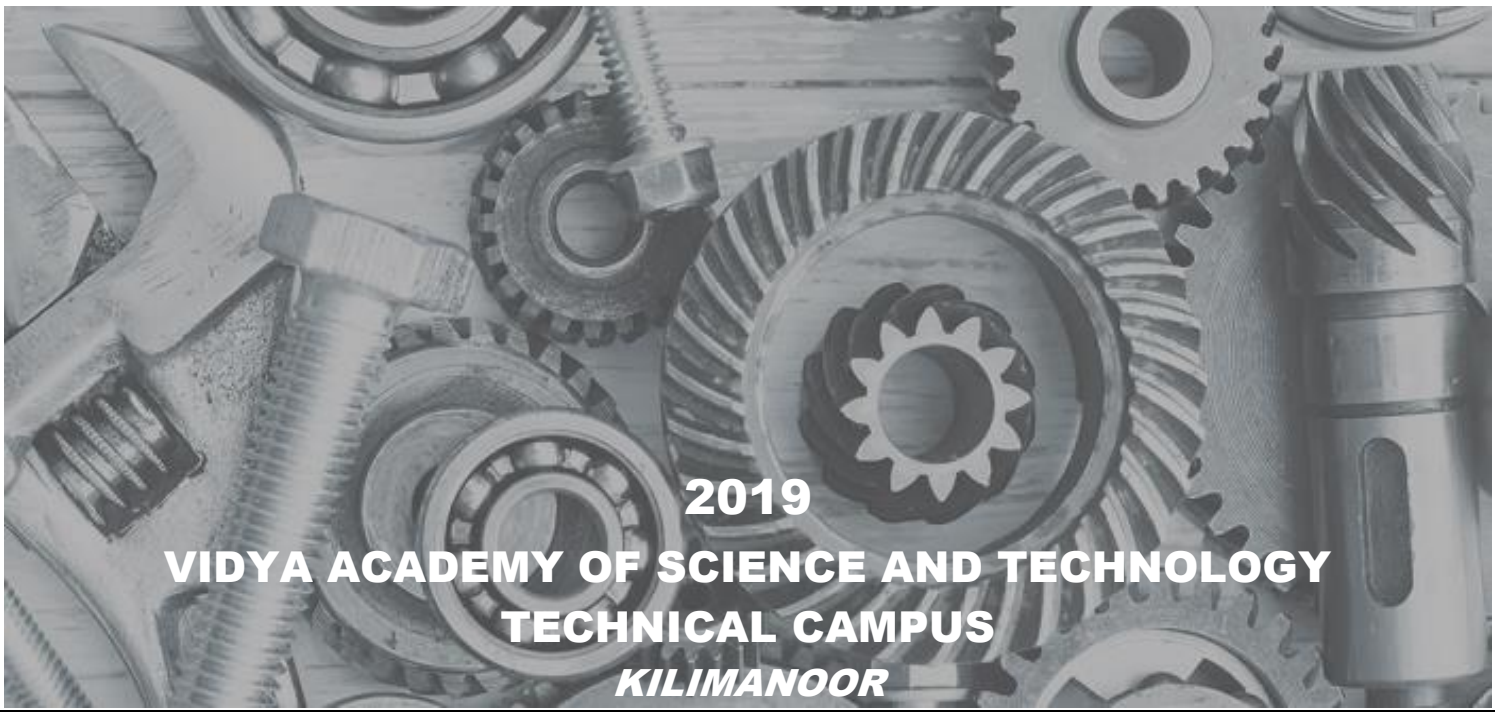
S1 ME QUESTION BANK

Department of Mechanical Engineering



2019

VIDYA ACADEMY OF SCIENCE AND TECHNOLOGY

TECHNICAL CAMPUS

KILIMANOOR

Question Bank

FIRST SEMESTER

Subject: MAT101 LINEAR ALGEBRA AND CALCULUS

Module I

Sl. No	Questions	Marks	KU/KTU
1.	Solve the following system of equations? $Y + z - 2w = 0$ $2x - 3y - 3z + 6w = 2$ $4x + y + z - 2w = 4$	7	Model question
2.	Determine the rank of the matrix $A = \begin{bmatrix} 1 & 2 & -1 \\ -2 & -4 & 2 \\ 3 & 6 & -3 \end{bmatrix}$	3	Model question
3.	Solve the following by Gauss elimination $Y + z - 2w = 0$, $2x - 3y - 3z + 6w = 2$, $4x + y + z - 2w = 4$	7	Model question
4.	Diagonalize the matrix $\begin{bmatrix} -1 & 2 & -2 \\ 2 & 4 & 1 \\ 2 & 1 & 4 \end{bmatrix}$	7	Model question
5.	Write down the Eigen values $\begin{bmatrix} 2 & 0 \\ 0 & -1 \end{bmatrix}$	3	Model question
6.	What kind of conic section the quadratic from $3x_1^2 + 22x_1x_2 + 3x_2^2 = 0$ represents and transform it to principal axes	7	KTU JAN-2016
7.	Find the Eigen values and Eigen vectors of the matrix $\begin{bmatrix} -2 & 2 & -3 \\ 2 & 1 & -6 \\ -1 & -2 & 0 \end{bmatrix}$	7	KTU JAN-2016
8.	Determine whether the matrix is orthogonal $\begin{bmatrix} 1 & 0 & -0 \\ 1 & 1/\sqrt{2} & -1/\sqrt{2} \\ 0 & 1/\sqrt{2} & 1/\sqrt{2} \end{bmatrix}$	3	KTU JUN-2016
9.	Reduce the matrix $A = \begin{bmatrix} 2 & 3 & -1 & -1 \\ 1 & -1 & -2 & -4 \\ 3 & 1 & 3 & -2 \end{bmatrix}$ to row echelon form. Hence find its rank	7	KTU Aug-2016
10	Find out what type of conic section the quadratic form $17x_1^2 - 30x_1x_2 + 17x_2^2 = 128$ and transform it to principal axes	7	KTU Dec-216
11	Solve the system of equation by Gauss elimination method $3x + 3y + 2z = 1$ $x + 2y = 4$ $10y + 3z = -2$ $2x - 3y - z = 5$	7	KTU Dec-2016
12	$A = \begin{bmatrix} 3 & 0 & 2 \\ 0 & 2 & 0 \\ -2 & 0 & 0 \end{bmatrix}$ find an orthogonal matrix P that diagonalizes A	3	KTU Feb-2017
13	Reduce to echelon form and hence find the rank of the matrix $A = \begin{bmatrix} 3 & 0 & 2 \\ -6 & 42 & 24 \\ 21 & -21 & 0 \end{bmatrix}$	7	KTU Mar 2017
14.	Find the rank of the matrix $A = \begin{bmatrix} 2 & -2 & 0 \\ 0 & 4 & 8 \\ 2 & 0 & 4 \end{bmatrix}$	3	KTU Mar 2017

15	If 2 is an eigen value of $\begin{bmatrix} 3 & -1 & 1 \\ -1 & 5 & -1 \\ 1 & -1 & 3 \end{bmatrix}$ without using its characteristic equation ,find other eigen values .Also find the eigen values of A^3 ,A^T ,A^{-1} ,5A, A-3I and Adj A	7	KTU Dec 2016
16	What kind of conic section or pair of straight line is given by the quadratic form $3x^2+22xy+3y^2=0$ express $(x,y)^T$ interms of new coordinates.	7	KTU Dec-2016

Module II

1.	Let Z=f(x,y) where x= rcosθ , y= rsinθ prove that $\left(\frac{\partial z}{\partial x}\right)^2+\left(\frac{\partial z}{\partial y}\right)^2=\left(\frac{\partial z}{\partial r}\right)^2+1/r^2\left(\frac{\partial z}{\partial \theta}\right)^2$	7	Model question
2.	show that the function u(x,t) = sin (x-ct) is a solution of the equation	3	Model question
3.	Use Lagrange multiplier to determine the dimensions of a rectangular box open at the top having a volume $32ft^3$ and requiring the least amount of material for its construction.	7	Model question
4.	Find $f_x(1,3)$and $f_y(1,3)$ for the function $f(x,y) = 2x^3y^2+2y+4x$	3	Model question
5.	Find the slope of the surface $Z= x^2y+5y^3$in the X direction at the point(1,-2)	3	Model question
6.	Let $W=\sqrt{x2+y2+z2}$,x = $\cos\theta, y=\sin\theta, z=\tan\theta$. Use chain rule to find $\frac{dw}{d\theta}$ when θ= $\pi/4$	7	Model question
7.	Locate all relative maxima ,relative minima and saddle points of $f(x,y)=xy+ a^3/x +b^3/y$ ($a\neq 0$, $b \neq 0$	7	Model question
8.	Find the points on the sphere $x^2 + y^2 +z^2 =4$ that are closest to and farthest from the point (3,1,-1)	3	Model question
9.	Given the function W=xy+z use chain rule to find the instantaneous rate of change of W at each point along the curve x=$\cos t, y=\sin t, z=t$	3	Model question
10.	Use the chain rule to find d $\frac{dw}{ds}$ at s=$\frac{1}{2}$ if $w=r^2-r\tan\theta$, r=$\sqrt{s}$, $\theta=\pi s$	3	Model question
11.	11.Find the slope of sphere $x^2 +y^2 +z^2 =1$ in the y-direction at $(\frac{2}{3}\frac{1}{3}\frac{-2}{3})$	3	Model question
12.	Locate all relative maxima , relative minima and saddle point if any for $f(x,y)=y^2+xy+4y+2x+3$	7	Model question
13	Given $f = e^x siny + e^y cosx$, show that the function satisfies the Laplace equation $f_{xx} + f_{yy} = 0$	3	KTU Apr-2018
14	Let $w = 4x^2 + 4y^2 + z^2$,where $x = \rho sin\varphi cos\theta, y = \rho sin\varphi sin\theta, z = \rho cos\varphi$. Find $\frac{\partial w}{\partial \rho}, \frac{\partial w}{\partial \varphi}, \frac{\partial w}{\partial \theta}$using chain rule.	7	KTU Dec-2018
15	Locate all relative extrema and saddle points of the function $f(x,y) = 2xy - x^3 - y^2$	7	KTU Apr-2018
16	If $u = \log(x^3 + y^3 + z^3 - 3xyz)$, show that $(\frac{\partial}{\partial x} + \frac{\partial}{\partial y} + \frac{\partial}{\partial z})^2 u = \frac{-9}{(x+y+z)^2}$	7	KTU June-2016

