [1 × 10]

(a) Assume that an integer and a pointer each takes 4 bytes.  
Predict the output of the following program with Justification .

```
#include<iostream>
using namespace std;
class Base{
public:
    virtual void show() { cout<<" In Base \n"; }
};
class Derived: public Base{
public:
    void show() { cout<<"In Derived \n"; }
};
int main(void){
    Base *bp = new Derived;
    bp->show();
    Base &br = *bp;
    br.show();
    cout<<sizeof(bp);
    return 0;
}
```

~~(b)~~ Predict the output of the following program with Justification.

```
#include<iostream>
using namespace std;
class Test{
private:
    int x;
public:
    Test(int x = 0) { this->x = x; }
    void change(Test *t) { this = t; }
    void print() { cout << "x = " << x << endl; }
};
int main(){
    Test obj(5);
    Test *ptr = new Test (10);
    obj.change(ptr);
    obj.print();
    return 0;
}
```

~~(c)~~ Predict the output of the following program with Justification.

```
#include<iostream>
using namespace std;
class abc {
public:
    static int x;
    int i;
    abc() { i = ++x; }
};
int abc::x;
int main() {
    abc m, n, p;
    cout << m.x << "\n" << m.i << endl;
    return 0;
}
```

(d) Justify, why a overloaded new operator function is static member by default.

(e) Differentiate between function overloading and function overriding.

(f) Write difference approaches to detect the end of file.

(g) Write the order of call of constructors for the following class declaration and justify it.

class D : public A, public virtual B, public C

(h) Distinguish between macro and template.

(i) What do you mean by function with default arguments? Explain with an example.

(j) Explain rethrowing of exception.

2. (a) Create a class Time having data members Hour, Minute and Second. Initialize the data members of the class through parameterized constructor. Using a member function add two Time objects and display the result. [4]

(b) Define copy constructor with a suitable example. Explain, why it takes the object as an argument by reference only. [4]

3. (a) Create an abstract class Shape which contains a pure virtual function calculate\_area() and a protected attribute named as Area. Derive two classes from the above class named Circle and Rectangle having data members named as Radius and Sides respectively. Write the complete program to calculate the area of a circle and rectangle by using base class pointer and display the result. [4]

(b) Give the syntax of overloading insertion operator with a suitable example. Explain, why the insertion operator(<<) cannot be overloaded using member function. [4]

4. (a) Explain different types of inheritance available in C++ with suitable examples. [4]
- (b) Write a program using friend class to make the swapping of two data members that belongs to two different classes. [4]
5. (a) Write a function which accepts an index and returns the corresponding element from an array. If the index is out of bounds, the function should throw an exception. Handle this exception in main(). [4]
- (b) Write a program to overload new and delete operator. [4]
6. (a) Write a program to create a class Student having Name, Roll\_no, Age and Section as its data members. Create another class Mark that stores marks of three subjects. Derive a class Result from Student and Mark class, that stores total and average marks. Display all the details of a student by calling the necessary member functions. [4]
- (b) Write a program using function template to sort the elements of an array of n integers, where n is the user input. [4]
7. (a) Write a program to copy the content of two files and merge them into a third file. [4]
- (b) Generic function can be overloaded. Justify your answer with an example. [4]
8. Write short notes on any two [4 × 2]
- (a) this pointer
- (b) Pure virtual function
- (c) Access specifies

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**SPRING END SEMESTER EXAMINATION-2018**  
**2<sup>nd</sup> Semester B.Tech**

**PHYSICS**

**PH-1003**

**(For 2017 Admitted Batch)**

Time: 3 Hours

Full Marks: 50

**Answer any SIX questions including question No.1 which is compulsory.**

*The figures in the margin indicate full marks.*

*Candidates are required to give their answers in their own words as far as practicable  
and all parts of a question should be answered at one place only.*

1.  (a) If 250N force is experienced by a body moving in a resistive medium having coefficient of resistance  $10^6$  dyne cm<sup>-1</sup>sec, then what is the velocity of the body at that instant? [1 × 10]
- (b) What changes will be observed in the spectrum if the number of lines in a plane diffraction grating is made large?
- (c) Find the order of spectrum observed in a direction of  $56.7^\circ$  when a light of wavelength 5896Å is incident normally on a plane diffraction grating having 12000 lines per inch.
- (d) The acceptance angle of an optical fibre for surrounding air medium is  $30^\circ$ . If the core has refractive index 1.5, then calculate the refractive index of the cladding.
- (e) In case of ruby laser, the laser beam produced corresponds to a wavelength 6943Å. Find the energy difference between metastable state and ground state.
- (f) Prove that electric field is irrotational.

