

Set-14(1)

B. Tech-1st (All Br.)

Mathematics-I

Full Marks : 50

Time : 2.30 hours

Answer all questions.

The figures in the right-hand margin indicate marks.

1. Answer all parts of this question : *2 × 5*
- (a) Find the value of $\Gamma(7/12)$.
 - (b) Define periodic function and write the period of $\cos 5x$.
 - (c) Find a unit normal vector to the curve $9x^2 + 4y^2 = 36$ at $(2, 1)$?
 - * (d) Are the row vectors $[1 \ 2 \ 3]$, $[0 \ 0 \ 1]$ and $[5 \ 5 \ 1]$ linear dependent.
 - * (e) What will be the eigen value of A^{-1} , if eigen value of A is 3. Also define skew symmetric matrix.

(Turn Over)

(2)

2. (a) Test the convergence of the improper integral

$$\int_0^\infty \frac{\cos x}{1+x^2} dx$$

4

✓ (b) Using gamma function evaluate the integral

$$\int_0^\infty e^{2ax-x^2} dx$$

4

Or

(a) Using Dirichlet test check the convergence

of the improper integral $\int_a^\infty \frac{\sin x}{\sqrt{x}} dx$

(b) Using gamma and beta function evaluate the integral

$$\int_0^a x^9 \sqrt[3]{a^6 - x^6} dx$$

3. (a) Find the Fourier series of functions

$f(x) = 0.5x^2$, $-\pi \leq x \leq \pi$ which is periodic with period $P = 2\pi$. Hence prove that

$$1 - \frac{1}{4} + \frac{1}{9} - \frac{1}{16} + \dots = \frac{\pi^2}{12}$$

8

(3)

Or

- (b) Find the Fourier series of following functions
 $f(x)$ which is periodic.

$$f(x) = x^3, \quad -\pi \leq x \leq \pi, \text{ period } P = 2\pi.$$

4. (a) Find the directional derivative of
 $f = (x^2 + y^2 + z^2)^{-1/2}$ at $(3, 0, 4)$ along direction of the vector $a = [1, 7, 0]$. 4
- (b) Prove that $\text{Curl}(\text{grad } f) = 0$. 4

Or

- (a) Prove that $\text{div}(\text{Curl } v) = 0$.

- (b) Find the directional derivative $f = e^x \cos yz$ at $(1, 0, 2)$ along direction of the vector $a = [6, 8, 0]$.

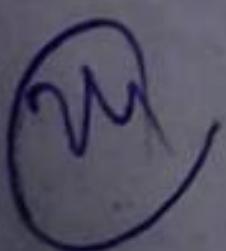
5. (a) Using Gauss elimination method solve the following equations : 4

$$x - y - 2z = -2$$

$$3x - y + z = 6$$

$$x - 3y - 4z = -4$$

- (b) Find the rank of the matrix 4



(4)

$$A = \begin{bmatrix} 9 & 3 & 1 & 0 \\ 3 & 0 & 1 & -6 \\ 1 & 1 & 1 & 1 \\ 0 & -6 & 1 & 9 \end{bmatrix}$$

Or

- (a) Check the set of positive real numbers for a vector space in R^3 .
- (b) Show that vectors $(1,0, -1)$, $(1,2,1)$ and $(0, -3,2)$ form a basis for R^3 .
6. Find the eigen values and eigen vectors of the matrix 8

λ

$$A = \begin{pmatrix} -10 & 10 & -15 \\ 10 & 5 & -30 \\ -5 & -10 & 0 \end{pmatrix}$$

Or

Diagonalize the matrix

$$A = \begin{pmatrix} 3 & 0 & 0 \\ 2 & 6 & 0 \\ 3 & 6 & 7 \end{pmatrix}$$

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Total Pages—6

Set-14(1)

B. Tech-1st (All Br.)
Engineering Physics

Full Marks : 50

Time : 2.30 hours

Answer all questions.

The figures in the right-hand margin indicate marks.

Symbols carry usual meaning.

Any supplementary materials to be provided.

1. Answer all questions : *2 × 5*

(a) Why the material executes elastic behavior
and on what factors it depends ?

(b) Sketch the phase-frequency response of a
body executing forced oscillation and at what
frequency zero damping occurs ?

(c) Why an extended source of light is required
for fringes in a Newton's ring experiment ?

(Turn Over)

(2)

- (d) A region is specified by the potential function given by $\phi = 4x^2 + 3y^2 - 9z^2$. Calculate electric field strength at any point (3, 4, 5) in this region.
- (e) Explain one major feature of the wave function for which the wave function and its first derivative needs to be continuous everywhere.
2. (a) With a suitable theory of torsion pendulum derive an expression for torque experienced and show that torsional couple per unit twists is proportional to fourth power of radius of the torsion pendulum.