Module III

1	use double integral to find the area of the region enclosed between the parabolas $y=\frac{1}{2}X^2$ and the line y=2x	3	Model question
2	Use polar coordinates to evaluate the area of the circle $X^2+Y^2=4$	3	Model question
3	Evaluate the integral $\int_0^4 \int_{\sqrt{y}}^2 e^{x3}\,dxdy$ by changing the order of integration	7	Model question
4	Find the volume of the solid bounded by the cylinder $x^2+y^2=4$ and the planes y+z=4 and z=0	7	Model question
5	Use spherical coordinates to find the volume of the solid bounded above by the	7	Model question

	sphere $x^2+y^2+z^2=16$ and below by the cone Z= $\sqrt{x2+y2}$		
6	Evaluate $\iiint xdxdydz$ where v is the volume of the tetrahedron bounded by the plane x=0,y=0,z=0,x+y+z=a	7	Model question
7	Evaluate $\iiint \sqrt{1-x^2-y^2-z^2}\, dxdydz$ taken throughout the volume of the sphere$x^2+y^2+z^2=1$ by transforming to spherical polar coordinates	3	Model question
8	Find the area of the region R enclosed between the parabola y= $\frac{x2}{2}$ and the line y=2x	7	Model question
9	Use triple integral to find the volume of the solid within the cylinder x^2+y^2 =9 and between the planes z=1 and x+z=5	7	Model question
10	Evaluate$\int_0^1 \int_0^1 \frac{dydx}{\sqrt{1-x^2}\sqrt{1-y^2}}$	3	Model question
11	Use the integral to find the area enclosed by the given curves y=sin x and y=cos x in $0\leq x \leq \frac{\pi}{4}$	7	Model question
12	Evaluate $\int_0^1 \int_0^{y^2} \int_{-1}^{z} zdxdydz$	7	Model question
13	Evaluate $\iint_R xydA$, where R is the region bounded by the curves $y=x^2$ and $x=y^2$.	7	KTU Dec-2017
14	Evaluate $\int_0^3 \int_0^{\sqrt{9-y^2}} 2ydxdy$	3	KTU Dec-2016
15	Evaluate $\int_{-1}^{2} \int_0^2 \int_0^1 (x^2+y^2+z^2)\, dxdydz$	3	KTU Apr-2018
16	Use a triple integral to find the volume of the solid within the cylinder $x^2+y^2=9$ and between the planes $z=1$ and $x+z=5$.	7	KTU Dec-2017
	Module IV		
1	Test the convergence of the series $\sum_{k=1}^{\infty} \frac{k}{k+1}$	3	Model question
2	Test the convergence of the alternating series $\sum_{k=1}^{\infty} (-1)^{k+1} \frac{1}{k}$ using Leibnitz test.	3	Model question
3	Check Whether the series $\sum_{k=1}^{\infty} (-1)^{k+1} \frac{(2k)!}{(3k-2)!}$ Is absolutely convergent, conditionally convergent or divergent.	7	Model question
4	Check the convergence of the series $\frac{3}{4}+\frac{3.4}{4.6}+\frac{3.4.5}{4.6.8}$+.....	3	Model question
5	Determine Whether the alternating series $\sum_{k=1}^{\infty} (-1)^{k+1} \frac{3^{2k-1}}{k^2+1}$ is absolutely convergent.	7	Model question
6	Show that the series $\sum_{k=1}^{\infty} \frac{cosk}{k^2}$ is convergent	3	KTU JAN-2016
7	Test the convergence of the series $1+\frac{1.2}{1.3}+\frac{1.2.3}{1.3.5}$ +.....	3	
8	Check whether the series $\sum_{k=1}^{\infty} \frac{1}{2k-1}$converges or not.	3	KTU JUN-2016
9	Test whether the series converges or diverges $\sum_{k=1}^{\infty} \frac{k}{2^k}$	3	KTU Aug-2016
10	Determine whether the series$\sum_{k=1}^{\infty} \left(\frac{3}{4}\right)^{k+2}$ converges and if so find its sum	3	KTU Dec-216
11	Test the convergence of$\sum_{n=1}^{\infty} \left(\frac{n}{n+1}\right)^{n^2}$	7	KTU Dec-2016

12	Show that the series $\sum_{n=1}^{\infty}\left(\frac{1}{2}\right)^n$ converges	3	KTU Feb-2017
13	Find the interval of convergence and radius of convergence of the infinite series $\sum_{n=0}^{\infty} n!\,x^n$	7	KTU June-2017
14	Determine whether the series $\sum_{k=0}^{\infty}\frac{5}{4^k}$ is converges, if so find the sum	3	KTU Apr-2018
15	Determine whether the alternating series $\sum_{k=1}^{\infty}(-1)^{k+1}\frac{k+7}{k(k+4)}$ is absolutely convergence.	7	KTU Apr-2018
16	Test the convergence of $\frac{x}{1.2}+\frac{x^2}{2.3}+\frac{x^3}{3.4}+\cdots$	7	KTU Dec-2016

Module V

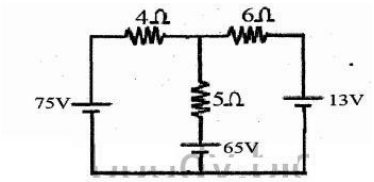
1	Find the values to which the Fourier Series of f(x)=x for $-\pi \le x \le \pi$ with f(x+2π) $= f(x)$	7	KTU Apr-2018
2	State the conditions for which a function f(x) can be represented as fourier series.	3	KTU Apr-2018
3	Discuss the convergence of a Fourier series of a periodic function f(x) of period 2π	3	KTU Dec-2017
4	Find the Fourier cosine series representation of $f(x) = x, 0 \le x \le \pi$.Also find the Fourier series representation f(x) if f(x) is periodic function with period π	3	KTU Dec-2017
5	Find the Fourier series of the periodic function f(x) of period 4,where f(x)=$f(x) = \begin{cases} -2, & -2 < x \le 0 \\ x, & 0 < x < 2 \end{cases}$ and deduce that i. $1+\frac{1}{3^2}+\frac{1}{5^2}+\frac{1}{7^2}+\cdots=\frac{\pi^2}{8}$ ii. $1-\frac{1}{3}+\frac{1}{5}-\frac{1}{7}+\cdots=\frac{\pi}{4}$	7	KTU Apr-2018
6	Find the Fourier series of $f(x) = x, -\pi \le x \le \pi$	3	KTU DEC-2017
7	Obtain the half range cosine series of $f(x) = x^2, 0 \le x \le C$	3	KTU Dec-2017
8	Obtain the Fourier series of $f(x) = f(x) = \begin{cases} -\frac{\pi}{4}, & -\pi < x < 0 \\ \frac{\pi}{4}, & 0 < x < \pi \end{cases}$	7	KTU Dec-2017
9	Find the half range cosine series of $f(x) = x, 0 < x < l$	3	KTU Apr-2018
10	Find the Fourier series of $f(x) = \begin{cases} -1+x, -\pi < x < 0 \\ 1+x, & 0 < x < \pi \end{cases}$	7	KTU Apr-2018
11	Find the half range sine series of $f(x) = \begin{cases} x, 0 < x < 1 \\ 2-x, 1 < x < 2 \end{cases}$	7	Model question
12	Find the half range sine series of f(x)=$\begin{cases} \frac{2kl}{x} & if\ 0 < x < 1/2 \\ \frac{2k(l-x)}{l} & if \frac{1}{2} < x < l \end{cases}$	7	Model question
13	obtain the fourier series for f(x)=e^{-x} in the interval 0<x<2π with f(x+2π) = f(x). Hence deduce the value of $\sum_{n=2}^{\infty}(-1)^n/1+n^2$	7	Model question
14	Find the fourier series of the function f(x)=x^2 -2$\le x < 2$ f(x+4)=f(x)	7	Model question
15	Find the Maciaurian series expansion of f(x)=$(1+x)^k$ for IxI <1 where k is any real number	7	Model question

16	Find the Taylors series of $\frac{1}{x+2}$ about x=1	3	Model question

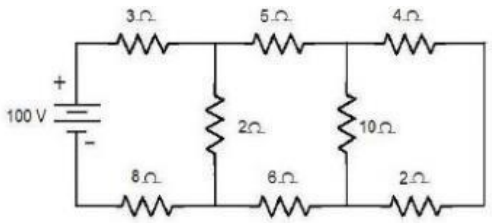
BASICS OF ELECTRICAL ENGINEERING

Module 1

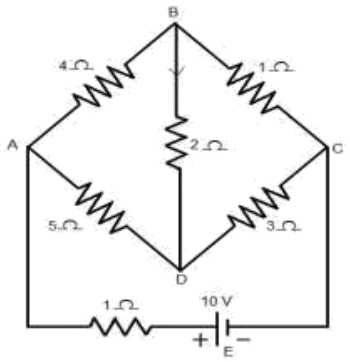
1. State and explain KCL with an example.
2. State and explain KVL with an example.
3. What do you mean by Junction rule and loop rule?
4. What do you mean by Constant voltage source?
5. What are constant voltage and constant current sources? Voltage and current sources are mutually transferable. Explain.
6. What do you mean by Constant current source?
7. A 50 ohm resistor is in parallel with a 100 ohm resistor. Current in 50 ohm is 7.2A. What is the value of third resistance to be added in parallel to this circuit to make the total current 12.1 A.
8. Find the current flowing through 5ohm resistor using No al analysis.