~~(g)~~ What happens to the wavelength of matter waves associated with a particle trapped in a one dimensional potential box when its energy increases?

~~(h)~~ What is adiabatic process? Draw a T-S diagram for this process.

~~(i)~~ What is elastic limit? Mention its SI unit.

~~(j)~~ Find the Miller indices of a crystal plane having intercepts  $2a$ ,  $3b$  and  $4c$ .

2. (a) Derive an expression for the intensity at any point on the screen due to diffraction at single slit and find the condition for principal maximum, minima and secondary maxima. [6]

(b) Explain why some orders are absent in a grating spectrum. [2]

~~3. (a)~~ Derive Maxwell's electromagnetic wave equations in free space in terms of  $\vec{E}$  and  $\vec{B}$ , and show that the speed of electromagnetic waves in air is same as that of light. [5]

~~(b)~~ Show that the vector given by the equation  $\vec{A} = 5yz\hat{i} + 5zx\hat{j} + 5xy\hat{k}$  is both solenoidal and irrotational. [3]

4. (a) A particle is confined in a one dimensional potential box of infinite height. Write down the Schrödinger's equation and solve it to find the wave function of the particle. [5]

(b) Explain quantum mechanical tunneling. Give two examples of it. [3]

~~5. (a)~~ Using thermodynamic potentials derive Maxwell's four thermodynamic relations. [6]

(b) The entropy of a system increases from 40 cal/K to 60 cal/K under a constant temperature of 127°C. Calculate the amount of heat absorbed. [2]

6. (a) Define Young's modulus ( $Y$ ), modulus of rigidity ( $\eta$ ) and Poisson's ratio ( $\sigma$ ) of a given material and establish the relation,  $\eta = \frac{Y}{2(1+\sigma)}$  [6]

(b) Calculate the stretching force required to double the length of a wire of diameter 2 mm. Given  $Y = 12 \times 10^{11}$  dyne/cm<sup>2</sup>. [2]

7. (a) Find out the atomic radius and packing fraction for SC, BCC and FCC crystal systems. [6]

(b) Calculate the maximum wavelength of x-rays that can be used to observe second order Bragg's reflection from a crystal. Given the interplanar spacing of the crystal is 2.2 Å. [2]

8. (a) What is the principle of propagation of light through optical fibre? Derive an expression for numerical aperture. [4]

(b) What is population inversion? Why is it necessary for laser action? Mention any four methods for achieving population inversion. [4]

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## SPRING END SEMESTER EXAMINATION-2018

2<sup>nd</sup> Semester B.Tech

### BASIC ELECTRICAL ENGINEERING

EE-1003

(For 2017 Admitted Batch)

Time: 3 Hours

Full Marks: 50

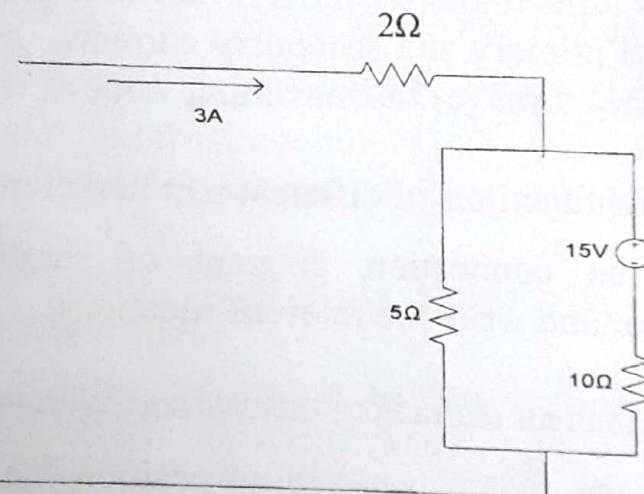
*Answer any SIX questions including question No.1 which is compulsory.*

*The figures in the margin indicate full marks.*

*Candidates are required to give their answers in their own words as far as practicable and all parts of a question should be answered at one place only.*

1. (a) Find the current in  $5\Omega$  resistor.

