

**B.Tech. DEGREE EXAMINATION, DECEMBER 2008.**

**(Examination at the end of Second Year First Semester)**

**(Electricals and Electronics)**

**Paper I — MATHEMATICS — III**

**Time : Three hours**

**Maximum : 75 marks**

**Answer Question No. 1 Compulsorily.**

**Answer ONE question from each of the Units.**

**Question No. 1**

**(1 × 15 = 15)**

1. (a) Find 'a<sub>0</sub>' of the Fourier Series to represent  $f(x) = (\pi - x)^2 / 4$  in the interval  $(0, 2\pi)$ .
- (b) What are the sufficient conditions for the uniform convergence of a Fourier series?
- (c) Write the Fourier series for  $f(x)$  in the interval  $c < x < c + 2l$ .
- (d) Write the second harmonic of Fourier series.
- (e) Write the Fourier Integral of  $f(x)$ .
- (f) What is the Fourier sine integral of  $f(x)$ .
- (g) Write the inversion formula for the Fourier sine transform.
- (h) Explain Bisection method briefly.
- (i) Give geometrical interpretation of Newton's method.
- (j) Show that  $\Delta = E - 1$ .
- (k) Write Bessel's formula.
- (l) Write Weddle's rule.
- (m) Explain Taylor's series method briefly.
- (n) Write the difference approximation for  $u_{yy}$ .
- (o) Write the difference between IVP and BVP.

**UNIT I**

2. (a) Given  $f(x) = \begin{cases} 1-x & \text{for } -\pi \leq x \leq 0 \\ 1+x & \text{for } 0 \leq x \leq \pi \end{cases}$ . Is the function even or odd? Find the Fourier series for  $f(x)$  and deduce the value of  $\frac{1}{1^2} + \frac{1}{3^2} + \frac{1}{5^2} + \dots$

**Or**

- (b) State and prove Parseval's formula for the Fourier series of  $f(x)$  converges uniformly in the interval  $(-l, l)$ .

**UNIT II**

3. (a) Find the Fourier transform of  $f(x) = \begin{cases} 1-x^2, & |x| \leq 1 \\ 0, & |x| > 1 \end{cases}$ . Hence evaluate  $\int_0^{\infty} \frac{x \cos x - \sin x}{x^3} \cos \frac{x}{2} dx$ .

Or

- (b) Evaluate  $\sqrt{84}$  correct to four decimal places by developing Newton-Raphson method for finding square root of a number 'M'.

### UNIT III

4. (a) Given  $y_{21}=18.4708$ ,  $y_{25}=17.8144$ ,  $y_{29}=17.1070$ ,  $y_{33}=16.3432$  and  $y_{37}=15.5154$ . Find  $y_{30}$  using Gauss's forward formula.

Or

- (b) Given

$x:$	1.00	1.05	1.10	1.15	1.20	1.25	1.30
$y:$	1.0000	1.0247	1.0488	1.0733	1.0954	1.1180	1.1401

Find  $\frac{dy}{dx}$  and  $\frac{d^2y}{dx^2}$  at  $x=1.25$ .

### UNIT IV

5. (a) Using Runge-kutta method of order 4, find  $y(0.2)$ . Given that  $\frac{dy}{dx} = 3x + \frac{y}{2}$ ,  $y=1$  when  $x=0$ , choosing proper  $h$ .

Or

- (b) Solve  $\nabla^2 u = 0$  under the conditions  $u(0, y) = 0$ ,  $u(4, y) = 12 + y$  for  $0 \leq y \leq 4$ ;  $u(x, 0) = 3x$ ,  $u(x, 4) = x^2$  for  $0 \leq x \leq 4$  taking the interval lengths on both directions as unity.

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**(DEE 212)**

**B.Tech. DEGREE EXAMINATION, DECEMBER 2008.**

**(Examination at the end of Second Year 1st Semester)**

**Electricals and Electronics**

**Paper II — NETWORK ANALYSIS — I**

**Time : Three hours**

**Maximum : 75 marks**

**Answer Question No. 1 compulsory.**

**Answer ONE question from each Unit.**

**All questions carry equal marks.**

1. (a) Define 'Self Inductance'.

- (b) Write the expression for energy stored in a capacitor.
- (c) What is the difference between Ideal source and practical source?
- (d) What is the difference between dependent source and independent source?
- (e) Define Thevenin's theorem.
- (f) Define 'RMS Value' and 'Average Value'.
- (g) Define Millman's theorem.
- (h) Define 'Crest Factor'.
- (i) Define 'Phase difference' in Sinusoidal Waveforms.
- (j) What is Active power?
- (k) Define 'Reactive Power'.
- (l) What is Q-factor of a practical capacitor?
- (m) Define 'Final-Value' theorem.
- (n) What is the time constant of a series R-L circuit?
- (o) What is 'Control Statement'? ( $1 \times 15 = 15$ )

### UNIT I

2. (a) Find the power loss in 1 ohm resistor of the following circuit using Star-Delta transformation technique. (7)

- (b) Use 'Mesh Analysis' to obtain the value of current 'I<sub>o</sub>' in the circuit given below : (8)

**Or**

3. (a) Find the value of 'I<sub>x</sub>' in the circuit given below using 'Source-Transformation' method. (7)

(b) Determine voltage ' $V_1$ ' and ' $V_2$ ' and ' $V_3$ ' (Node-voltages) in the following circuit using 'Nodal-Analysis' method. (8)

## UNIT II

4. (a) Calculate the 'R.M.S.-Value' of the voltage wave form shown below : (7)

(b) Obtain the Thevenin's equivalent circuit at the terminals A–B for the circuit shown below : (8)

**Or**

5. (a) Obtain the Norton's equivalent circuit for the following circuit across terminals A–B and hence find the current ' $I_x$ '. (7)

(b) Find the maximum power transferred to resistor ' $R_L$ ' in the following circuit. (8)

### UNIT III

6. (a) An inductive circuit draws 10 Amps and 1 kW power from a 220 Volts, 60 Hz a.c. supply. Determine (i) The impedance in cartesian form (ii) The impedance in polar form (iii) The power factor (iv) The reactive power and (v) The apparent power. (7)
- (b) Find the Q-factor and frequency of resonance of the circuit shown below : (8)