6

- (b) A steel wire of length 2 m and diameter 0.52 mm is suspended from a rigid support and loaded with 5 kg. An elongation of 2.3 mm is observed. Calculate the coefficient of longitudinal elasticity of steel.

2

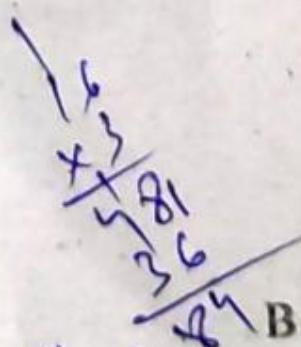
Or

- (a) Find the bending moment necessary for the bending of a beam and hence deduce the depression at the free end of a cantilever.

6

(3)

- (b) A wire of length 1 m and diameter 1 mm is clamped at one of its end. Calculate the couple required to twist the other end by 90° . Given modulus of rigidity $2.8 \times 10^{10} \text{ N/m}^2$.
3. (a) For a forced harmonic oscillator establish the relation between quality factor and sharpness of resonance.
- (b) Write down the differential equation for a damped harmonic oscillator. Solve the differential equation and discuss specially the case of oscillatory motion.
- 5
- Or
- (a) List out the various force acting on a body executing forced oscillation and obtain the steady state solution which leads to condition for amplitude resonance.
- (b) A particle executes SHM of period 31.4 s and amplitude 5 cm. Calculate the maximum velocity and maximum acceleration.
- 6
- 2



(4)

4. (a) Write the need of coherent sources for interference. Starting from the general differential wave equation obtain the solution for one dimensional wave. 4
- (b) Describe with necessary equation; how you will determine the refractive index of water using Newton's ring apparatus. 4

Or

- (a) Derive the condition for obtaining minima for the diffraction pattern due to a single slit. What happens to the width of the central maximum in a single slit Fraunhofer diffraction pattern when the slit width is increased ? 6
- (b) A plane of polarized light is incident on a quartz plate that is cut parallel to the axis. The minimum thickness of the plate for which the O- and E- ray recombine to form a plane polarized light is 2.65×10^{-3} cm. If $\mu_e = 1.5500$, calculate the value of μ_o assuming that $\lambda = 5.2 \times 10^{-5}$ cm. 2

(5)

5. (a) How Gauss divergence theorem different from that of Stokes theorem ? Prove that $\iint_S (\text{curl } \vec{F}) \cdot d\vec{S} = 0$ for any closed surface S. 3
- (b) Write the necessity for which the Ampere's circuital law is modified. Derive the corresponding Maxwell's Equation based on modified Ampere's circuital law. 5

Or

- (a) Derive Maxwell's wave equation for electric field in a conducting medium. Identify the dissipative term present in the said equation and write the physical significance of this term. 5
- (b) Show that electric field and magnetic field both are separately transverse to the propagation of electromagnetic wave. 3
6. (a) What are de Broglie matter waves ? Can a photon and an electron of the same momentum have the same wavelength ? Compare their wave length if the two have the same energy. 4

(6 .)

- (b) What do mean by population inversion ?
Distinguish between three levels and four
level pumping schemes.

4

Or

- (a) Establish the three dimensional Schrödinger
wave equation for a particle confined in a box.
Explain the concept of energy eigenvalue and
degeneracy of the system.

6

- (b) What are Einstein's coefficients ? Write
down the relation between them.

2

B.Tech-1st- (All Br.)
Engineering Mechanics

Full Marks : 50

Time : 2.30 hours

Answer all questions.

The figures in the right-hand margin indicate marks.

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Any supplementary materials to be provided.

1. Answer *all* questions : 2×5

**(a)* State Varignon's principle. Explain by an example.

(b) State and explain principle of virtual work.

(c) What do you mean by radius of gyration ?

**(d)* Using Papus theorem calculate the centroid of a semicircular arc of radius r .

(e) Distinguish between Newton's 2nd law and motion and D'Alembert principle.

(Turn Over)