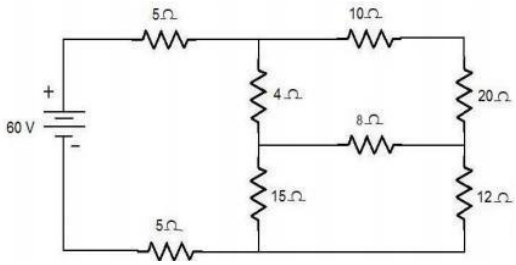
9. How constant voltage source different from an Ideal Voltage source?
10. How constant current source different from an Ideal current source?
11. State and explain Ohms law.
12. Define voltage, current, resistance, resistive , power and energy.
13. Give equation of star to delta and delta to star conversions.
14. Three resistors R1=2O ohm, R2=90 ohm and R3=10 ohm are connected in star .Obtain the equivalent delta circuit.
15. What is the advantage of node voltage method over mesh current method?
16. Compare series and parallel electric circuit.
17. Explain step by step procedure for formation of network equations by mesh current method.
18. Explain step by step procedure for formation of network equations by Node Voltage method.
19. Explain star to delta conversion with equations.
20. Find the current through each branch by mesh current method.



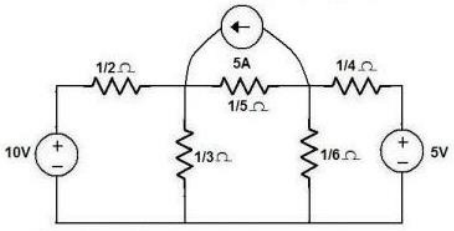
21. In the circuit shown, determine the current through the 2 ohm resistor and the total current delivered by the battery. Use Kirchhoff's laws.



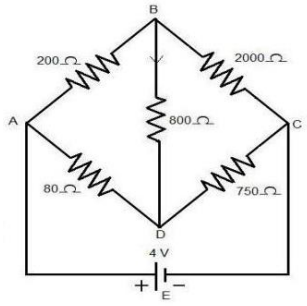
22. In the network shown below, find the current through all resistors.



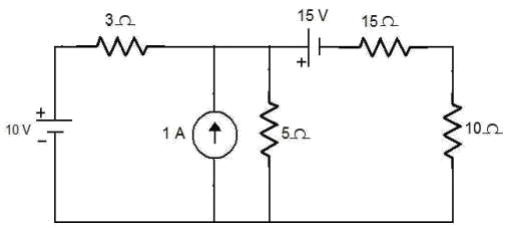
23. Using the node voltage analysis, find all the node voltages and currents in 1/3 ohm and 1/5 ohm resistances of figure.



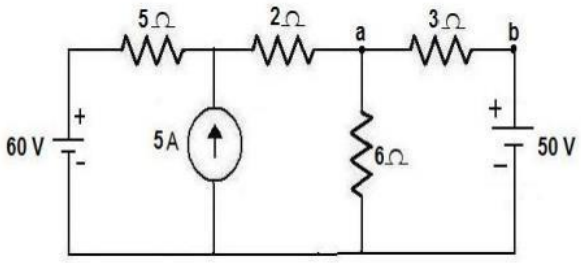
24. Determine the current through 800 ohm resistor in the network shown in figure.



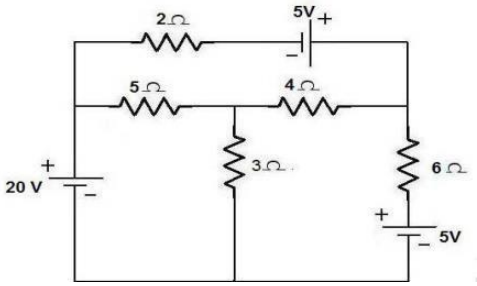
25. Find the power dissipated in 10 ohm resistor for the circuit shown in figure.



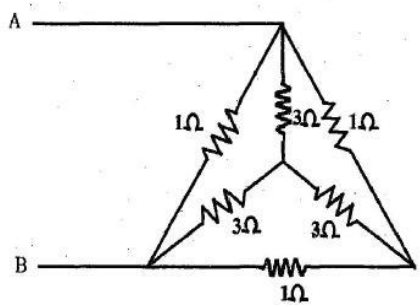
26. Find the current through branch a-b using mesh analysis shown in figure.



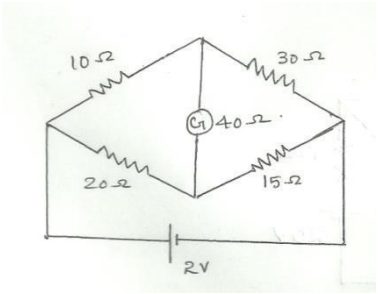
27. Using Mesh analysis, find current through 4 ohm resistor.



28. Determine the equivalent resistance across A and B using star delta transformation.

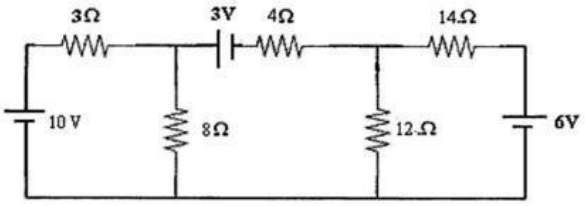


29. Find the current through the galvanometer.

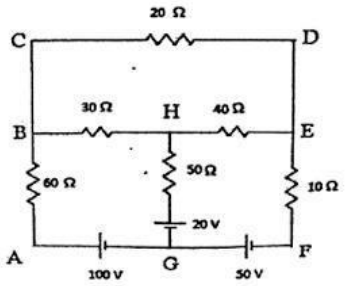


30. State and Explain Kirchhoff's Laws.

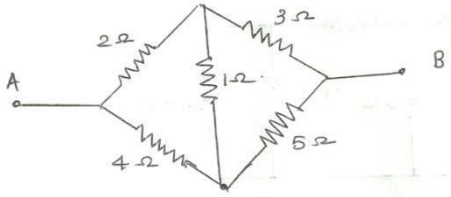
31. For the given circuit, find the current through 8 ohm and 12 ohm resistors.



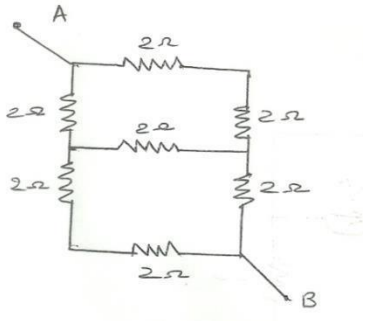
32. Calculate the current in each branch of the circuit shown using mesh analysis.



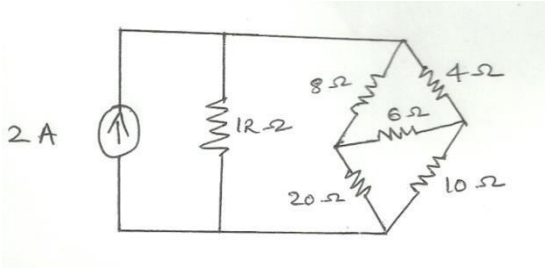
33. Find the equivalent resistance across A and B



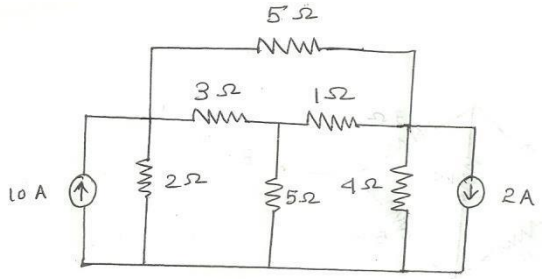
34. Find the equivalent resistance across A and B



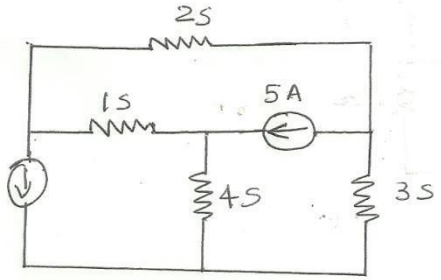
35. Find the current flowing through all the resistors in the circuit given below.



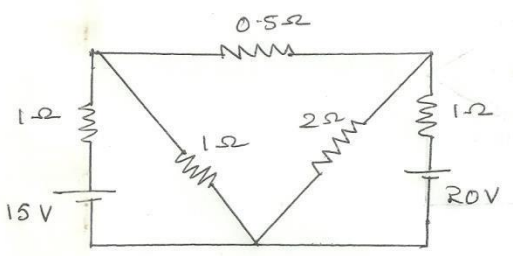
36. Find the current flowing through all the resistors in the circuit given below.