Or

7. (a) Use the “Super position Theorem” to find the current ‘ $I_X$ ’ in the following circuit. (7)
- (b) In the following network, find the complex power supplied by each source. (8)

### UNIT IV

8. (a) In the following circuit, the switch is in closed position for a long time and at  $t = 0$ , it is opened. Find  $V_k$ ,  $\frac{dV_k}{dt}$  at  $t = 0^+$ . (7)

( $V_K$  = voltage across the switch 'K')

(b) In the network shown below, the switch is closed at  $t = 0$  and there is no initial charge on either of the capacitor. Find the current ' $i$ ' by Laplace Transform method. (8)

Or

9. (a) Find the complete response ' $V_C$ ' and then ' $i$ ' for  $t > 0$  in the following circuit. (7)

(b) In the following circuit,  $I_S = 0$  for  $t < 0$  and the system is at rest.  $I_S = \cos\left(3t + \frac{\pi}{4}\right)$  for  $t > 0$ . Using Laplace transform method, obtain the expression for  $i(t)$ . (8)

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(DEE 213)

**B.Tech. DEGREE EXAMINATION, DECEMBER 2008.**

**(Examination at the end of Second Year First Semester)**

**Electricals and Electronics**

**Paper III — ELECTRONIC DEVICES**

**Time : Three hours**

**Maximum : 75 marks**

**All questions carry equal marks.**

**Answer Question 1 compulsorily.**

**Answer ONE question from each Unit.**

1. (a) Define cut-in voltage.
- (b) Write voltage and current expression in the P-N junction diode.
- (c) Define base width modulation.
- (d) Draw the equivalent circuit of a diode.
- (e) Define resistivity in a diode.
- (f) Define deflection sensitivity.
- (g) Draw the ideal V-I characteristics of diode.
- (h) Write applications of zener diode.
- (i) Give the relation between  $\alpha$  and  $\beta$ .
- (j) Pinch-off voltage in JFET explain.
- (k) Define stability factor 'S'.
- (l) Write characteristics of SCR.
- (m) Write the relation between  $\mu$  and  $gm$ .
- (n) Define 'Thermal run away'.
- (o) Draw the characteristics of UJT.  
(15 × 1 = 15)

#### **UNIT I**

2. (a) Draw the block diagram of CRT. (8)
- (b) Derive the equation for electrostatic deflection sensitivity in a CRT. (7)

**Or**

3. (a) Explain 'Intrinsic and extrinsic' semi conductor. (5)
- (b) Classify the material based on the energy band diagram. (5)
- (c) Explain law of mass action. (5)

#### **UNIT II**

4. (a) Explain P-N junction diode and draw V-I characteristics of P-N junction diode. (7)
- (b) Explain Transition and Diffusion capacitances of P-N diode and derive them. (8)

**Or**

5. (a) Explain photo diode and write the applications. (7)  
(b) Explain 'zener and avalanche' breakdown and draw neat diagrams for voltage regulator. (8)

### UNIT III

6. (a) Explain CE configuration using NPN transistor and draw its I/P and O/P characteristics. (8)  
(b) How transistor act as a switch explain. (7)

Or

7. (a) Explain 'Thermal runaway' and its significance. (7)  
(b) Explain photo transistor. (2)  
(c) Explain self and fixed bias in a transistor. (6)

### UNIT IV

8. (a) Explain different biasing methods in JFET. (8)  
(b) Explain UJT and draw its characteristics. (7)

Or

9. (a) Explain TRIAC and draw its characteristics. (6)  
(b) Draw and explain SCR with neat diagrams. (6)  
(c) Draw the characteristics of DIAC. (3)

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**(DEE 214)**

**B.Tech. DEGREE EXAMINATION, DECEMBER 2008.**

**(Examination at the end of Second Year First Semester)**

**Electricals and Electronics**

**Paper IV — ELECTRICAL AND ELECTRONICS ENGINEERING MATERIALS**

**Time : Three hours**

**Maximum : 75 marks**

**Answer Question No. 1 compulsory.**

**Answer ONE question from each Unit. (15 × 1 = 15)**

1. (a) What is the difference between nano wire and nano tube?  
(b) Mention few applications of nano structured materials.  
(c) What is the meaning of effective mass?  
(d) Give few examples of insulators.

- (e) What is 'carrier concentration'? Define.
- (f) Mention few examples of extrinsic semi conductors.
- (g) Write London's equation.
- (h) What is meaning of penetration depth?
- (i) Define the term 'isotope'.
- (j) Define 'Ferrites'.
- (k) Give few examples of hard magnetic material.
- (l) What is the meaning of 'paramagnetism'? Define.
- (m) What is 'total polarization'?
- (n) Give few examples of dielectric materials applications.
- (o) What is piezoelectricity? Define.

### UNIT I

- 2. (a) Explain briefly the synthesis of nano wires. (7)
- (b) Explain electrical characteristics of carbon nano tubes in detail. (8)

**Or**

- 3. (a) Explain synthesis of carbon nano tubes in detail. (7)
- (b) Discuss applications of nano structured materials. (8)

### UNIT II

- 4. (a) What are Brillouin zones? How are they related to the energy of an electron in a metal? (7)
- (b) What is meant by Fermi level in a metal? How does it vary with temperature in a metal? (8)

**Or**

- 5. (a) Explain the significance of Brillouin zones with particular reference to any cubic lattice. (7)
- (b) What is Fermi level? Derive an expression for the Fermi energy in terms of the number of electrons per unit volume. (8)

### UNIT III

- 6. (a) What is super conductivity? Explain Meissner effect. (7)
- (b) What are Ferrites? How are they superior to magnetic metals? Explain. (8)

**Or**

- 7. (a) How are Cooper Pairs formed? Explain the BCS theory of superconductivity, briefly. (7)
- (b) Briefly describe the Weiss molecular theory of ferromagnetism and derive the Curie-Weiss law. (8)