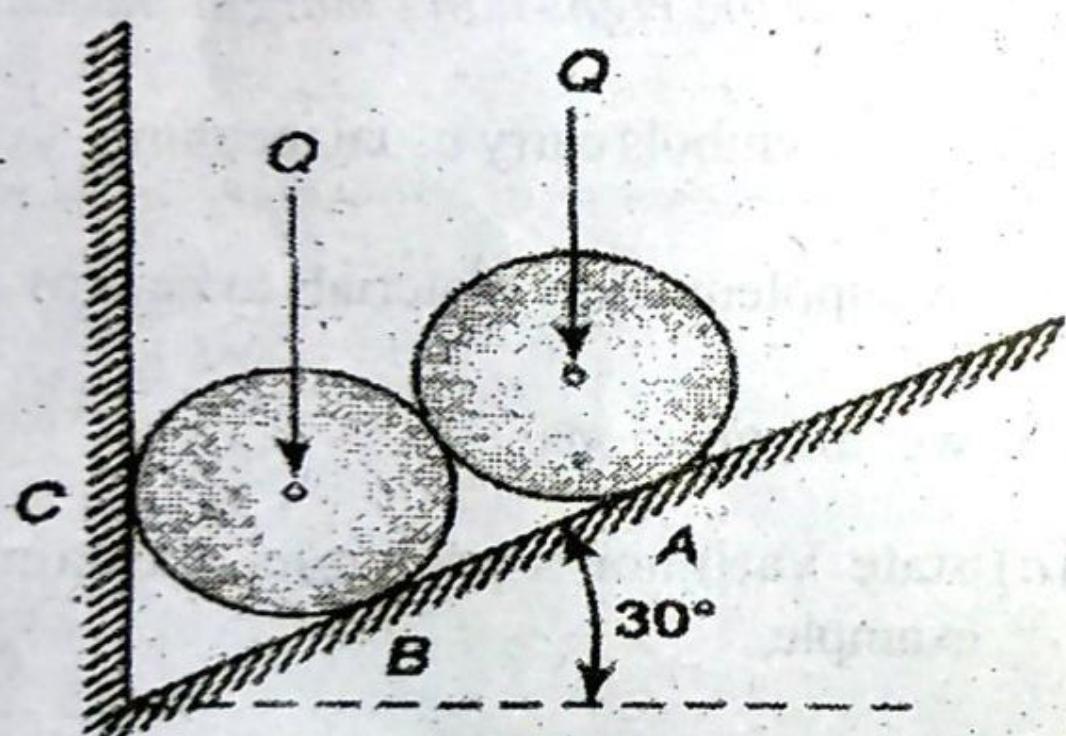
(2)

2. (a) State and explain Lamis theorem.

2

- (b) Two identical rollers each of weight $Q = 445 \text{ N}$ are supported by an inclined plane at a vertical wall as shown in the figure. Assuming the smooth surfaces, find the reaction induced at the point of support A, B and C.

6



Or

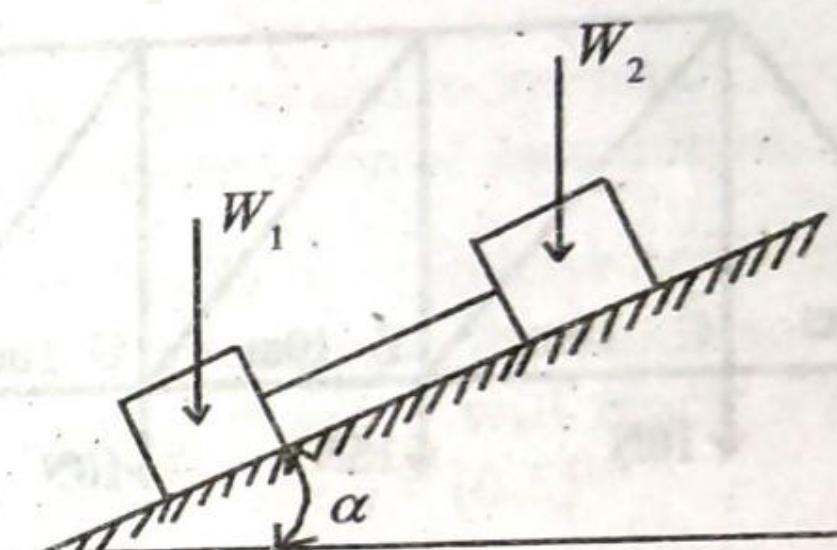
- (a) Distinguish between static friction and kinetic friction. Which one is higher and why?

2

- (b) Two blocks of weights and rest on a rough inclined plane and are connected by a short piece of string as shown in Figure if the coefficients of friction are $= 0.2$ and $= 0.3$ respectively, find the angle of inclination of the plane for which sliding will impend. Assume $= 22.25 \text{ N}$.