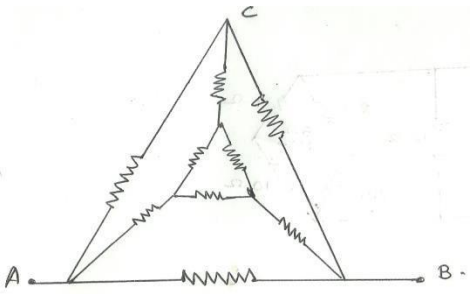
37. Find the current flowing through all the resistors in the circuit given below



38. Find the power consumed by 2 ohm resistor in the circ it given below.



39. Find the equivalent resistance across A and B , Value of each resistor =1 ohm



Module 2

1. State and explain Faradays laws of EMI.
2. Define MMF, Flux, Reluctance, Flux Density, Give equations and units.
3. What is Lenz's law? What's its significance?
4. Differentiate between statically induced and dynamically induced EMF.
5. Derive expression for dynamically induced EMF?
6. Define Self inductance
7. Derive expression for self inductance.
8. What do you mean by Coefficient of coupling
9. Derive equation for energy stored in magnetic circuits.
10. Give equations for Self inductance, Mutual inductance, Coefficient of coupling.
11. Define - MMF, Magnetic Field Strength, Magnetic Flux, Magnetic Flux density, Magnetizing force OR Intensity of magnetization, Reluctance.
12. Compare Self inductance and Mutual inductance.
13. Compare Electric circuit and Magnetic circuit.
14. An iron ring having cross-sectional area of 400mm and mean circumference of 500mm carries a coil of 250 turns wound uniformly around it

    Calculate (a) Reluctance of the ring (b) Current required to produce a flux of 1000μwb in the ring. Relative permeability of iron is 400.

15. Explain the term "residual magnetism". An iron ring of mean length 60cm has an air gap of 2mm and a winding of 300 turns. If the relative permeability of iron used in the ring is 400 when a current of 1.5 A flows through it, find the flux density. (Neglect Leakage Flux)

16. Derive the expression for mutual inductance between two coils.

17. Two coils having 150 and 200 turns respectively are wound side by side on a closed magnetic circuit of cross- section $1.5x10^{-2}$ and mean length of 3m. The relative permeability of the magnetic circuit is 2000. Calculate

    i) Mutual inductance between the coils.

    ii) The voltage induced in the second coil if the current changes from 0 to 10A in the first coil in 20ms.

18. A circular iron ring having cross-sectional area of 20 cm^2 and length 30 cm in iron has an air gap of 2mm made by a saw cut. Relative permeability of iron is 900. The ring is wound with a coil of 2500 turns and the current in the coil is 3A. Determine the air gap flux. Given that the leakage coefficient is 1.1?

19. A circular magnetic circuit has a mean length of iron 50 cm and an air gap of 1mm. It is wound with a coil of 500 turns, carrying a current of 3A. The cross sectional area of the core is 10cm.sqr. The mmf required for the air gaps is 60% of total mmf Determine:

    i) Magnetic flux ii)Total Reluctance

    iii) Relative permeability of iron. (Neglect Leakage Flux)

20. Derive the expression for self inductance of a coil.

21. A steel ring of circular cross section of 1 cm in radius and having a mean circumference of 94.3 cm has an air gap of 1 mm long. It is uniformly wound with an exciting coil consisting of 600 turns and excited with a current or 2.5 A. Neglecting magnetic leakage

    Calculate:

    i) mmf

    ii) Magnetic flux

    iii) Reluctance

    iv) Flux density

    v) Relative permeability of steel

    Assume that steel part takes about 40% of total ATs

22. Two identical coils P and S having 500 turns lie in parallel planes. Current in coil P is changing at the rate of 500A/s induces an emf of 12V in coil S. Calculate the mutual inductance between the two coils. If the self inductance of each coil is 50 mH, calculate the flux produced in coil P per ampere of current and the coefficient of coupling between the two coils.

23. A steel ring of 25cm diameter and of circular cross section 3cm in diameter has an air gap of 1.5mm length. It is wound uniformly with 750 turns of wire carrying a current of 2.1 A. Calculate (i) mmf (ii) flux density in air gap (iii) magnetic flux (iv) relative permeability of steel ring. Assume that iron path takes about 35% of total magneto motive force.

Module 3

1. Define Form factor and Peak factor.
2. Obtain expression for Form factor an alternating quantity.
3. What do you mean by alternating current? How it differs from DC.
4. What are the advantages of AC system over DC system
5. Define average value and RMS value of alternating current.
6. Explain importance of RMS value over average value of AC
7. Explain phasor representation of alternating quantities.
8. Draw and explain "power triangle".
9. What do you mean by rectangular form, polar form and exponential form trigonometric forms of alternating quantities?
10. Show that power consumed in a purely capacitive circuit is zero.
11. When an AC supply with a supply voltage of 250V is applied across the circuit, the current in the circuit is

    found to be 25A. If the current is t 0.8pf lagging, find the impedance of the circuit in j form and its

    magnitude
12. Show that power consumed in a purely inductive circuit is zero.
13. Define Active power, Reactive power and apparent power - with equations.
14. Define Power factor. Explain its significance.
15. Obtain expression for power factor in an R-L/R-C circuit
16. What do you understand by impedance triangle? What's its importance?
17. What do you understand by power triangle? What's its importance?
18. What do you mean by series resonance in a series AC circuit?
19. What do you mean by quality factor (Q-factor)
20. Define Inductive reactance and capacitive reactance?

21. What do you by impedance of an AC circuit?
22. Advantages of three phase system over single phase system.
23. Obtain expression for Form factor.
24. What do you mean by alternating current? How it differs from DC.
25. What are the advantages of AC system over DC system
26. Explain importance of RMS value over average value of AC
27. Explain phasor representation of alternating quantities.
28. What do you mean by rectangular form, polar form and exponential form trigonometric forms of alternating quantities?
29. Define - Waveform, Cycle, Time period, Frequency, Amplitude
30. Define - Maximum value (Peak value), Average value, RMS value, Instantaneous value.
31. Obtain expression for alternating voltage. ($v=V_M \sin\omega t$).
32. Explain relation between phase and line values in a star and delta connected system.
33. Explain- Generation of alternating voltage with the help of neat diagrams OR Work g of an elementary single phase alternator (Generator).
34. Derive expressions for average value of sinusoidal AC voltage/current
35. Derive expressions for RMS value of sinusoidal AC voltage/current.
36. Define Resonance. Derive expression for resonant frequency in a series resonant circuit.
37. Explain R- L series network, with waveform, phasor diagram and equations. Obtain expression for current.
38. Explain R- C series network, with waveform, phasor diagram and equations. Obtain expression for current.
39. Explain R- L-C series network, with waveform, phasor diagram and equations. Obtain expression for current.
40. Draw the waveform and phasor diagram of a series R-C circuit. Derive expression for power in a RC circuit.
41. Draw the waveform and phasor diagram of a series R-L circuit. Derive expression for power in a series RL circuit.
42. What do you mean by Average value, RMS value, and maximum value, Instantaneous value of AC.
43. Compare star and delta connected systems. Derive relations between phase and lines values of voltage and current
44. Prove that in a star connected network Line Voltage = $\sqrt{3}$ * Phase voltage.
45. Prove that in a delta connected network Line current = $\sqrt{3}$ * Phase current.
46. Explain generation of 3 phase voltage with neat diagrams OR working of an elementary 3 phase alternator.
47. Explain advantages and disadvantages of star and delta connected systems.

48. What do you mean by 3 phase 4 wire system? What are its advantages? Why it can be used only with star connected windings.

49. Explain how three phase active and reactive power can be measured using two wattmeters?

50. Show that total power in a three phase system can be measured by two wattmeters.

51. A series circuit has R=10Ω, L=50mH, and C=100μF and is supplied with 200V,50Hz. Find (i) Impedance (ii)current (iii) power (iv) power factor (v) voltage drop across the each element.

52. A 400V is applied to three star connected identical impedances each consisting of a 40 Ω resistance in

    series with 3Ω inductance reactance. Find (i) line current (ii) Total power supplied.

53. A series RLC circuit is connected to a 230V, 50 Hz, 1-phase AC supply. The value of R=5Ω, L=13mH and C=140μF. Find total reactance, impedance, current drawn by the circuit and p.f of the circuit

54. A resistance of 20 Ω and an inductance of 0.2H and a capacitance of 100 μF are connected in series across 220V, 50 Hz main. Determine (i) Impedance (ii) current taken from mains, (iii) Power and power factor of the circuit

55. A coil of resistance 10 Ω and inductance 0.1 H is connected in series with a 150 μF capacitor across 200V, 50 Hz supply. Calculate (i) Inductive reactance, Capacitance reactance, impedance, current and power factor. (ii) The voltage across the coil and capacitor respectively.

56. A series circuit having pure resistance of 40 Ω, pure inductance of 50mH and a capacitor is connected across a 400V, 50 Hz ac supply. This RLC circuit draws a current of 10A. Calculate 1) Power factor of the circuit, 2) Capacitor value.

57. Three 100 Ω resistors are connected first in star and then in delta across 415 V, 3-phase supply. Calculate the line and phase currents in each case and also the power taken from the source.

58. A 400V is applied to three star connected identical impedances each consisting of a 40 Ω resistance in series with 3 Ω inductance reactance. Find (i) line current (ii) Total power supplied

59. In a two watt meter method to measure power in a three phase circuit, it was found that the two watt meters read 3 kW and 1.5 kW respectively. Determine the total power consumed and power factor of the balanced three phase circuit.

60. What do you mean by delta connected system? Obtain the expressions for line voltage, line current and 3 phase power with a neat phasor diagram.

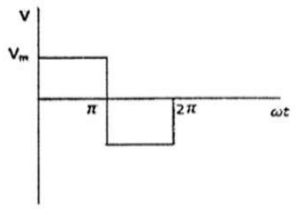
61. When an AC supply with a supply voltage of 250V is applied across the circuit, the current in the circuit is found to be 25A. If the current is 0.8pf lagging, find the impedance of the circuit in j form and its magnitude.