## UNIT IV

8. (a) Define 'polarization density'. Obtain an expression for Lorentz field in a dielectric material and hence derive the Clausius-Mosotti equation. (7)
- (b) Explain the terms dielectric loss and dielectric breakdown, briefly. (8)

Or

9. (a) Briefly describe different dielectric polarization mechanisms. What is complex dielectric constant? (7)
- (b) On what factors does the breakdown voltage of a dielectric material depend? What is the mechanism of thermal breakdown? (8)

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(DEE 215)

**B.Tech. DEGREE EXAMINATION, DECEMBER 2008.**

**(Examination at the end of Second Year First Semester)**

**Electricals and Electronics**

**Paper V — DIGITAL ELECTRONICS**

**Time : Three hours**

**Maximum : 75 marks**

**Answer Question No. 1 compulsorily and ONE question from each Unit.**

1. (a) Convert 1583.456 into binary form.
- (b) Define race around condition.
- (c) What are the advantages of ECL family?
- (d) Perform binary subtraction  $(1001)_2 - (0101)_2$ .
- (e) Convert J-K flip-flop into D flip flop.
- (f) State Demorgan's laws.
- (g) Define Dual theorem.
- (h) Define min term and max term.
- (i) Convert 10111 gray code to binary code.
- (j) How many flip-flops are needed for MOD-10 counter?
- (k) What is the excess-3 code for 1101?
- (l) Draw the binary adder circuit.
- (m) What is the advantage of HTL family?
- (n) Define register.

## UNIT I

2. (a) Perform the binary multiplication for 1011 with 1110. (8)
- (b) Minimize the following using K-map and implement the minimized function (7)

$$f(ABCD) = \Sigma m(0, 1, 3, 8, 9, 13, 15) + \Sigma \phi(10, 12, 14).$$

**Or**

3. (a) Perform 1's and 2's complement subtraction for 10110 – 11010 .

(7)

- (b) Using tabulation method reduce the following function  $\Sigma(w, x, y, z) = \Sigma(1, 4, 6, 7, 8, 9, 10, 11, 15)$  indicate prime implicants and essential prime implicants.

(8)

### UNIT II

4. (a) Design a three bit comparator and explain its operation.

(7)

- (b) Realise the following Boolean function with a multiplexer

(8)

$$F(A, B, C, D) = \Sigma m(0, 1, 3, 4, 8, 9, 15)$$

**Or**

5. (a) Design a full adder using NAND gate.

(8)

- (b) Design a BCD adder/subtractor.

(7)

### UNIT III

6. (a) Design a 4-bit asynchronous counter using J-K flip flops.

(8)

- (b) Convert D flip flop into J-K flip flop and draw its circuit.

(7)

**Or**

7. (a) Draw the circuit of a JK-FF using NAND gates. What type of problem is encountered in this type of FF? Explain the methods to overcome this.

(7)

- (b) Design a synchronous MOD-10 up counter using JK M/S flip flop and draw its o/p wave forms for a continuous clock. (8)

### UNIT IV

8. (a) Explain TTL-NAND gate with neat circuit.(7)

- (b) What are PAL and PLA's? Explain their working in brief with an example for each case.

(8)

**Or**

9. (a) Draw an ECL gate and explain its working.

(7)

- (b) Implement the following Boolean function using PLA

(8)

(i)  $F_1(A, B, C) = \Sigma(0, 1, 2, 4)$

(ii)  $F_2(A, B, C) = \Sigma(0, 5, 6, 7).$

**(DEE 216)**

**B.Tech. DEGREE EXAMINATION, DECEMBER 2008.**  
**(Examination at the end of Second Year First Semester)**

**Electricals and Electronics**

**Paper VI — ELECTRO MECHANICS — I**

**Time : Three hours**  
**75 marks**

**Maximum :**

**Answer question No. 1 is compulsory. (1 × 15 = 15)**

**Answer ONE question from each Unit.**

**(4 × 15 = 60)**

1. (a) Draw BH curve of a Hard magnetic material.
- (b) What are permanent magnets?
- (c) What is coercivity?
- (d) Why the armature core of a D.C. generator is Laminated?
- (e) How the polarity of a D.C series generator can be reversed?
- (f) What is the purpose of brushes in a D.C. Motor?
- (g) Why is the air gap between the pole pieces and armature kept very small?
- (h) What is the location of interpole?
- (i) In a D.C. Machine, where are compensating windings placed?
- (j) Why a D.C. series motor should not be run with out a load?
- (k) Identify suitable D.C. motor for (i) vaccum cleaner (ii) shearing.
- (l) Why is the induced e.m.f. in a motor called as Back e.m.f.?
- (m) How the direction of rotation of a D.C. shunt motor can be reversed?
- (n) On what factors does Hystersis loss depend?
- (o) What are the possible causes of sparking at the brushes?

**UNIT I**

2. (a) What is co-energy and how it is determined in magnetic systems?

(b) Two coils have self and mutual inductances of  $L_{11} = L_{22} = \left(\frac{2}{1+2x}\right)$  and  $L_{12} = (1-2x)$  : The coil resistances may be neglected. If the current  $I_1$  is maintained constant at 5A and  $I_2$  of -2A, find the mechanical work done when  $x$  increases from 0 to 0.5 mts.

**Or**

(c) Explain the principle of energy conversion in detail with suitable figures.

(d) An electrochemical device has the following stator and rotor coil inductances :

$$L_{11} = L_{22} = 1.6 + \cos 2\theta \text{ H};$$

$$L_{12} = L_{21} = 1 + 0.4 \cos \theta \text{ H}.$$

Neglecting coil resistances, find the torque developed as a function of angle ' $\theta$ ' when both coils are connected in a parallel to a voltage source  $160 \sin 314 t$  volts.

## UNIT II

3. (a) Give merits and de-merits of Lap winding and wave winding of Armature.

(b) A 20 KW compound generator works on full load with a terminal voltage of 250 V. The armature resistance is  $0.05 \Omega$  and series field and shunt field resistances respectively  $0.025 \Omega$  and  $100 \Omega$ . Calculate the total e.m.f. generated in the armature when the machine is short shunt connected.