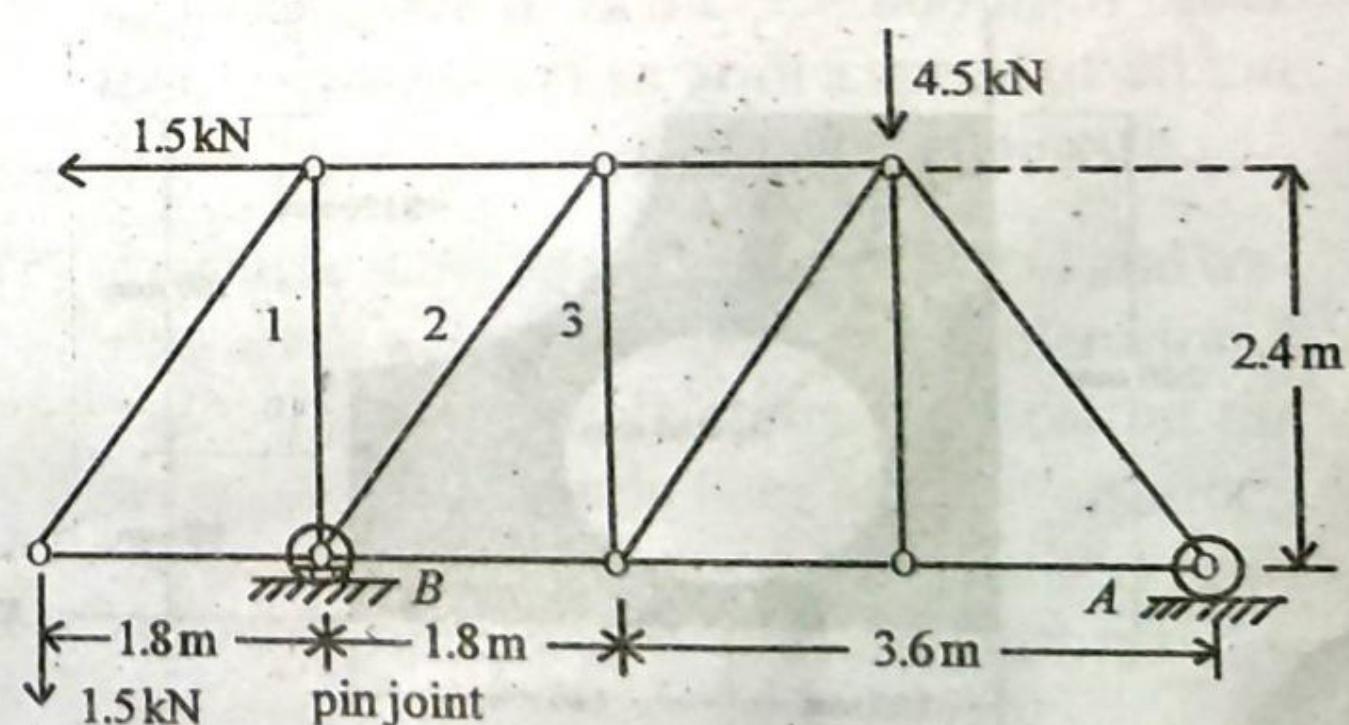
piece of string as shown in Figure if the coefficients of friction are $= 0.2$ and $= 0.3$ respectively, find the angle of inclination of the plane for which sliding will impend. Assume $= 22.25 \text{ N}$.