[1 × 10]



- (b) Calculate the average value of the signal  $v(t)=100 \cos(100t)$ .

- (c) Say the type of load for each cases

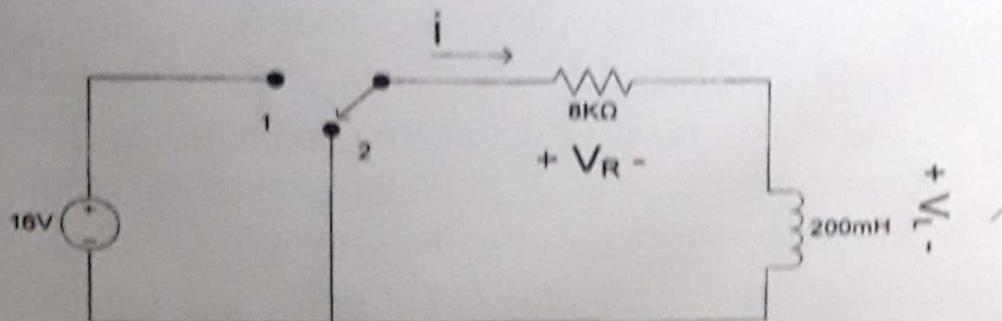
(i)  $v(t) = 42 \cos \omega t$  V,  $i(t) = 4.2 \sin \omega t$  A

(ii)  $v(t) = 10.4 \cos(\omega t - 22^\circ)$  V,  $i(t) = 0.4 \cos(\omega t - 22^\circ)$  A

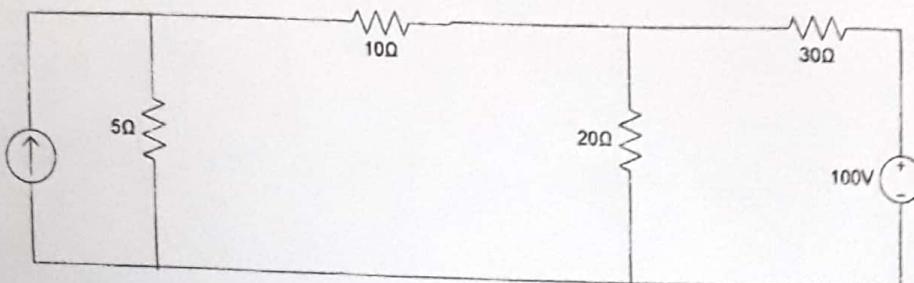
- (d) It is desired to have a 4.13 mWb maximum core flux in a transformer operating at 230V and 50Hz. Determine the required number of turns on the primary.

- (e) A 50Hz induction motor has 2 poles and runs at 2500 rpm. Calculate the percentage slip.

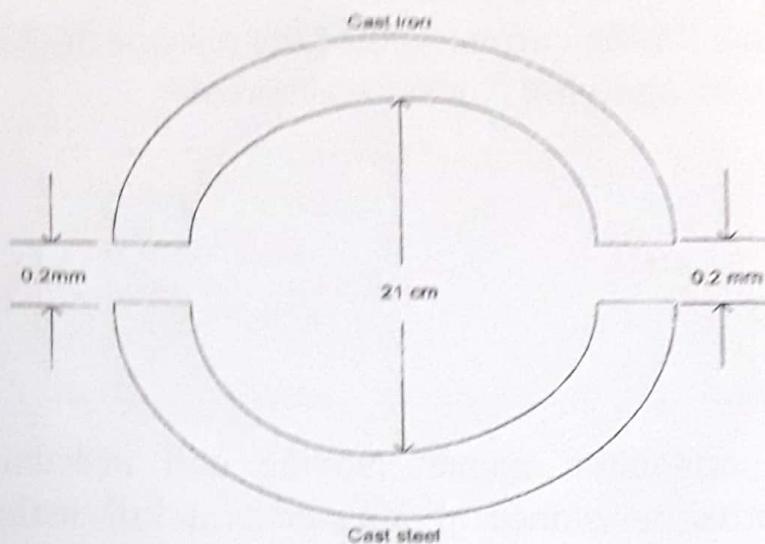
- (f) Why transformers work on a.c. supply only?
- (g) Write the applications of d.c. shunt motor.
- (h) What are the functions of the starter and choke in the operation of fluorescent tube?
- (i) The two wattmeter method is used to find power in a balance three-phase current. If the two wattmeters are found to have equal readings. Find the power factor of the circuit.
- (j) Draw BH curve of the magnetic material and show coercive force and residual flux density in it.
2. (a) State and explain superposition theorem. [4]
- (b) A 75 KVA, 6600/440 V, 50 Hz single phase transformer has 100 turns in the secondary. Calculate (a) the values of full load primary and secondary currents, (b) the number of primary turns (c) the maximum value of flux.
3. (a) Write the functions of different part of d.c. machine. [4]
- (b) Draw the connection diagram of shunt compound generator and write the relevant equations. [4]
- A. (a) Give the salient features of thermal and hydropower station. [4]
- ~~(b)~~ In Fig., the switch was kept at position 1 and was upto  $250\mu s$  and the switch was moved to position 2. Find  
 i) The current and voltage across inductor at  $t=100\mu s$ .  
 ii) The current and voltage across resistor at  $t=300\mu s$