**Or**

(c) Derive the expression for the e.m.f. generated in D.C. shunt generator.

(d) A 250 V ; 25 KW ; 4 pole D.C. generator has 328 wave connected armature conductors. When the machine is delivering full load, the brushes are given a lead of  $7.2^\circ$  Elec. Calculate Demagnetizing and cross-magnetizing ampere turns per pole.

## UNIT III

4. (a) What are the advantages of parallel operation of generators?

(b) A 220V, DC series motor running at a speed of 800 rpm and draws 100 A ; calculate at what speed the motor will run when developing half the torque. Total armature and field resistances is  $0.1 \Omega$ . Assume magnetic circuit unsaturated.

**Or**

(c) Explain armature control method for speed control of DC shunt motor with a neat circuit diagram.

(d) A 220 V shunt motor has an armature resistance of  $0.5 \Omega$ , the armature current at starting must not exceed 40 A. If the number of sections is 6. Calculate the values of the resistance steps to be used in the starter.

## UNIT IV

5. (a) Explain Swinburne's test and efficiency of a D.C generator can be predicted from it.

(b) A 220V ; D.C. shunt motor at no load takes a current of 2.5 A ;  $R_a$  is  $0.8 \Omega$  and  $R_f$  is  $200 \Omega$  estimate the efficiency of the motor when the input current is 20 A. State all the assumptions model.

Or

(c) Explain the operation of Amplidyne in detail.

(d) Enumerate various losses that occur in D.C. machine and obtain the condition for maximum efficiency of D.C. motor.

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(DEE 217)

**B.Tech. DEGREE EXAMINATION, DECEMBER 2008.**

**(Examination at the end of Second Year First Semester)**

**Electricals and Electronics**

**Paper VII — ENVIRONMENTAL STUDIES**

**Time : Three hours**

**Maximum : 75 marks**

**Answer ALL questions.**

**All questions carry equal marks.**

1. Explain the following in 1 or 2 sentences :

- (a) Define Environment and what are its components.
- (b) Distinguish between herbivores and carnivores.
- (c) What are the characteristics of Deserts?
- (d) What is biogas and how is it produced?
- (e) What are Hot spots of biodiversity?
- (f) What are greenhouse gases?
- (g) What are the pollutants responsible for ozone depletion in stratosphere?
- (h) Mention two sources of water pollution.
- (i) What is meant by sustainable development?
- (j) What is vermicomposting?
- (k) What is the significance of Ralegaon Siddhi?
- (l) Define water pollution.
- (m) What is cloud seeding?
- (n) What is Eutrophication?
- (o) What are the uses of green plants?

**UNIT I**

2. Explain the effects of modern agriculture.

Or

3. What is an Ecosystem? What are the functions involved?

**UNIT II**

4. Discuss in detail the “Values of Biodiversity”.

Or

5. What are the effects of Air Pollution on humanbeings, plants and materials?

**UNIT III**

6. What is the relation between population and pollution?

Or

7. What is the need for Environmental education? Explain.

**UNIT IV**

8. Explain the salient features of Environmental Protection Act.

Or

9. Write short notes on :

- (a) Chipko movement
- (b) Silent valley project.

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**(DEE 221)**

**B.Tech. DEGREE EXAMINATION, DECEMBER 2008.**

**(Examination at the end of Second Year Second Semester)**

**Electricals and Electronics**

**Paper I — MATHEMATICS — IV**

**Time : Three hours**

**Maximum : 75 marks**

**All questions carry equal marks.**

**Answer Question No. 1 compulsorily.**

**(1 × 15 = 15)**

**Answer ONE question from each Unit.**

**(4 × 15 = 60)**

1. (a) Determine the analyticity of  $f(z) = 2xy + i(x^2 - y^2)$ .
- (b) Prove that  $u = \frac{y}{x^2 + y^2}$  is harmonic.
- (c) Show that  $f(z) = z^3$  is analytic in the entire  $z$ -plane.
- (d) Write the real and imaginary parts of  $\log z$ .
- (e) If  $u = x^2 - y^2$  find the corresponding analytic function.

- (f) Write Cauchy's integral formula for derivatives.
- (g) Find the value of  $\oint_C \frac{dz}{z+1}$ ,  $C : |z| = 1$ .
- (h) Define essential singularity of  $f(z)$ .
- (i) Determine the poles and residue at each pole  $f(z) = \cot z$ .
- (j) Find the value of  $\oint_C \frac{3z^2+7z+1}{z+1} dz$  where  $C : |z| = \frac{1}{2}$ .
- (k) Define regular singular point of a differential equation.
- (l) Write the orthogonality property of Legendre polynomials.
- (m) Write the generating function for Bessel function.
- (n) Write Legendre's equation.
- (o) Write the value of  $P_1(x)$ .

### UNIT I

2. (a) Show that the function  $z|z|$  is not analytic anywhere.
- (b) If  $u - v = (x - y)(x^2 + 4xy + y^2)$  and  $f(z) = u + iv$  is an analytic function of  $z = x + iy$ , find  $f(z)$  in terms of  $z$ .

Or

3. (a) Determine the analytic function, whose imaginary part is  $V = \sinh x \cos y$ .
- (b) If  $f(z)$  is analytic show that

$$\left\{ \frac{\partial}{\partial x} |f(z)| \right\}^2 + \left\{ \frac{\partial}{\partial y} |f(z)| \right\}^2 = |f'(z)|^2$$

### UNIT II

4. (a) Evaluate  $\oint_C \frac{e^z dz}{(z+1)^4(z-2)}$ , where  $C$  is the circle  $|z-1|=3$ .
- (b) Find the Taylor series expansion of  $f(z) = \frac{1}{(z-1)(z-3)}$  about the point  $z = 4$ .

Or

5. (a) Evaluate  $\oint_C \frac{e^z}{z^2+1} dz$  over the circular path  $|z|=2$ .
- (b) Obtain Laurent's series expansion for  $f(z) = \frac{1}{(z+1)(z+3)}$  when (i)  $1 < |z| < 3$  (ii)  $|z| < 3$  (iii)  $|z| < 1$ .

