INSTITUTE OF ENGINEERING

Examination Control Division

2074 Bhadra

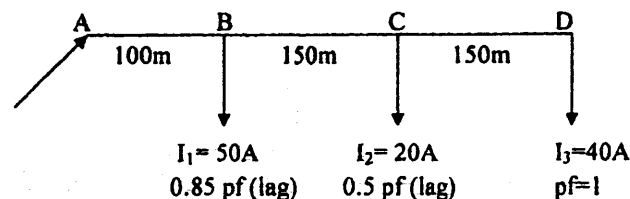| Exam.		Regular	
Level	BE	Full Marks	80
Programme	BEX	Pass Marks	32
Year / Part	II / II	Time	3 hrs.

Subject: - Power System (EE553)

✓ Candidates are required to give their answers in their own words as far as practicable.
✓ Attempt **All** questions.
✓ The figures in the margin indicate **Full Marks**.
✓ Assume suitable data if necessary.

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1. a) Draw a single line diagram of general power system. Mention the function of each of the components. [3+5]

   b) A transmission line at a river crossing is supported by two towers 50m and 55m above water level. The horizontal distance between towers is 300m. The tension in the conductor is 2000kg and weight of conductor is 0.85 kg/m. [8]

      (i) Find minimum clearance between conductor and water.
      (ii) Determine the position of minimum clearance.

2. a) Justify that the inductance of a conductor due to its internal flux linkage do not depend on conductor geometry and current carried by the conductor. [8]

   b) A 50 Hz, 132 kV overhead transmission line has conductors placed in a horizontal plane as shown below. Radius of the conductor is 1.12 cm. If the line length is 100 km, calculate the charging current per phase assuming complete transposition. [8]

3. a) A 132kV, 3-phase transmission line of 200 km long has, resistance, reactance and susceptance per km of 0.15Ω and 0.5Ω and 2x10-6 Siemen respectively. If the transmission line is delivering 50 MVA at 0.85 pf (lagging) at the receiving end. Calculate sending end voltage and current, voltage regulation and efficiency of line. [8]

   b) Explain clearly the Ferrantic effect with a phasor diagram. Also discuss the significance of surge impedance loading in case of ferranti effect. [8]

4. a) How the Y-matrix can be formulated in load flow analysis. Derive with suitable example. [8]

   b) The loading on a distributor having resistance and reactance of 0.25 Ω and 0.125 Ω per 1000 meters is given below. If the voltage at point D is to be kept 400V, what should be the voltage at point A. [8]

5. a) State the difference between a fuse and circuit breaker. Explain the time current characteristics of a fuse with necessary mathematical aid. [8]

   b) Write short notes on: [4×2]
      (i) Under ground cables
      (ii) Transposition of Transmission line

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Exam.		**Regular**	
Level	BE	Full Marks	80
Programme	BEX, BCT	Pass Marks	32
Year / Part	II / II	Time	3 hrs.

Subject: - Discrete Structure *(CT551)*

✓ Candidates are required to give their answers in their own words as far as practicable.
✓ Attempt **All** questions.
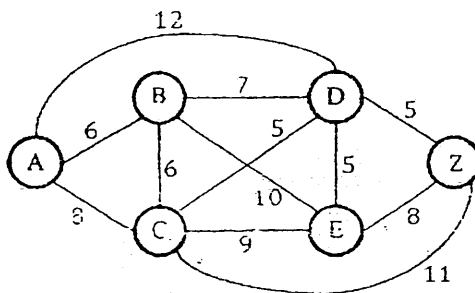✓ The figures in the margin indicate **Full Marks**.
✓ Assume suitable data if necessary.

1. Use rules of inference to show that the hypothesis "If my cheque book is in office, then I have paid my telephone bill", "I was looking for phone bill at breakfast or I was looking for phone bill in my office", "If I was looking for phone bill at breakfast then my cheque book is on breakfast table", "If I was looking for phone bill in my office then my cheque book is in my office", "I have not paid my phone bill" imply the conclusion "My cheque book is on my breakfast table." [8]

2. Write the inverse, converse and contrapositive of the statement "I visit temple only if it's Saturday". Prove that if n is a positive integer, then n is even if and only if 7n + 4 is even. [3+5]

3. Define tableau method with its significances? Use mathematical induction to prove the formula for the sum of a finite number of terms of Geometric Progression: [4+4]

$$\sum_{j=0}^{n} ar^j = a + ar + ar^2 + ... + ar^k = \frac{ar^{n+1} - a}{r-1},$$

when $r \neq 1$, where n is non-negative integer.