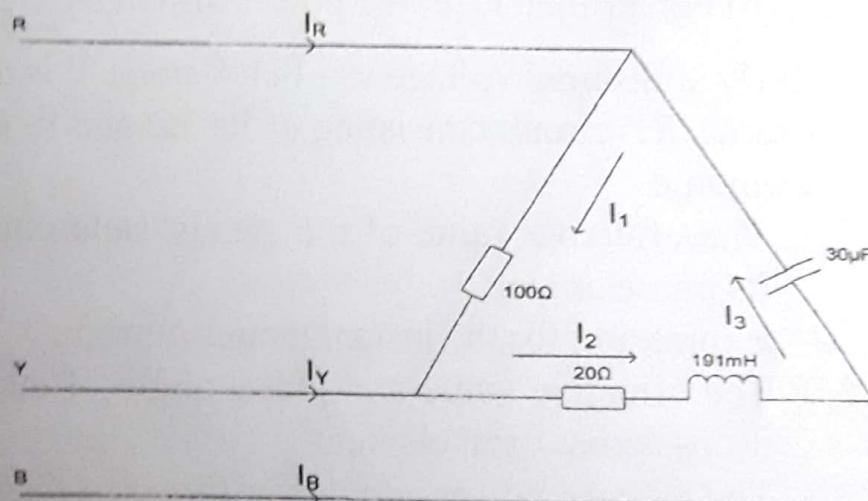
5. (a) Solve for the current in the  $20\Omega$  resistor of the network of Fig. by applying Norton's Theorem. [4]



- (b) A permanent magnet moving coil instrument having internal resistance of  $50\Omega$  gives a full scale deflection with a voltage of 25 mV. Find the series multiplier resistance value to extend its range to 10V. [4]
6. (a) An iron choke takes 4A when connected to a 20V DC supply. When connected to a 65 V, 50 Hz AC supply, it takes 5A. Determine (a) resistance and inductance of the coil, (b) power factor, (c) the power drawn by the coil. [4]
- (b) A 50 Hz sinusoidal voltage  $v = 141.4 \sin\omega t$  V is applied to a series RL circuit consisting of  $R=3\Omega$  and  $L=0.01272$  H. Compute [4]
- The effective value of the steady state current and its phase angle.
  - Expression for the instantaneous current.
  - The effective value and phase angle of the voltage drops across each element.
  - The average power and power factor of the circuit.
  - The reactive power.
7. (a) A ring having a mean diameter of 21 cm and cross-sectional area of  $10\text{cm}^2$  is made up of semicircular sections of cast iron and cast steel with each joint having reluctance equal to air-gap of 0.2 mm, as shown in figure. Determine the ampere-turns required to produce a flux of 0.8 mWb. The relative permeabilities of cast iron and cast steel are 166 and 800 respectively. Neglect fringing and leakage effects. [4]



- (b) A 3-phase, 50 Hz, 415V supply is connected to a delta-connected load comprising a resistance of  $100\Omega$ , a resistance of  $20\Omega$  in series with an inductance of  $191\text{ mH}$  and a capacitance of  $30\mu\text{F}$  as shown in Fig. Calculate [4]
- Phase currents
  - Line currents.



8.

Answer any two.

[4×2]

- (a) Analogy between electric and magnetic circuit
- (b) Explain the Function of transformer and differentiate step up & step down transformer
- (c) Torque-slip characteristics of 3 phase induction motor and its principle

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