### UNIT III

6. (a) Evaluate  $\oint_C \frac{4 - 3z}{z(z-1)(z-2)} dz$  using residue theorem  $C : |z| = \frac{3}{2}$ .

(b) Solve in series the differential equation

$$3x \frac{d^2 y}{dx^2} + 2 \frac{dy}{dx} + y = 0.$$

Or

7. (a) Evaluate  $\int_0^\infty \frac{\cos mx}{(1+x^2)} dx$ .

(b) Solve in series the equation  $\frac{d^2 y}{dx^2} + x^2 y = 0$ .

#### UNIT IV

8. (a) Show that

(i)  $P_{2m}(0) = \frac{(-1)^m \cdot 1 \cdot 3 \cdot 5 \cdots (2m-1)}{2 \cdot 4 \cdot 6 \cdots 2m}$ .

(ii)  $P_{2n+1}(0) = 0$ .

(b) Prove that  $J_3(x) + 3J_0'(x) + 4J_0'''(x) = 0$ .

Or

9. (a) Prove that

$$\int_{-1}^1 [P_n(x)]^2 = \frac{2}{2n+1}.$$

(b) Prove that

$$\frac{d}{dx} (x J_n J_{n+1}) = x (J_n^2 - J_{n+1}^2)$$

### B.Tech. DEGREE EXAMINATION, DECEMBER 2008.

(Examination at the end of Second Year Second Semester)

#### Electricals and Electronics

#### Paper II — ELECTRONIC CIRCUITS — I

Time : Three hours

Maximum : 75 marks

Answer Question No. 1 is compulsory.

Answer ONE question from each Unit.

1. (a) Define ripple factor.

(b) What is the value of the rectification efficiency of a half wave rectifier?

(c) What is meant by transmission error?

- (d) What is  $\alpha$ ,  $\beta$  in a transistor? How they are related?
- (e) Which transistor configuration has highest input resistance?
- (f) Define  $f_T$ .
- (g) Define lower and upper cut off frequencies for an amplifier.
- (h) What are the advantages of RC coupled amplifier?
- (i) Why are coupling capacitors used in amplifiers?
- (j) Which transistor configuration is used as intermediate stage in a multistage amplifier?
- (k) Define amplification factor ( $\mu$ ) in a FET.
- (l) Define transconductance.
- (m) What is the current gain of Darlington pair?
- (n) What is cascode amplifier?
- (o) What is Miller capacitances of a transistor?

### UNIT I

2. (a) Define regulation. Derive the regulation equation for a full wave circuit.  
 (b) Draw the circuit diagram of a half wave capacitor filtered rectifier circuit and explain its operation.

**Or**

3. (a) Obtain the response of a high pass circuit to ramp and square wave inputs. Discuss the effect of RC on the response.  
 (b) Obtain the response of low pass RC circuit to Ramp input.

### UNIT II

4. (a) Using the approximate  $h$ -parameter model, obtain the following expressions for emitter follower with a collector resistor circuit.  
 (i) current gain (ii) input impedance  
 (iii) voltage gain (iv) output impedance.  
 (b) Explain Miller's theorem with the help of a circuit diagram.

**Or**

5. (a) Draw the circuit of a CE transistor configuration and give its  $h$ -parameter model.  
 (b) A CE transistor amplifier is driven by a voltage ' $V_S$ ' of internal resistance  $R_S = 800 \Omega$ . The load resistor is a resistor  $R_L = 2000 \Omega$ . The parameters are :  $h_{ie} = 1100 \Omega$ ,  $h_{re} = 2.5 \times 10^{-4}$ ,  $h_{fe} = 50$ ,  $h_{oe} = 25 \mu A/V$ . Compute the current gain, voltage gain, overall current gain, overall voltage gain, input impedance, output impedance.

### UNIT III

6. (a) Draw the high frequency equivalent circuit of emitter follower. Derive the expression for the overall voltage gain.  
 (b) Derive the expression for the CE short circuit current gain ( $A_i$ ) as a function of frequency.

**Or**

7. (a) Explain how  $f_B$  and  $f_T$  of a BJT can be determined. Obtain the expression for the gain-bandwidth product of a transistor.
- (b) Derive the hybrid  $\pi$  parameters  $C_e, r_{bb'}, r_{b'e}, C_c$ .

**UNIT IV**

8. (a) Obtain the high frequency response of two interacting transistor amplifier stages.
- (b) Draw the common source amplifier circuit and the small signal equivalent circuit at high frequencies. Derive the expressions for voltage gain and input impedance.

**Or**

9. (a) Explain the frequency response of an RC coupled amplifier. Explain its significance.
- (b) Explain common Drain amplifier at high frequency.

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**(DEE 223)**

**B.Tech. DEGREE EXAMINATION, DECEMBER 2008.**

**(Examination at the end of Second Year Second Semester)**

**Electricals and Electronics**

**Paper III — ELECTROMAGNETIC FIELD THEORY**

**Time : Three hours**

**Maximum : 75 marks**

**Answer Question No. 1 compulsorily.**

**Answer ONE question from each Unit.**

**All questions carry equal marks.**

1. (a) Define 'Gauss's law' in integral form.
- (b) What is 'Electric field intensity'?
- (c) Define 'Electric Potential'.
- (d) What is Electric dipole?
- (e) Define 'Conduction Current'.
- (f) State 'Biot-Savart Law'
- (g) State 'Maxwell's Curl equation' for steady magnetic fields.
- (h) What is 'energy density' in magnetic field?
- (i) Define 'Scalar magnetic potential'.

- (j) What is Maxwell's divergence equation for magnetic field?
- (k) Define 'Displacement Current'.
- (l) State magnetic boundary conditions.
- (m) State 'Poynting theorem'.
- (n) What is 'Power density' in electromagnetic field?
- (o) What are the differences between perfect dielectrics and lossy dielectrics?

### UNIT I

2. (a) Show that the electric field intensity is equal to the negative potential gradient. In a certain region, the electric scalar potential is given by  $V = x^2 - 3y^2 + 6z$ . Find the intensity of electric field at a point  $P(4, -1, 2)$  metres.