62. Three identical resistors of 20 ohm each are connected in star to 415V, 50Hz three phase supply. Calculate (i) the total power consumed, (ii) total power consumed if they are connected in delta

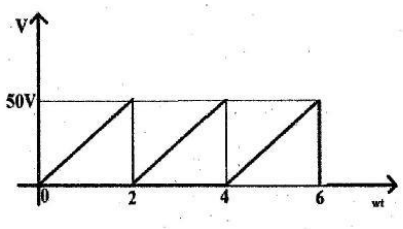
    (iii) total power consumed, if one of the resistors is opened in both star connection and delta connections.

63. A Series R-C circuit takes a power of 7000W when connected to 200V, 50Hz supply. The voltage across the resistor is 130 V Calculate, i) Resistance ii) Current iii) Power factor iv) Capacitance v) Impedance vi) Equations for instantaneous values of voltage and current.

64. Determine average value & RMS value of symmetrical square wave also finds the form factor.

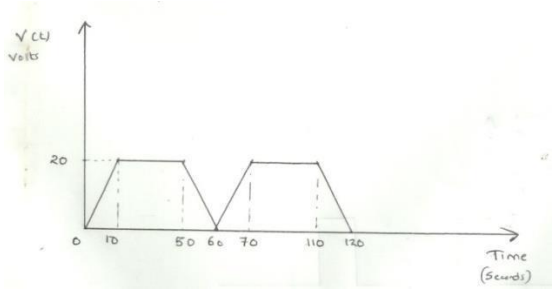


65. Determine the form factor of the sawtooth waveform.

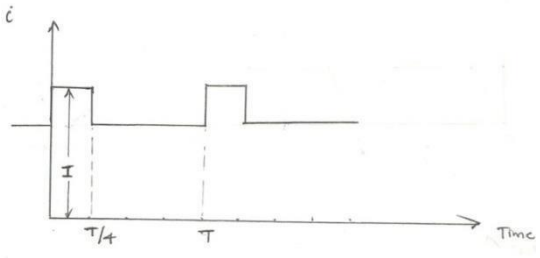


66. What do you mean by three phase four wire system? Explain how power is measured in a three phase system using two wattmeters.

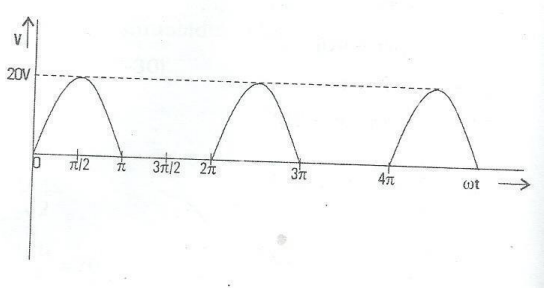
69. Determine average value, RMS value of the current waveform shown below.



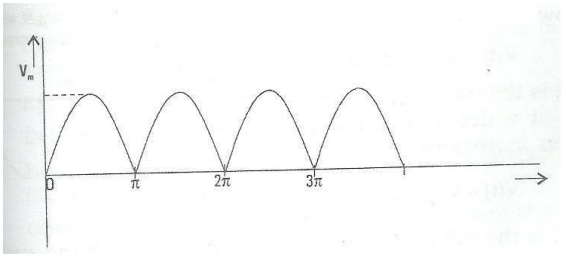
70. Determine average value, RMS value of the current waveform shown below.



71. Calculate the average value,.RMS value and form factor of the half wave sinusoidal voltage wave as shown Below.



79. Calculate the average value, RMS value and form factor of the full wave sinusoidal voltage wave as shown below.



Module 4

1. Explain the need of transmission at high voltages?
2. Explain primary distribution and secondary distribution.
3. What are the important equipments in a substation? Explain.
4. Explain primary and secondary transmission system
5. Explain primary and secondary distribution system.
6. Explain the need for instrument transformers in a substation.
7. What's the role of moderator, control rod and fuel rod in a nuclear reactor?
8. What's the function of valve house and surge tank in a hydroelectric power pla t?
9. Explain the terms ‘Primary transmission’ & ‘secondary transmission’ in our electr cal power system.
10. Explain significance of renewable energy sources.
11. Write short notes on solar energy, wind energy, geothermal energy, Ti al energy.
12. Give advantages and disadvantages of renewable energy sources.
13. Explain electrical energy scenario of Kerala.

14. With a neat diagram, explain a typical power transmission scheme.
15. Give reasons for using high voltages in AC transmission system.
16. Explain the operation of a Nuclear Power Plant with a neat schematic block diagram.
17. Draw and explain a typical power transmission scheme.
18. Explain the functions of different substation equipments.
19. With a neat schematic diagram, explain generation of power in hydro-electric/ thermal/nuclear power plants
20. Mention advantages and disadvan ages of hydro electric/ thermal/nuclear power plants.
21. What do you mean by renewable energy sources? Mention its advantages and disadvantages over non-renewable energy sources
22. Draw and explain a typical Power transmission scheme.
23. Explain primary and secondary distribution systems

Module 5

1. What are the different types of Losses in a Transformer?
2. What do you mean by copper loss and core loss in a transformer? Explain
1. What do you mean by transformation ratio of a transformer?
2. What do you mean by efficiency of a transformer, obtain expression for efficiency.
3. What is the nature of air gap in a DC Machine?
4. Laminated silicon steel is used for construction of DC motor armature why?
5. How transformer core is constructed with laminated silicon steel, why?
6. What happens when a transformer is supplied with DC?
7. Explain working of a DC motor?
8. Explain how torque is produced in a dc motor.
9. Laminated silicon steel is used for construction of DC motor armature why?
10. What is the nature of air gap in a DC Machine?
11. What are the functions of commutator in a DC generator?
12. Define ‘Back EMF’ in a DC motor.
13. Derive the voltage equation of a DC motor
14. Give principle of operation of a dc motor.

15. Differentiate between short and long compound wound dc motors.

16. Obtain the EMF equation of a transformer.

17. Explain the constructional details of a DC motor.

18. Explain the different types of DC motors.

19. Explain the working principle of single phase transformer.

20. A single phase transformer has a core whose cross-sectional area is 150 cm.sqr, operates at a Maximum flux density of 1.1Wb/m.sqr from a 50Hz supply. If the secondary winding has 66 turns, determine the output KVA when connected to a load of 40 ohm impedance. Neglect any voltage drop in transformer.

21. Derive EMF equation of a transformer.

22. The iron loss of 230/115V, 5KVA transformer is 200W.The copper loss at full load is 250W. Find efficiency of the transformer when delivering (i) full load power at unity power factor. (ii) Half full load power at 0.8 pf lagging.

23. The power input to a 230V de shunt motor is 8.477kW. The field resistance is 2300 and armature resistance is 0.280. Find input current, armature current and back emf.

24. What are the different losses occurring in a transformer?

25. Explain construction single phase and three phase core type transformer?

26. Explain working principle of a DC mo or?

27. List 4 advantages of three phase transformers compared to single phase transformer

28. What do you mean by Shunt wound/Series wound DC motor? Explain its working.

29. Maximum efficiency of a transformer occurs at unity power factor and at full load. If the full load copper loss is 60 W, calculate the total loss at full load, ½, ¼ and ¾ full load?

30. Explain types of DC motor Give application of each type of motor.

31. The armature of a dc separately excited machine has a resistance of 0.1Ω and is connected to a 230V supply.

    Calculate the generated emf when it is running

    (i) as a generator giving 80A.

    (ii) as a motor taking 60A.

32. A shunt generator delivers 50 kW at 250 V and runs at 400 rpm. The armature and field resistances are 0.02 Ω and 50 Ω respectively. Calculate the speed of the machine running as a shunt motor and taking 50 kW input at 250 V. Allow 1 V per brush for contact drop.

33. A single phase transformer has 400 and 1000 primary and secondary turns respectively. The net cross sectional area of the core is 60 cm.sqr. If the primary winding be connected to a 50Hz supply at 500V.Calculate:

i) Peak value of flux density in the core and

ii) The voltage induced in the secondary winding

34. Calculate the generated emf in the armature winding of a 4 pole lap wound dc machine having 728 conductors running at 1800 rpm. The flux per pole is 30 mWb.

35. A lap wound 750 rpm shunt motor has an armature resistance of 0.4 Ω and shunt field resistance of 200 Ω respectively. The armature has 120 coils each of 3 turn each. The flux per pole is 0.03Wb. If the load resistance is 10 Ω, determine the terminal voltage

36. A 40kVA single phase transformer has core loss of 450W and full load copper loss of 850W. If the power factor of the load is 0.8, calculate (i) full load efficiency, (ii) load corresponding to maximum efficiency, and (iii) maximum efficiency at unity power factor.;

37. The iron loss of 230/115 V, 5 KVA transformer is 200 W. The copper loss at full load is 250 W. Find the efficiency of the transformer when delivering: (i) full load power at upf ( ) half full load power at 0.8 pf lagging

38. With a neat diagram, explain principle of operation of a DC motor. Which are the different types of DC motor?

39. A single phase transformer has 400 primary and 1000 secondary turns. The net cross sectional area of the core is 60cm.sqr. If the primary winding is to be connected to 50Hz supply at 500V. Calculate:

    i) The maximum value of flux density in the core.

    ii) The voltage induced in the secondary winding

40. A 25 kVA, single phase transformer has 250 turns on the primary and 40 turns on the secondary winding. The primary is connected to 1500V, 50Hz mains, calc late (i) Primary and secondary currents on full load (ii) Secondary emf (iii) Maximum flux in the core.

41. A shunt generator delivers 450 A at 230 V and the resistance of the shunt field and armature are 50 ohm and 0.03 ohm respectively. Calculate the generated e.m.f..