6



3. Determine the axial force in each of the bars 1, 2 and 3 of the plane truss shown in Figure.

8

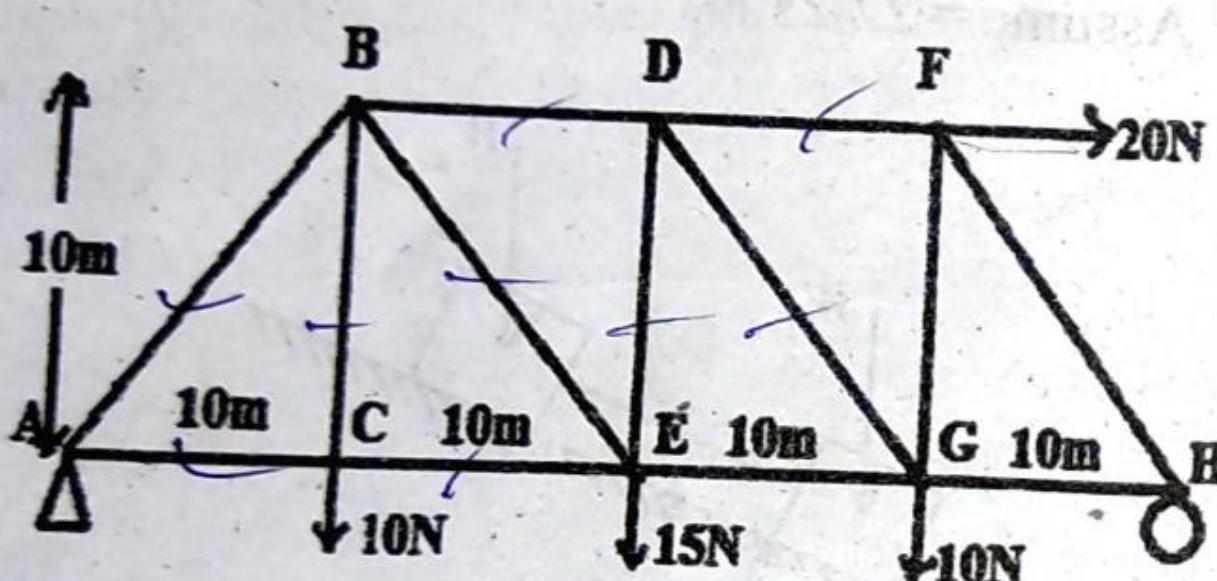


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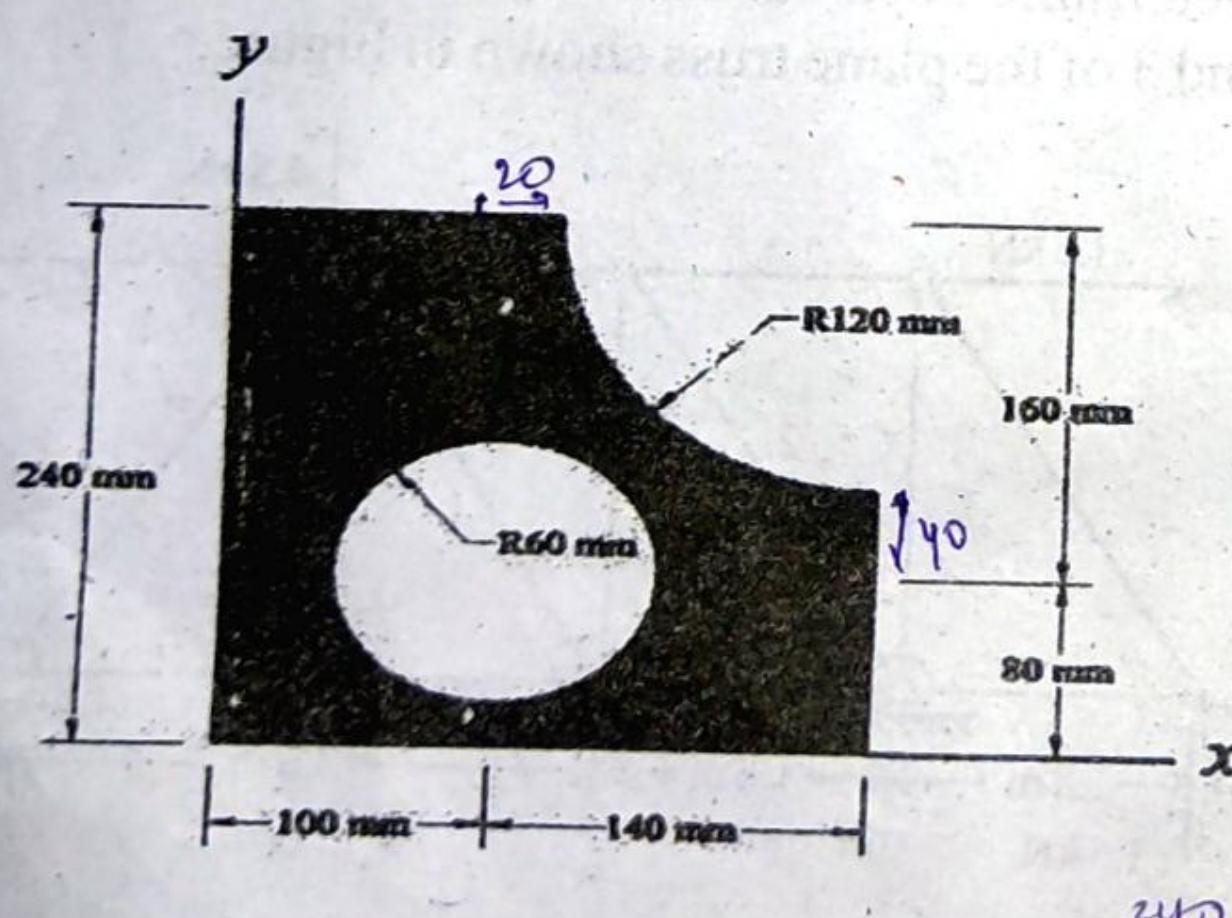
2.

Or

- Find the force in each member of the following truss.