(b) Derive an expression for the capacitance of a pair of coaxial cylinders of radii ' $a$ ' and ' $b$ ' and length ' $l$ ', the dielectric being air. The outside cylinder is earthed.

**Or**

3. (a) Using Laplace's equation, derive an expression for the potential difference at any point between spherical shells in terms of the applied voltage.

(b) Three point charges 3, 6 and 8 coulombs are situated in free space at the three corners of an equilateral triangle with side 8 units. Find the energy density within the triangle.

### UNIT II

4. (a) Derive an expression for the magnetic field at any point on a line through the centre at a distance ' $R$ ' from the centre and perpendicular to the plane of a plane circular loop of radius ' $r$ ' and carrying a current of ' $I$ ' amps.

(b) Derive an expression for 'Vector magnetic potential' due to an infinitely long straight wire carrying current 1 ampere lying along the  $z$ -axis. Then find the magnetic flux density.

**Or**

5. (a) Show that  $\text{curl}H = J$ .

(b) Explain the concept of scalar and vector magnetic potential.

(c) Calculate the energy stored in the magnetic field of a solenoid 50 cms. long and 6 cms. in diameter wound on a cylindrical paper tube with 4,000 turns of wire carrying a current of 20 Amps.

### UNIT III

6. (a) Express Maxwell's equations in differential and integral form. Compare them.

(b) A parallel plate capacity of separation 0.4 mm and with a dielectric of  $\epsilon_r = 19$ , has an applied rms voltage of 40 volts at a frequency of 20 GHz. Find the rms displacement current density. Neglect fringing.

**Or**

7. (a) State and explain Lorentz force equation for electromagnetic fields.
- (b) The magnetic flux density in region 1 of an interface between two materials is given by  $B_1 = 0.5a_x + 1.2a_y$  web/mt<sup>2</sup>. The permeability of region 1 is  $\mu_1$  and that of region 2 is  $\mu_2$ . Determine the 'B' field in region 2 just across the interface. The interface is the  $xz$  plane.

**UNIT IV**

8. (a) Show that in empty space ( $\bar{J} = 0, P = 0$ ),  $\bar{B}$  satisfies the wave equation.

$$\nabla^2 \bar{B} = \frac{1}{C^2} \frac{\partial^2 \bar{B}}{\partial t^2}.$$

- (b) Find the average Poynting vector for a plane wave of amplitude  $H_o = 1$  A/mt. in a homogeneous isotropic medium for which  $\mu_r = 1, \epsilon_r = 4$ . Find also, the maximum energy density of this wave.

**Or**

9. (a) What is 'Skin effect'? Explain. Define skin depth. Show that in case of a semi-infinite solid conductor, the skin depth ' $\delta$ ' is given by  $\delta = \sqrt{2/\omega \mu \sigma}$ , symbols have their usual meanings.
- (b) Derive an expression for Poynting vector. Show how this can be used to calculate the power.

**(DEE 224)**

**B.Tech. DEGREE EXAMINATION, DECEMBER 2008.**

**(Examination at the end of Second Year Second Semester)**

**Electricals and Electronics**

**Paper IV — NETWORK ANALYSIS — II**

**Time : Three hours**

**Maximum : 75 marks**

**Answer Question No. 1 compulsorily. (1 × 15 = 15)**

**Answer ONE question from each Unit. (4 × 15 = 60)**

**All questions carry equal marks.**

1. (a) What is a sub-graph of a network?
- (b) Define 'Tie-Set' matrix.
- (c) Define short-circuit parameters of a network (2-port).
- (d) Give the interrelation between  $z$ -parameters and  $h$ -parameters of a 2-port network.
- (e) State 'Initial-value' theorem.
- (f) Define 'poles' and 'zeros' of a network function.
- (g) Draw the configuration of a 'Ladder' network.
- (h) Define 'Mutual Inductance'.
- (i) What is a 'coupled circuit' ?

- (j) Distinguish between low pass and band pass filters.
- (k) Define 'positive real' function.
- (l) What is a 'link' of a graph of a network?
- (m) What is a 'Filter' circuit?
- (n) Show the configuration of star and delta connections of a 3-phase system.
- (o) Give the expression for the total power consumed by a 3-phase star-connected load from a 3-phase power supply.

### UNIT I

2. (a) For the oriented graph given below, obtain the 'cut-set' and 'Tie-set' schedules choosing elements 2, 4, 5 and 7 as links.

(b) Find  $[Y]$  for the two-port network shown below :

**Or**

3. (a) Obtain the node voltages for the network given below using network topology. The graph of the network is also given

(b) In the following 2-port network, find the hybrid-parameters.

### UNIT II

4. (a) Find the expression for the voltage across the capacitor with application of the step voltage in the following circuit. Let the initial voltage in the capacitor be 1 volt.

- (b) Obtain the  $Y$ -parameters for the following network :

**Or**

5. (a) Find the voltage across the capacitor in the network shown below :

- (b) Find the impedance function of the network given below :

### UNIT III

6. (a) Determine the coupling coefficient. Calculate the energy stored in the coupled inductors at time  $t = 1$  sec. if  $v = 60 \cos (4t + 30^\circ)$  volts, considering the following coupled circuit.

- (b) Draw the configurations of constant  $K$ -low pass filter. Derive the expressions for the elements of the filter circuit in terms of cut off frequency  $f_c$  and design impedance  $R_K$ .

**Or**

7. (a) For the following circuit, determine the coupling coefficient and the energy stored in the coupled inductors at  $t = 1.5$  sec.

(b) Draw the configurations of Band Pass  $m$ -derived filter. Derive the expressions for  $f_{\alpha 1}$  and  $f_{\alpha 2}$  frequencies.

#### UNIT IV

8. (a) A 3-phase, 3 wire, 220 volt, CBA system has a star connected load with  $z_a = 6 \angle 0^\circ$ ,  $z_b = 6 \angle 30^\circ$  and  $z_c = 5 \angle 45^\circ$  ohms. Find the line currents and displacement neutral voltages.