4. Given a language, L = {w ∈ {a, b}* : w contain at-least three 'b' s}

Write the regular expression for L and design a Finite State Automata that accepts the Language L. Your design should include the proper definition of the finite-state automation, transition table and the transition diagram. [2+6]

5. Consider the regular grammar G={N, T, P, σ} where N = set of non-terminal symbols = {σ, C}, T = set of terminal symbols = {a, b}, P is the set of production rules = {σ→bσ, σ→aC, C→bC, C→b} and σ being the starting symbol. Construct a non-deterministic finite state automaton equivalent to the given regular grammar. Use this non-deterministic finite state automaton to generate equivalent deterministic finite state automaton. [3+5]

6. State linear homogeneous and non-homogeneous recurrence relation with examples. Find all solutions of the recurrence relation: $a_n = 2a_{n-1} + 2n^2$ with initial condition $a_1 = 4$. [3+5]

7. Use Dijkstra's algorithm to find the length of shortest path from vertex A to vertex Z in the following weighted graph. Also highlight the shortest path/paths in the graph: [8]

8. State Handshaking Theorem for undirected graph. Define bipartite graph with suitable example. Draw the figure for Complete Bipartite Graph $K_{3,4}$ and determine its chromatic number. [2+2+2+2]

9. How does Hamiltonian circuit differ from Euler circuit? Define Planar and Regular graphs with suitable examples. [4+2+2]

10. Write short notes on: [4+4]

   a) Tree and its applications
   b) Max-flow Min-cut Theorem

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Exam.		Regular	
Level	BE	Full Marks	80
Programme	BGE, BEL, BEX, BCT, BAG	Pass Marks	32
Year / Part	II / II	Time	3 hrs.

Subject: - Numerical Method *(SH553)*

✓ Candidates are required to give their answers in their own words as far as practicable.
✓ *Attempt All questions.*
✓ *The figures in the margin indicate **Full Marks.***
✓ *Assume suitable data if necessary.* (SBK)

1. Discuss the significance of Numerical Methods in the field of science and engineering in modern day context. [4]

2. Write pseudo-code for finding a real of a non-linear equation using the False Position Method. [6]

3. Find a real root of the following equation, correct to six decimals, using the Fixed Point iteration method. [6]

$$\sin x + 3x - 2 = 0$$

4. Solve the following system of equations using LU factorization method. [8]

$$5x_1 + 2x_2 + 3x_3 = 31$$
$$3x_1 + 3x_2 + 2x_3 = 25$$
$$x_1 + 2x_2 + 4x_4 = 25$$

5. Write a pseudo-code to determine the largest Eigen value and the corresponding vector of a square matrix using Power Method. [8]

6. The following data are provided; use least-squares method to fit these data with the following model, $y = ax + b + \dfrac{c}{x}$ [8]

7. From the following data, compute: (a) y(3) using Newton's forward interpolation formula
   (b) y(6.4) using stirling's formula [8]

x	2	4	6	8	10	12
y	5.1	4.2	3.1	3.5	6.2	7.3

8. Evaluate the following integral using Romberg's method. (correct to two decimal planes) [8]

$$\int_0^2 \frac{e^x + \sin x}{1 + x^2} \, dx$$

9. Solve $y' = 4e^{0.8x} - 0.5y$; subject to initial condition y(0) = 2. for y(0.5) and y(1.0) using Runge-Kutta 2nd order method. [6]
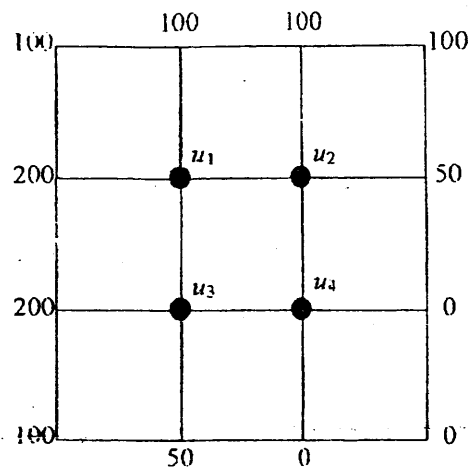
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10. Solve the following boundary value problem using the finite difference method by dividing the interval into four sub-intervals. [8]

$$y'' = e^x + 2y' - y; \quad y(0) = 1.5; \quad y(2) = 2.5$$

11. Find the values of u(x, y) satisfying the Laplace equation $\nabla^2 u = 0$, at the pivotal points of the square region with boundary conditions as shown below. [10]

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Exam.		Regular	
Level	BE	Full Marks	80
Programme	BGE, BEL, BEX, BCT	Pass Marks	32
Year / Part	II / II	Time	3 hrs.

Subject: - Applied Mathematics *(SH551)*

✓ Candidates are required to give their answers in their own words as far as practicable.
✓ *Attempt __All__ questions.*
✓ *The figures in the margin indicate __Full Marks__.*
✓ *Assume suitable data if necessary.* (SBK)

1. a) Define an analytic function for a function of complex variable. Derive Cauchy Riemann equations in Cartesian form. [1+4]

   b) Define linear fractional mapping. Find bilinear mapping which maps the points z = 0, 1, -1 to w = i, 2, 4. [1+4]

2. a) State and Prove Cauchy integral theorem. [5]

   b) Point out difference between Taylor's series and Laurent's series. Find Laurent' series of function $f(z) = \dfrac{\sin z}{z^6}$, $0 < |z| < TR$ [1+4]