4. Calculate the centroid of the shaded area as shown in Figure.



B.Tech-1-EME/Set-14(1)

240

(Continued)

(5)

Or

- Find the moment of inertia about the centroidal X-X and Y-Y axes of the I section whose top flange as $30 \text{ mm} \times 10 \text{ mm}$, bottom flange as $30 \text{ mm} \times 10 \text{ mm}$ and web as $30 \text{ mm} \times 10 \text{ mm}$. 8

5. (a) Define impulse and momentum. Explain the law of conservation of momentum. 3

(b) Find the height from which a heavy elastic ball must be dropped on the floor so that after rebounding thrice it will reach a height of 16 meters ? Take $e = (0.5)^{1/3}$. 5

Or

- (a) Find the proper super elevation e for a 7.2 m highway curve of radius $r = 600$ m in order to that a car travelling with a speed of 80 km /h will have no tendency to skid sidewise. 3

(b) A vehicle starts from rest at a point O and travels along a straight line with acceleration 2 m/s^2 . Another vehicle starts from rest at the same point 4 seconds later and travels along the same path with an acceleration of 3 m/s^2 . How far from O will be the location where the 2nd would overtake the first vehicle. 5

B.Tech-1-EME/Set-14(1)

(Turn Over)

(6)

6. A particle is aimed at a mark on the horizontal plane through the point of projection. It falls 12 m short when the angle of projection is 15° while it overshoots the mark by 24 m when the angle of projection is 45° . Find the angle of projection to hit the mark. Assume no air resistance. 8

Or

A bullet of mass 20 gm is fired horizontally with a velocity of 300 m/s from a gun carried in a carriage, which together with the gun has a mass of 100 kg. The resistance to sliding of carriage over the ice on which it rests is 20N. Find 8

- (i) Velocity, with which the gun will recoil
- (ii) Distance, in which it comes to rest
- (iii) Time taken to do so.

Total Pages—6

Set-14(1)

B. Tech-1st (All Br.)
Basic Electrical Engineering

Full Marks : 50

Time : 2.30 hours

Answer all questions.

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Symbols carry usual meaning.

Any supplementary materials to be provided.

1. Answer all questions : 2×5

(a) How to convert a star connected load to a delta connection. Explain with an example.

(b) How to improve power factor ?

(c) What is eddy current and hysteresis loss.

(d) What is a auto-transformer.

(e) What is a MI types of voltmeter ?

(Turn Over)

(2)

- ✓ 2. (a) Use Nodal analysis method to find current in each of the branches of the network in Figure-1.

4

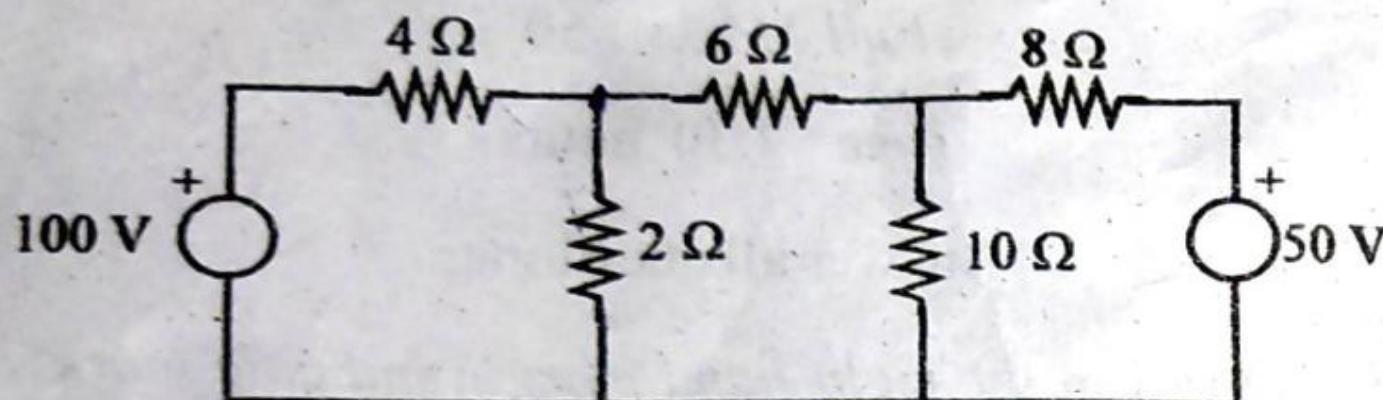


Figure 1

- (b) In Figure-2, find current in 10 ohm resistor using Thevenin's Theorem.