(b) 3-phase balanced load of impedances  $(10 + j8)$  ohms is connected in star and then in Delta configurations, across a 3-phase 400 volts, 50 Hz supply. Calculate the power factor and the total volt amperes consumed in both the cases.

Or

9. (a) A 3 wire, 400 volts, ABC system supplies a Delta connected load in which  $Z_{AB} = 15 \angle 30^\circ$  ohms,  $Z_{BC} = 20 \angle 0^\circ$  ohms and  $Z_{CA} = 25 \angle -30^\circ$  ohms. Find the line currents and the total power.

(b) Two wattmeters method is used to measure total power in a 3-phase load. The power readings of two wattmeters are +20 kW and -5 kW for a 3-phase load, if the supply voltage is balanced 400 V, find the true power drawn by the load, the power factor and line current.

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**(DEE 225)**

**B.Tech. DEGREE EXAMINATION, DECEMBER 2008.**

**(Examination at the end of Second Year Second Semester)**

**Electricals and Electronics**

**Paper V — PRIME MOVERS AND PUMPS**

**Time : Three hours**

**Maximum : 75 marks**

**Answer Q.No. 1 compulsory.**

**Answer ONE question from each Unit.**

**All questions carry equal marks.**

1. (a) What is internal energy?
- (b) Distinguish between extensive property and intensive property.
- (c) State second law of thermo dynamics.
- (d) Under what headings the centrifugal pumps are classified.
- (e) Explain briefly by providing the guide vanes for a reaction turbine.
- (f) Distinguish between steady state and equilibrium.
- (g) State the important differences between petrol engine and diesel engine.
- (h) State the important differences between two stroke engines and four stroke engines.

- (i) Define the pressure ratio for a Brayton's cycle.
- (j) Why is not possible to use high compression ratios in Otto cycle?
- (k) State the differences between impulse turbine and reaction turbine.
- (l) Explain the term "compounding in steam turbines".
- (m) What is a steady flow process?
- (n) What is a reversible process?
- (o) What is the effect of regeneration on Brayton's cycle efficiency?

### UNIT I

2. (a) Derive the equation for force exerted by a jet on moving curved vane at the centre. (7)
- (b) A set of water 50 mm in diameter having a velocity of 20 m/s impinges tangentially as a series of vanes, which when stationary deflect the jet through an angle of  $120^\circ$ . Calculate the magnitude of the resultant force on the vanes when they are (i) stationary (ii) moving with a velocity of 10 m/s in the same direction as the jet. Also determine the workdone for second and the efficiency in case(ii). (8)

**Or**

3. (a) Explain with neat sketches of the working of a single stage centrifugal pump. (7)
- (b) A centrifugal pump has an impeller 0.5 m outer diameter and when running at 600 rpm discharges water at the rate of 8000 lts per minute against a head of 8.5 m. The water enters the impeller with out whirl and shock. The inner diameter is 0.25 m, and the vanes are setback at outlet at an angle of  $45^\circ$  and the area of flow which is constant from inlet to outlet of the impeller is  $0.06 \text{ m}^2$ . Determine (i) the manometric efficiency of the pump (ii) the vane angle at inlet and (iii) the least speed at which the pump commences to work. (8)

### UNIT II

4. (a) What are the uses of a draft tube? Describe with neat sketches of the different types of draft tubes. (7)
- (b) An inward flow reaction turbine works under head of 22.5 m. The external and internal diameters of the runner are 1.35 m 1 m respectively. The angle of guide vanes is  $15^\circ$  and the moving vanes are radial at inlet. Radial velocity of flow through runner is constant and there is no velocity of whirl at outlet. Determine the speed of the runner in rpm, and the angle of vane at outlet. If the turbine develops 275 kW, find the specific speed neglect friction losses. (8)

**Or**

5. (a) What are the differences between impulse turbine and reaction turbine? (7)
- (b) A Pelton wheel has to be designed for the following data : power to be developed = 6000 kW, net head available = 300 m, speed = 550 rpm, ratio of jet diameter to wheel diameter = 1/10 and overall efficiency = 85%. Find the number of jets, diameter of the jet, diameter of the wheel and the quantity of water required. (8)

### UNIT III

6. (a) Explain the control volume technique in a variable flow process. (7)
- (b) A domestic refrigerator is loaded with food and the door closed. During a certain period the machines consumes 1 kwh of energy and the interval energy of the system drops by 5000 kJ. Find the net heat transfer for the system. (8)

Or

7. (a) Mention the merits and demerits of the Sterling and Ericsson cycles. (7)
- (b) In an air standard deisel cycle, the compression ratio is 16, and at the beginning of isentropic compression the temperature is  $15^{\circ}\text{C}$  and the pressure is 0.1 mega Pascal. Heat is added until the temperature at the end of the constant pressure process is  $1480^{\circ}\text{C}$ . Calculate (i) the cut off ratio (ii) the heat supplied per kg of air, (iii) the cycle efficiency, (iv) the m.e.p. (8)

#### UNIT IV

8. (a) Explain the differences between 2 stroke engines and four stroke engines. (7)
- (b) Explain the effect of pressure ratio as the net output and efficiency of a Brayton cycle. (8)

Or

9. (a) Derive an expression for force, workdone, diagram efficiency, stage efficiency and axial thrust in case of steam turbines. (7)
- (b) In a stage of impulse reaction turbine operating with 50% degree of reaction, the Wades are identical. The outlet of the moving blades is  $17^{\circ}$  and the absolute discharge velocity of the steam 50 m/s in the direction of  $110^{\circ}$  to the motion of the blades. Draw the velocity diagram and calculate the workdone per kg mass of flow per second. (8)

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**(DEE 226)**

**B.Tech. DEGREE EXAMINATION, DECEMBER 2008.**

**(Examination at the end of Second Year Second Semester)**

**Electricals and Electronics**

**Paper VI — ELECTRO MECHANICS — II**

**Time : Three hours**

**Maximum : 75 marks**

**All Questions carry equal marks.**

**Answer question No. 1 compulsorily**

**(1 × 15 = 15)**

**Answer ONE question from each Unit.**

**(4 × 15 = 60)**

1. (a) State EMF equation of a single phase transformer Identify all the quantities in the equation.