42. A four-pole generator, having wave-wound armature winding has 51 slots, each slot containing 20 conductors What will be the voltage generated in the machine when driven at 1500 rpm assuming the flux per pole to be 7.0 mWb.

46. A separately excited D.C. generator has armature circuit resistance of 0.1 ohm and the total brush-drop is 2 V. When running at 1000 r.p.m., it delivers a current of 100 A at 250 V to a load of constant resistance. If the generator speed drop to 700 r.p.m., with field-current unaltered, find the current delivered to load.

47. A single phase transformer as 400 primary and 1000 secondary turns. The net cross sectional area of the core is is 60 cm.sqr. If the primary winding be connected to a 50 Hz supply at 500 volt calculate (i) the peak value of flux density in the core (ii) the voltage induced in the secondary winding.

48. A 10 KVA , 500/ 250V, 50 Hz single phase transformer has a net area of cross section 90 cm.sqr and maximum flux density is 1.2 T .calculate the number of turns on both primary and secondary windings.

49. The emf per turn of a single phase 10 KVA 2200/220V, 50 Hz transformer is 10V. Calculate (i) the number of primary and secondary windings. (ii) the net cross sectional area for a maximum flux density of 1.5T

50. A 25-kW, 250-V, d.c. shunt generator has armature and field resistances of 0.06 ohm and 100 ohm respectively. Determine the total armature power developed when working (i) as a generator delivering 25 kW output and (ii) as a motor taking 25 kW input.

Module 6

1. Why three phase IM cannot be run at synchronous speed.
2. Why slip is necessary for three phase IM?
3. Why single phase IM is not self starting? Explain its working principle.
4. How a single phase IM can be made self starting?
5. How unidirectional torque is obtained from a universal motor? Explain
6. Give applications of single phase induction motor.
7. Draw and explain the torque-slip characteristics of a 3 phase induction motor
8. State and explain 'Double Field Revolving Theory.
9. Briefly explain construction of three phases IM.
10. Explain differences between squirrel cage and split ring rotors.
11. Explain working principle of single phase IM.
12. Explain construction of three phase induction motor
13. Explain the principle of operation of a 3-phase induction motor.
14. Why single phase IM is not self starting? Explain.
15. A 4 pole, 3 phase induction motor operates from a supply whose frequency is 50 Hz. Calculate,
    a. The speed at which the magnetic field of the stator is rotating.
    b. Speed of rotor when slip is 0.03.
    c. Frequency of the rotor current when slip is 0.04.
    d. Frequency of the rotor current at standstill.
16. Explain the different starting methods in a single phase induction motor.
17. Explain the working of a capacitor start induction motor.
18. If the induced emf in the stator of an 8 pole induction motor has a frequency of 50 Hz and that in the rotor is 1.5 Hz, at hat speed is the motor running and what is the slip?
19. A three phase, 12 pole, salient pole alternator is coupled to a diesel engine running at 500 rpm. It supplies an induction motor which has a full load speed of 1440 rpm. Find the percentage slip and number of poles of the induction motor.
20. A 3 φ 4 pole 50 Hz induction motor runs at 1460 rpm. Find its % slip.

21. A 12 pole 3 φ alternator drives at speed of 500 rpm supplies power to an 8 pole 3 φ induction motor. If the slip of motor is 0.03, calculate the speed.

22. A Three phase induction motor has to 2 poles and is connected to 400 V, 50 Hz supply. Calculate the actual rotor speed and rotor frequency when the sleep is 4 %.

23. A 6 pole induction motor is fed from 50 head supply, if the frequency of rotor emf at full load is 2 Hz, find full load speed and slip.

24. A three phase induction motor runs at almost 1000 rpm at no load and 950 rpm at full load when supplied with power from a 50 heads three phase line. Calculate

    a. How many poles has the motor?

    b. What is the percentage slip at full load?

    c. What is the corresponding frequency of rotor voltage?

    d. What is the corresponding speed of the rotor field with respect to Rotor?

    e. What is the corresponding speed of the rotor with respect to the stator?

    f. What is the corresponding speed of the field with respect to the stator field?

What is the frequency of at a slip of 10%?

ENGINEERING CHEMISTRY(CY100)

MODULE I

1. Distinguish between absorption spectrum & emission spectrum? (2)

2. State and explain Beer Lamberts law? (3)

3. What are different types of electronic transitions are possible in UV-Visible spectroscopy? (3)

4. Give the applications of UV visible spectroscopy? (4)

5. Explain the various modes of vibration possible for CO2 , which of them are IR active? (3)

6. Explain the various modes of vibration possible for H2O , which of them are IR active? (3)

7. Give the mechanism of interaction of electromagnetic radiation with oscillating dipole of a molecule? (4)

8. What is chemical shift. Explain shielding& deshielding? (4)

9. Write the basic principle of MRI imaging? Explain the process in NMR? (5)

10. Write the basic principle of IR spectroscopy ? (4)

11.The vibrational frequency of HCl molecule is 2886cm-1.Calcualte the force constant if the reduced mass is 1.63x 10 -37 Kg.? (5)

MODULE 2

1. State & explain Nernst equation ? (5)

2. What is meant by single electrode potential? (2)

3. Explain Helmholtz double layer? (2)

4.How will you determine the pH of a solution using glass electrode? (6)

5.Explain the construction of Ni Cd cell? (5)

6.Explain the construction of Li-Ion cell? (5)

7.Explain different types of electrodes? (4)

8.Explain potentiometric titration? (4)

9.Explain the process involved in H2-O2 fuel cell? (6)

10.Explain the process involved in calomel electrode and SHE? (6)

MODULE 3

1.Explain the principles of HPLC ? (5)

2. Distinguish between TGA & DTA ? (6)

3. Explain the various methods of thermal analysis ? (5)

4.Discuss principles & applications of gas chromatography? (5)

5.Explain the process TLC? (6)

6. Explain the measurement of conductivity by method of balancing length? (5)

7.Give the principle of column chromatography? List the various steps involved in it? (5)

8.Explain the major differences between GC & HPLC? (6)

9.Explain the decomposition of hydrated Calcium Oxalate? (5)

10.Explain the advantages of differential thermal analysis? (6)

11.Explain the term 'retention factor'? (2)

MODULE 4

1. Explain the different classifications of polymers? (5)

2. Differentiate between thermoplastics& thermosetting plastics? (4)

3. Differentiate between addition& condensation polymerization? (4)

4. What are nylons? Distinguish between nylon -6,6 &nylon 6? (5)

5.What are co-polymers? Explain the properties of BS & ABS? (5)

6. Give the applications of conducting polymers? Explain the preparation properties of

Poly pyrrole, poly aniline? (5)

7.Explain the structure of OLED? (5)

8.Write note on nano material? (5)

9.Give the applications of nano materials? (5)

10.What are fullerene? (5)

11.Write note on sol gel process? (5)

12.Draw the structure of bifunctional silicon chloride? (5)

How silicone rubber is prepared from it?

13. Explain the preparation and structure of Kevlar and polybutadiene rubber? (5)

MODULE 5

1.How will you determine the calorific value of a fuel using bomb calorimeter? (6)

2.Distinguish between HCV and LCV? (3)

3. Discuss various types of bio fuels? (5)

4. Explain knocking of petrol? (5)

5.Distinguish between diesel knocking and petrol knocking? (5)

6.Differences between cetane number and octane number? (3)

7.Explain the classification of lubricants? (6)

8.Explain the lubricating action of graphite and molybdenum di sulphide? (6)

9.Explain the properties of lubricants? (6)

10.What are greases? Give examples? (5)

11.Define the term calorific value? (3)

MODULE 6

1. What is hard water? What are the different units in which hardness is expressed? (3)

2. Describe EDTA method for the estimation of hardness? (5)

3. How are ion exchange resins useful in removing hardness? (5)

4. Explain desalination and reverse osmosis process? (3)

5. Explain with flow chart , how water is purified for drinking purposes? (5)

6.Explain trickling filter method for water purification?? (3)

7Explain the process chlorination? . (3)

8. What are the factors governs the amount of dissolved oxygen in water? (3)

9. Explain BOD & COD ? (5)

10. Explain UASB process? (5)

11. Write a note on aerobic & anaerobic waste water treatment? (5)

Introduction to Mechanical Engineering Sciences

MODULE 1

1 Expand the following words. SI Engine and CI Engine.

2 Name the process which is almost in equilibrium

3 “Entropy of universe is increasing”. Comment

4 Draw the p-v and T-s diagram of a Carnot , Diesel and Otto cycle explain

5 State Clausius theorem , Clausius inequality and Principle of increase of entropy

6 Explain the experiment which led to the formation of first law of thermodynamics. State the first law of thermodynamics when applied to a process and a cycle

7 State two classical statements of second law of thermodynamics. Also analyze these statements and prove that they are equivalent.

MODULE 2

1 Explain the working of a gas turbine with its schematic and p-v and T-s diagrams. Name any four areas where they are used.

2 Explain about hydraulic and steam turbines. List the examples

3 Compare the working of two stroke, petrol and diesel engine along with its thermodynamic cycle.

4 Identify and explain the engine that gives one power stroke for two revolution of crank shaft.

5 Sketch a centrifugal pump and label its parts. Explain its working

6 Describe the working of CRDI and MPFI.

7 Bring out the concept of hybrid vehicles

MODULE 3

1 Explain the working of a winter air conditioner and summer air conditioner.

2 Explain the working of a house hold refrigerator. KTU

3 Explain about the different refrigerants used and their impacts on environment

4 Sketch the different process in a psychometric chart and explain

5 Differentiate between comfort and industrial air conditioning

6 Demonstrate the working of a vapour compression refrigeration system with an example

7 Distinguish window air conditioner and split air conditioner. Draw their respective diagrams and label the parts

8 Define : DBT, WBT, Dew point temperature , Specific humidity, Relative humidity, Saturated air.

MODULE 4

1 Using a layout diagram show how the power is transmitted from engine to wheels in an automobile. Label important components and its functions.