4

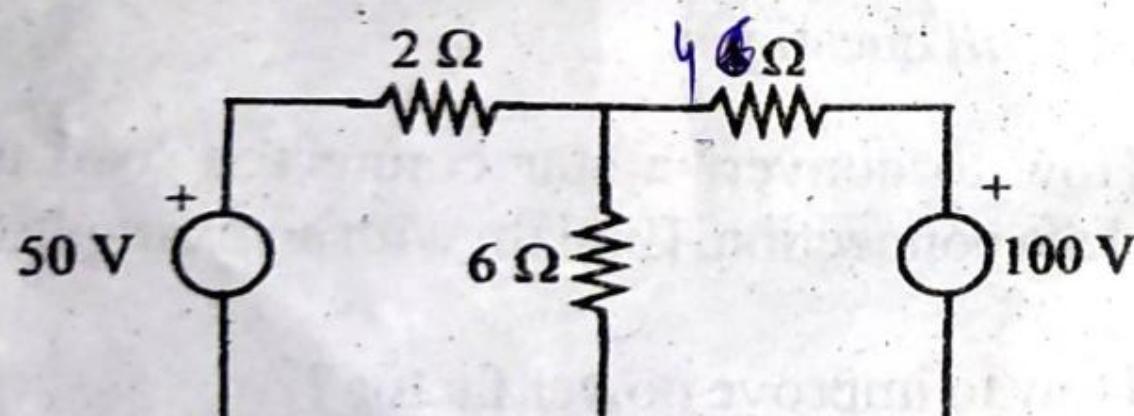


Figure 2

Or

- (a) Calculate loop/mesh currents in the network given in Figure-1.

4

(3)

- (b) Refer to Figure-3, find maximum power that can be transferred to R and also find the value of R.

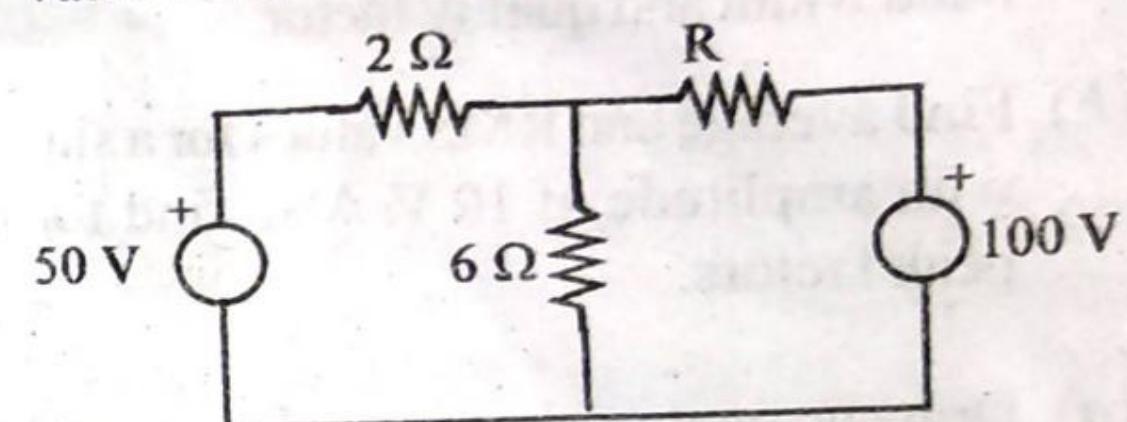


Figure 3

3. (a) A 3-phase star connected load, each of the phases with a 5 ohm resistor and 50 mH inductor are connected in series. The load is supplied from a 440 V, 3 phase supply. Calculate line voltage, phase voltage, line current, phase current. Also calculate active, reactive and apparent power.

6

- (b) In a measurement of 3-phase power using two wattmeter method, two wattmeters read as 200 and 100 watts respectively. Find the power factor of the load.

2

Or

(4)

- (a) Deduce the expressions for resonance in a series R-L-C circuit. Explain the terms band width and quality factor. 4
- (b) Find average and RMS values for a sine wave with amplitude of 10 V. Also find form and peak factors. 4
4. (a) Draw an analogy between electric and magnetic circuits. Draw the B-H curve for a magnetic circuit. 4
- (b) Given the Magnetic system in Figure-4, assume the core of cross section 4 m^2 , the path length of main core is 8 cm and air gap length is 1 mm. How many turns of the coil is required for a current of 400 mA to achieve a flux of 4 webers. 4