- (b) Draw the phasor diagram of a single-phase transformer under load condition.
- (c) What is 'All day efficiency' of a Transformer?
- (d) What are the advantages of 'Sumpners' Test?
- (e) Name the methods of cooling of Transformers.
- (f) What are the conditions for parallel operation of Transformer?
- (g) What is the function of Tertiary winding in a Transformer?
- (h) State the main constructional differences in squirrel cage and slip-ring type 3-phase Induction motors.
- (i) What is the meaning of term 'Slip' in a 3-phase Induction motor?
- (j) Draw the equivalent circuit of a 3-phase Induction motor and denote and identify all the parameter of circuit.
- (k) What are the experimental tests to be performed to predict the characteristics of a 3-phase Induction motor?
- (l) What is 'synchronous speed ( $N_s$ )' of Induction motor?
- (m) Name different types of speed control methods of 3-phase Induction motors.
- (n) What is 'Induction Generator'? Define.
- (o) Draw the equivalent circuit of single phase Induction Motor and denote the parameters.

### UNIT I

- 2.** (a) A single - phase transformer has 1000 turns on the primary and 500 turns on the secondary. The no-load current is 4 Amps. and the no-load power factor is 0.2 lagging. Calculate the current and power factor of the primary circuit when the secondary draws a current of 400 Amps. at a power factor of 0.8 lagging. The voltage may be neglected.
- (b) A 150 KVA distribution transformer is supplying the following loads :
- (i) 80 KW at 0.8 *p.f.* for 6 hours.
  - (ii) 40 KW at unity *p.f.* for 8 hours.
  - (iii) No - load for the remaining 10 hours of a day. Find all day efficiency if full-load copper losses are 2 KW and iron-losses are 1 KW.

**Or**

- 3.** (a) The open-circuit and short-circuit tests conducted on a 50 KVA transformer gave the following results :

O.C. Test : Primary voltage = 3000 volts

Secondary voltage = 400 volts;

Primary power input = 460 watts.

O.S. Test : Primary voltage = 124 volts

Primary current = 15.4 Amps;

Primary power = 540 watts.

Calculate (i) the efficiency at 3/4th full load and 0.8 p.f. lagging and (ii) the voltage regulation at 0.6 p.f. leading.

(b) Power input to two identical 250 KVA, single-phase transformers when connected. Back-to-Back was 4 KW. Power supplied through a regulating transformer to the secondary circuit is passing full load current, was 6 KW. Calculate the efficiency of each transformer at 0.8 p.f. lagging.

## UNIT II

4. (a) The primary and secondary voltages of an auto-transformers are 230 volts and 100 volts respectively. Calculate the currents in different parts of the winding when the load current is 250 Amps. Also calculate the saving in the use of copper.

(b) Two single-phase transformer operate in parallel to supply a load of impedance  $(2 + j 1.5)$  ohms. The transformer impedances as referred to secondary winding are  $(0.15 + j 0.5)$  ohms and  $(0.1 + j 0.6)$  ohms respectively. The open circuit secondary emfs are 207 volts and 205 volts find : (i) voltage across load (ii) power supplied to load and (iii) power output of each transformer.

Or

5. (a) Draw the phasor diagram of a single-phase auto-transformer and hence obtain the equivalent circuit of auto-transformer.

(b) A scott connected transformer is fed from a 6000 volts, 2-phase network and supplies three phase power at 500 volts between lines (outer) on a 4-wire system. If there are 600 turns per phase on the 2-phase side, find the number of turns of low-voltage windings and the position of the tapping of the neutral wire. Show that if the load is balanced on one side, it will be balanced on the other side.

## UNIT III

6. (a) Derive the expression for Torque in a 3-phase Induction motor and deduce the condition for maximum torque.

(b) A 3-phase induction motor has an efficiency of 0.96 when the load is 45 hp. At this load, the stator copper losses and rotor copper losses each equals to the iron loss. The mechanical losses are one-third of the no-load losses. Calculate the slip.

Or

7. (a) The power input to a 400 V, 50 Hz, 6-pole, 3-phase induction motor running at 975 rpm is 60 KW. The stator losses are 1 KW and friction and windage losses are total to 2 KW. Calculate (i) the slip, (ii) the rotor copper loss, (iii) the output horse-power and (iv) the efficiency.

(b) The results of no-load and blocked rotor tests on a 440 volts, 40 hp, 50 Hz, 3-phase, 4-pole induction motor are as follows :

No-load test :  $V_0 = 440 \text{ V}$ ,  $I_0 = 30 \text{ A}$ ,  $W_0 = 1800 \text{ W}$

Blocked rotor Test :  $V_{sc} = 110 \text{ V}$ ,  $I_{sc} = 80 \text{ A}$ ,  $W_{sc} = 4000 \text{ W}$ .

The motor has star connected stator having a resistance of 0.1 ohm per phase. Draw circle, diagram and find out full load current power factor, slip, torque and efficiency.

#### UNIT IV

8. (a) A 4-pole, 400 V, 3-phase, 20 hp induction motor has rotor resistance equal to 0.16 ohm per phase and stand still reactance equal to 0.2 ohm per phase. The voltage across slip rings at stand still is 142 volts per phase. The motor develops a torque of 64 N-m. at a slip  $S = 0.04$  and at a rotor current of 30 Amps. Find the magnitude and phase of emf to be injected into rotor circuit so that motor may operate at a speed of 40% above synchronous speed and develop the same torque.

(b) With neat sketches, explain the construction and working of a split-phase type single phase induction motor.

Or

9. (a) With relevant figures, explain (i) Star-Delta starting and (ii) Auto-Transformer starting of 3-phase Induction motor.

(b) A = 220 V, 50 Hz, 6 pole, 0.5 hp single-phase induction motor has  $r_1 = 11.4$  ohm,  $r_2^1 = 13.8$  ohm  $x_1 = x_2^1 = 14.3$  ohm and  $X_0 = 275$  ohms using the double revolving field theory, find (i) input current and power factor and (ii) torques due to forward and backward field components and Gross torque.

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