2 What are the different systems used in automobiles. Explain any three in detail

3 Explain the different types of power transmission drives

4 A good fuel for an SI engine will be a bad fuel for a CI engine. Comment

5 Categorize power transmission device along with its application

6 Explain the working of cone clutch in an automobile.

7 Discuss any two types of breaking mechanisms used in automobile

8 What are the different types of gears used for power transmission

MODULE 5

1 Briefly describe Rolling process.

2 Describe the forging process with sketches

3 Differentiate between soldering and brazing

4 Briefly describe different types of rolling mills with sketches

5 List and explain the steps involved in casting process

6 Discuss with figures, commonly used forming operation.

7 Explain about Gas Welding

8 Explain about conventional metal joining process

MODULE 6

1 Explain the working of a drilling machine the help of a neat sketch.

2 Differences between a shaper and a planer.

3 Describe a shaper with a neat diagram.

4 List any six machining operations that are performed on a lathe

5 Draw a diagram of centre lathe, label its important parts along with its functions

6 Differentiate NC and CNC machines

7 Sketch a milling machine and indicate the important components of it.

8 Differentiate the following:(i)Shaper, Planer and Slotter(ii)Milling Machine, Grinding Machine

INTRODUCTION TO SUSTAINABLE ENGINEERING

MODULE 1

1 Technology may affect sustainability in positive and negative ways. Give one example each for both cases.

2 Comment on the challenges for sustainable development in our country and suggest a way to overcome the same

3 Match the items in the following sets:

SetA: {ISO 14006; ISO 14041; ISO 14048;ISO 14012}

Set B: {LCA Data Documentation Format; Environmental Auditing qualifying criteria; Eco design guidelines; LCA inventory analysis}

4 Write short note on the need of environmental sustainability? Also explain the cpncept of zero waste?

5 List the challenges for sustainable development.

6 Biodiversity suffers through over consumption and unsustainable development practices. Justify the above statement with suitable examples?

7 llustrate with a neat sketch the pillars of sustainability.

8 Illustrate the nexus between agricultural technology and sustainability.

9 Explain the phenomenon of ozone layer depletion

MODULE 2

1 What is carbon credit? Explain in not more than five sentences.

2 Briefly discuss the effects of water pollution. List the sources of water pollution.

3 List the salient features of Water Act, 1974. Also List the salient features of Air Act, 1981?

4 Discuss the relationship between climate change and global warming?

5 Differentiate between carbon foot print and carbon credits

6 What is carbon trading? Which are the mechanisms involved in it?

MODULE 3

1 Write short notes on ISO 14000 series

2 What is LCA? Explain the scope and goal of LCA.

3 List the major steps incorporated in Environmental Impact Assesment (EIA)?

4 Explain the term bio mimicking?

5 Suppose you are required to do the Life Cycle Assessment of an Electric Vehicle. In the utilisation stage, the assessment must be made for the energy used to drive the vehicle. List any three possible impacts of the Electric Vehicle during the usage stage? Suggest a possible way to reduce the impact during utilisation of the vehicle?

6 Cochin Intemational Airport in Kerala, India, isgoing all inon Solar.46,150 solar panels are powering the airport. What are the social, economic and environmental advantages of providing power from Solar Energy?

MODULE 4

1 How a green building differs from a conventional building? Compare any five aspects?

2 Explain the criteria for the material selection of sustainable builings?

3 Write short note on the green building certification in India.

4 List the methods for increasing energy efficiency in buildings?

5 Discuss the term sustainable city?

6 Write short note on sustainable transportation? What are all the characterestics?

MODULE 5

1 Explain in detail any one methodogy to extract geothermal energy

2 How can energy be derived from oceans?

3 Write a short note on fuel cells.

4 Explain the working of a photovoltaic cell with a neat sketch?

5 What are the steps involved in bio fuel production?

6 Explain the working of a solar water heating system?

MODULE 6

1 lllustrate industrial symbiosis with a suitable example. What are the major advantages of industrial symbiosis?

2 Write a short note on Industrial Ecology

3 What are the main causes ofurbanization? List any three urban problems affecting sustainability, faced by the MEDCs (Medium Economically Developed Countries).

4 Write a short note on Green Engineering.

5 Illustrate the push and pull factors which leads to the migration of people from rural areas to urban areas?

6 Discuss on industrialisation and poverty reduction?

7 Explain industrial symbiosis?

ENGINEERING MECHANICS

MODULE 1

1. Explain the laws of mechanics
2. Show that the resultant of the forces is zero for the system of forces shown in figure 1.

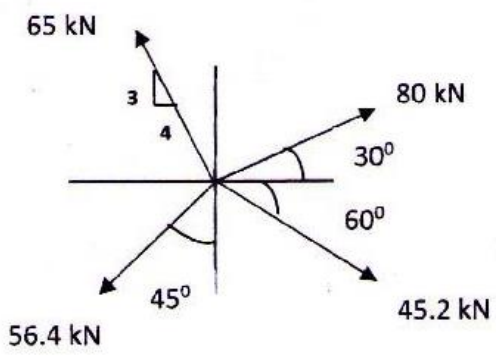
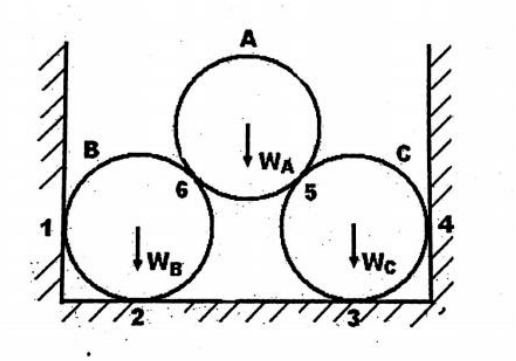


Figure 1

3. Explain the concept of freebody diagram with figures
4. The greatest and least resultants of two forces F1 and F2 are 17N and 3N respectively. Determine the angle between them when their resultant is 149N?
5. ABCD is a square , each side being 20cm and E is the middle point of AB. Forces of magnitude 7,8,12,5,9 and 6 kN act on lines of directions AB, EC, BC, BD, CA and DE respectively. Find the magnitude and direction of resultant force.
6. State and explain the principle of transmissibility of forces with figure?
7. 3 cylinders of weight 300N (A), 200N (for B and C)are placed on a rectangular channel as shown in fig. Determine the reactions at 1, 2 and 4?



8. Block P=0.5 kg and block Q of mass m kg are suspended through a chord, which is in equilibrium as shown in Figure 2. Determine the mass of block Q.

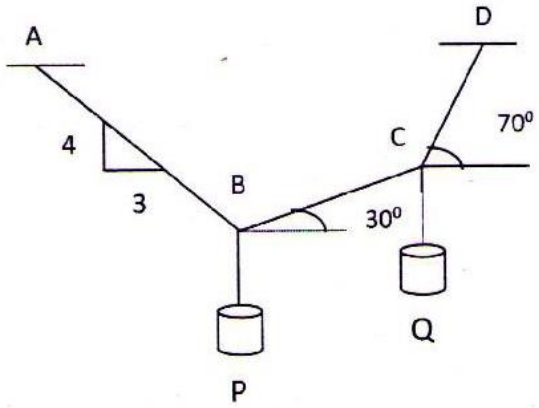


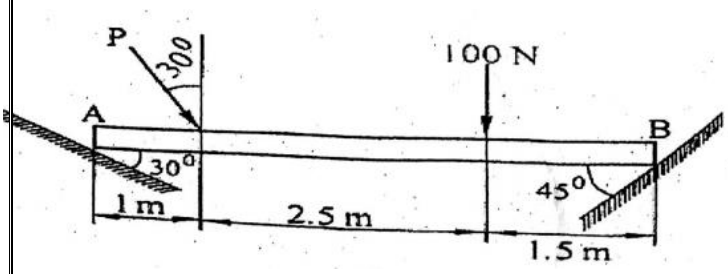
Figure 2

MODULE 2

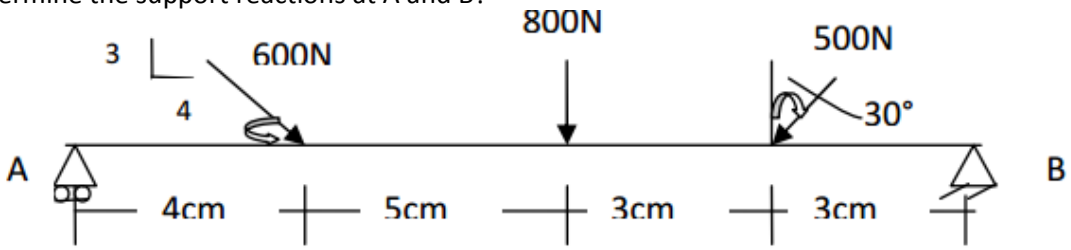
1.Write short notes on

Types of beams
Types of loads
Types of supports

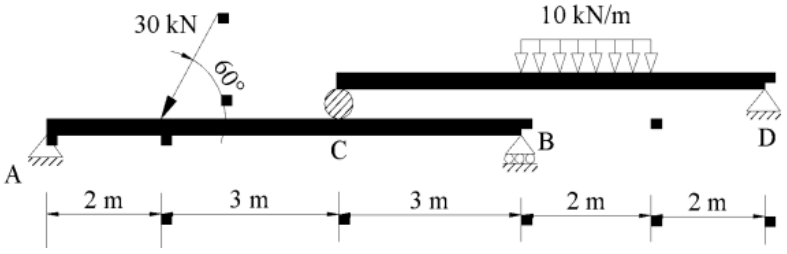
2.Determine the load P and support reactions?