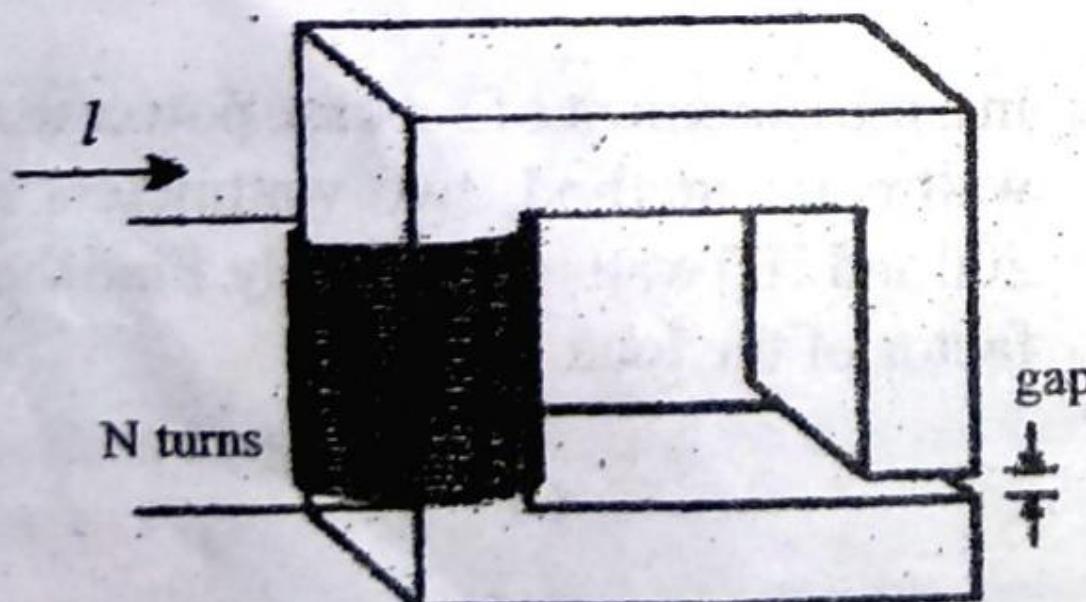


Figure 4

(5)

Or

- (a) Derive EMF equation of a DC generator. Explain each of the terms. 4
- (b) A 4-pole, 1500 rpm, Lap wound DC generator having 32 slots and 8 conductors per slot. If flux per pole is 0.04 Wb, determine the EMF induce in the armature. 4
5. (a) A 250 KVA, 11 KV/415 V, 50 Hz, single phase transformer has 80 turns in the secondary. Calculate (i) rated primary and secondary currents, (ii) number of primary turns, (iii) maximum flux in the core and (iv) voltage induce per turn in secondary. 4
- (b) Discuss the principle of rotating magnetic field. 4

Or

- (a) Discuss the principle of operation of an alternator. 4
- (b) How you will start a single phase induction motor? 4

(6)

6. (a) What is power supply system ? Draw a single line diagram of a typical AC power supply system.

4

(b) Draw a general layout of electrical power system and explain function of its elements.

4

Or

(a) Explain the principle of PMMC type of measuring instruments.

4

(b) Explain the principles of induction type energy meter.

4

B. Tech-1st (EFBC)

English for Business Communication

Full Marks : 50

Time : 2.30 hours

Answer all questions.

The figures in the right-hand margin indicate marks.

Symbols carry usual meaning.

Any supplementary materials to be provided.

1. Answer all questions : 2 × 5

(a) Rewrite the following sentence so as to make it bias-free :

Teachers who want to teach in a school meant for blind or deaf students should make sure that their students are treated with kindness and sympathy.

(b) Give an example of the present perfect progressive tense along with the form.

(Turn Over)

(2)

- (c) Transcribe the following words phonetically using IPA symbols.
- (i) Judge
(ii) Laugh
- (d) Distinguish between a salutation and a complimentary close.
- (e) State any two differences between a notice and a circular.
2. (a) Illustrate any four barriers to communication and state how they can be overcome. 4
- (b) What is plain English/communication ? Discuss the guidelines essential to maintain clarity and economy in writing. 4

Or

3. (a) What is a grapevine ? Briefly discuss the advantages and disadvantages of a grapevine. 4
- (b) Explain any four forms of non-verbal communication with examples. 4

(3)

3. (a) Distinguish between stative and dynamic verbs. Explain the two verbs with appropriate examples. 4
- (b) What are active and passive voices ? State some rules associated with active and passive voice along with examples. 4
- Or
- (a) What do the perfective and progressive aspects express ? Provide their structure along with examples. 4
- (b) Explain the different kinds of conditionals with examples. 4
4. (a) What is intonation ? What are the general uses of rising tone ? 4
- (b) What English sounds are difficult for Indian speakers/non-native speakers ? 4

Or

- (a) How the vowels in English are classified ? 4

(4)

- (b) Write a short note on the following : 4
- (i) International phonetic alphabet (IPA)
 - (ii) Contrastive stress
5. (a) Write a paragraph on the following topic in about 120 words : 4
Without education man is just a beast.
- (b) As the Purchase Manager of Satyam Computers, 9 Naidu Road, Hyderabad-500007, you had ordered two dozen Personal Computers from Hindustan Computers Limited (HCL), 140 M. G. Road, Bangalore-500001. When the consignment arrived, you found some pieces in a damaged condition. Write a complaint letter to the company's Sales Manager asking for repair, replacement, or compensation. 4

Or

- (a) What are sentence linkers ? Justify your answer with suitable examples. 4
- (b) Elucidate the various differences between a letter report and a memo report. 4

(5)

6. (a) Discuss the important points to be considered while drafting a cover letter to accompany a Curriculum Vitae. 4
- (b) How are letters and memos different from each other ? Explain the similarities and dissimilarities. 4

Or

- (a) Differentiate between a notice and an agenda ? Discuss the format of an agenda. 4
- (b) Discuss the key elements of a Curriculum Vitae. 4