3. Determine the support reactions at A and B?



4. Determine the support reactions?



5. A force of magnitude 60 N is applied at the origin of the x-y-z axes and through the point A (1,1.5,2.25). Determine the components of force along x,y,z axes and the direction of force with respect to the axes.

6. A force acts at the origin of a co-ordinate system in a direction defined by the angles $\alpha_x = 69.3^0$ and $\alpha_z = 57.9^0$. Knowing that the Y component of the force is -174 N, determine the (i) angle α_y and (ii) the other components and the magnitude of the force.

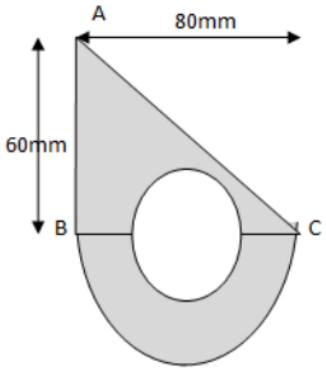
7. A simply supported beam AB of span 4m is carrying point loads 5 kN, 2kN and 3 kN at 1m,2m, and 3m respectively from the support A. Calculate the support reactions at A and B.

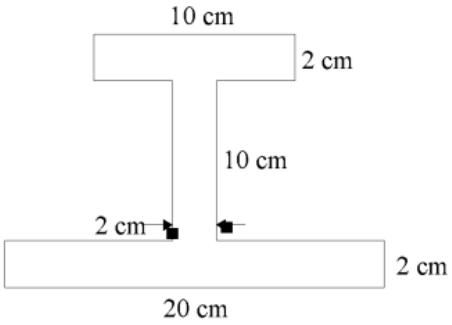
8. Find the support reactions of a cantilever beam of span 6m carrying a UDL of 6 kN/m.

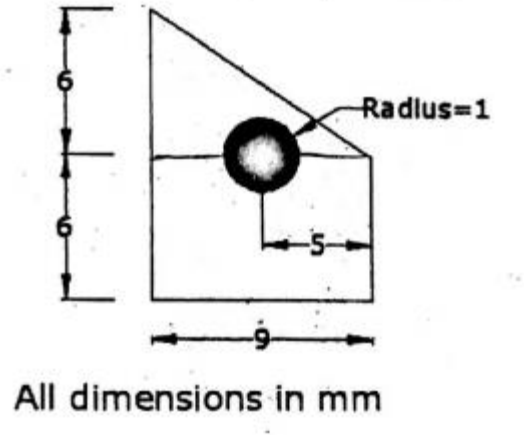
MODULE 3

22.State and prove pappus guldinus theorem?

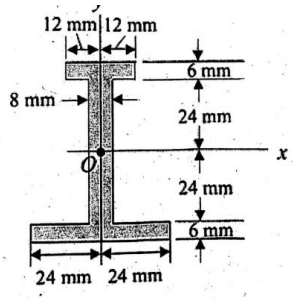
23.Calculate the centroid of given areas?







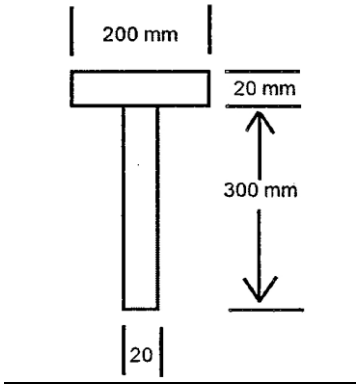
24.Determine the moment of inertia of given section



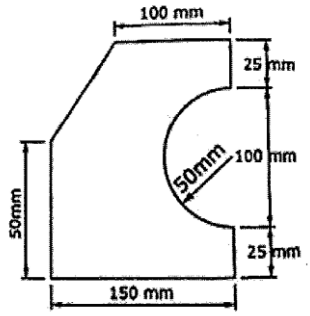
25.Explain principal moment of inertia, principal axis?

26. State and prove parallel axis theorem?

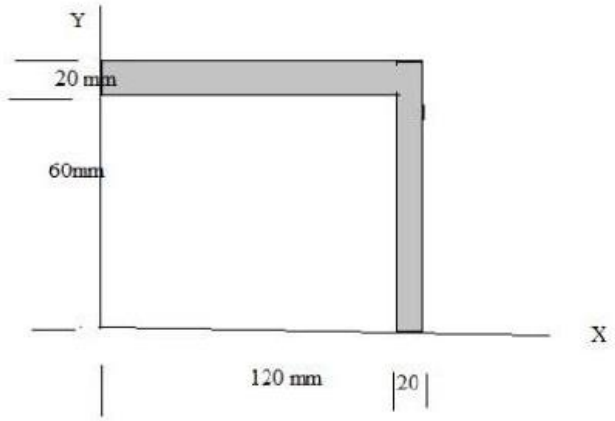
27.Locate the centroid of the T section shown in figure



7.Find the centroid of the given figure



8.Determine the product of inertia of the sectioned area about the X-Y axis.



MODULE 4

23. Define angle of friction and angle of repose. Establish the relationship between angle of friction and coefficient of friction?

24. Distinguish between (i) Static and kinetic frictions,(ii) Sliding friction and rolling friction.

25. A uniform ladder of 4m length rests against a vertical wall with which it makes an angle of 45. The coefficient of friction between the ladder and the wall is 0.4 and that between ladder and floor is 0.5. If a man, whose weight is one-half of the weight of ladder, ascends it, how high will he be when the ladder slips?

26. An effort of 200N is required just to move a certain body up an inclined plane of angle 15 the force acting parallel to the plane. If the angle of inclination of the plane is made 20^0 the effort required

, again parallel to the plane is found to be 230N. Find the weight of the body and the coefficient of friction.

27. A ladder 5 m long and weighing 260 N is placed against a vertical wall at an inclination of 30^0 with wall. A man weighing 780 N climbs the ladder. When he is at a distance of 1.64 m along the ladder from lower end, the ladder slips, What is the coefficient of friction assuming it to be same for all contact surfaces?

28. Explain with sketches how the forces involved in the lifting of a load by a wedge are analysed.

29. A simply supported beam AB of span 4m is carrying a uniformly distributed load of 5 kN/m over a length of 2m from the right hand support. Calculate the support reactions using the principle of virtual work.

30. A uniform ladder of weight 100 N and length 5m is placed against a vertical wall in a position where its inclination to vertical is 30^0. A man weighing 800N climbs the ladder. At what position will the ladder slip? Coefficient of friction for all contact surfaces is 0.2.

MODULE 5

24. What do you mean by instantaneous centre of rotation? How can it be located for a

body moving with combined motion of rotation and translation?

25. State D'Alemberts principle giving equations expressing the above Principle on the motion of a lift moving upwards with an acceleration 'a' m/sec^2 carrying a weight of 'W' N

26. The crank of a reciprocating engine is rotating at 210 r.p.m. The length of the crank and connecting rod are 20cm & 100cm respectively. Find the velocity of point A (velocity of piston) when crank has turned an angle of 45^o with the horizontal

27. An elevator weigh 5000 N is ascending with an acceleration of 3 m/s2.During this ascend its operator whose weight is

700N is standing on the floor. What will be the reaction produced by the floor on the operator, what will be the total tension in the cable on the elevator.

28.A man weighing 500 N gets into a lift. Calculate the force exerted by him on the floor of the lift when it is:

i)Moving up with an acceleration of 2.5m/s^2 and

ii)Moving down with same acceleration

6.In a crank and connecting rod mechanism, the length of the crank and the connecting rod are 12 cm and 50 cm respectively. The crank is rotating at 300 rpm. Find the angular velocity of the connecting rod and velocity of the piston when the crank is at an angle of 45^0 with the horizontal.

7. A roller of radius 12 cm rides between two horizontal bars moving in opposite directions with velocities 2.88 m/sec and 1.92 m/sec. Calculate the distance defining the position of the path of the instantaneous centre of rotation of the roller. Assume no slip at points of contacts.

8. Two blocks A and B of weight 150 N and 100 N are released from rest on a 30^o inclined plane, when they are 15 m apart. The coefficient of friction between the upper block A and the plane is 0.2 and that between the lower block B and the plane is 0.4. In what time block A reach block B? after they touch and move as a single unit, what will be acceleration with which it will move down?

MODULE 6

25. Distinguish between SHM and periodic motion?
26. Explain the types of vibrations
27. Discuss – (a) amplitude (b) frequency (c) time period
28. A body performing simple harmonic motion completes 8 oscilations in one minute. The velocity of the body is half the maximum velocity at a distance of 12 cm from the

    centre. Determine the amplitude and maximum acceleration.
29. A particle has simple harmonic motion. Its maximum velocity was 6 m/s and the maximum acceleration was found to be 12 m/s^2. Determine the angular velocity and amplitude. Also determine its velocity and acceleration when displacement is half of the amplitude.
30. The strength of a spring is such that a load of 50 N is required to elongate it by 10mm. When a certain load W is suspended from one end and caused to perform SHM, the complete oscillations per minute is 100. Calculate the stiffness of the spring and the value of load W
31. Define stiffness and equivalent stiffness of spring. Give the expression for equivalent stiffness of spring in series

and parallel.

32. A body performing simple harmonic motion has a velocity of 12 m/s when the displacement is 50 mm and 3 m/s when the displacement is 100 mm, the displacement being measured from the midpoint. Calculate the frequency and amplitude of motion. What is the acceleration when the displacement is 75 mm?