3. a) Define pole of order m. Using Cauchy's residue theorem evaluate $\int_c \cot z \, dz$; where C is $|z| = 1$. [1+4]

   b) Using Counter integration evaluate,
   $$\int_{-\infty}^{\infty} \frac{dx}{(1+x^2)^2}.$$ [5]

4. a) Find the z-transform of:

   (i) $\cos at$ (ii) te^{-at} [2+3]

   b) State final value theorem. If x(t) = 0 for t < 0 and Z[x(t)] = X(z) for t ≥ 0 then prove that:
   $$Z[x(t+nT)] = z^n \left[X(z) - \sum_{k=0}^{n-1} x(kT) z^k \right].$$ [1+4]

5. a) Obtain inverse Z-transform of $\dfrac{z(3z^2 - 6z + 4)}{(z-1)^2 (z-2)}$. [5]

   b) Solve the difference equation by the application of z-transform:

   x (k+2) -4x (k+1) + 4x(k) = 0; with conditions x(0) = 1; x(1) = 0. [5]

6. a) Derive one dimensional wave equation and solve it completely. [5+5]

   b) A uniform rod of length ℓ has its end maintained at a temperature 0°C and the initial temperature of the rod is:

   $$u(x,0) = 3\sin\frac{\pi x}{\ell} \quad \text{for } 0<x<\ell.$$

   Find the temperature u(x, t). [10]

7. a) Find Fourier integral of the function

   $$f(x) = \begin{cases} 1 & \text{if } |x| < 1 \\ 0 & \text{if } |x| > 1 \end{cases}$$ [5]

   b) Verify the convolution theorem for Fourier transform for the functions

   $f(x) = g(x) = e^{-x^2}$. [5]

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Exam.	Regular		
Level	BE	Full Marks	80
Programme	BEX ,BCT, BME, BIE, BAM	Pass Marks	32
Year / Part	II / II	Time	3 hrs.

Subject: - Electrical Machine *(EE554)*

✓ Candidates are required to give their answers in their own words as far as practicable.
✓ Attempt __All__ questions.
✓ The figures in the margin indicate __Full Marks__.
✓ Assume suitable data if necessary. (S.B.K)

1. a) A steel ring of 12 cm mean radius and of circular cross-section 1 cm in radius has an air gap of 2 mm length. It is wound uniformly with 550 turns of wire carrying 3A of current. The air gap takes 60% of total magnetomotive force. Find the total reluctance. [5]

   b) Explain hysteresis and eddy current losses in electrical machines. Prove that hysteresis loss in a magnetic material is equal to the area of hysteresis loop. [5]

   c) Explain the following: [2×3]
   (i) Faraday's laws of electromagnetic induction
   (ii) Fleming's right and left hand rules

2. a) Derive expression giving amount of copper saving in an auto-transformer. [4]

   b) Discuss how to conduct open-circuit and short-circuit tests on a single phase transformer. From the test results how the efficiency and voltage regulation of the transformer is determined? [6]

   c) An ideal 3-phase delta/star step-down transformer delivers power to a balanced 3-phase load of 120 kVA at 0.8 power factor. The input line voltage is 11 kV and the turns ratio of the transformer, phase to phase is 10. Determine the line voltage, line currents, phase voltages and phase currents on both the primary and secondary sides. [6]

3. a) In a 220 V compound generator, the armature, series and shunt windings have resistances of 0.3Ω, 0.2Ω and 60 Ω respectively. The load consists of 80 lamps, each rated at 60 W and 220 V. find the total emf and armature current when the machine is connected for i) long shunt and ii) short shunt. [6]

   b) What do you mean by back emf in DC motors? Explain the significance of back emf. [4]

   c) Explain the speed-current, torque-current and speed-torque characteristics of a DC shunt motor. [6]

4. a) Explain the torque-slip characteristics of a three phase induction motor. Starting with the expression for torque as a function of slip, show that the value of maximum torque is independent of rotor resistance. [6]

   b) The power input to the rotor of a 440 V, 50 Hz, 3-phase, 6-pole, induction motor is 50 kW. The rotor emf makes 120 cycles per minute. Friction and windage losses are 2 kW. Calculate (i) slip (ii) rotor speed (iii) rotor copper losses (iv) mechanical power developed (v) output power (vi) output torque [6]

5. a) Explain about constructional details and working principle of three phase synchronous generator. [8]

   b) Describe briefly the effect of varying excitation upon the armature current and power factor of a 3-phase synchronous motor when input power to the motor is maintained constant. [6]

   c) Using double revolving field theory, explain the working of a single phase induction motor. [6]

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Exam.		Regular		
Level	BE		Full Marks	80
Programme	BEL, BEX, BCT		Pass Marks	32
Year / Part	II / II		Time	3 hrs.

Subject: - Microprocessor *(EX551)*

✓ Candidates are required to give their answers in their own words as far as practicable.
✓ Attempt __All__ questions.
✓ The figures in the margin indicate __Full Marks__.
✓ Assume suitable data if necessary. (SBK)

1. Explain fetch and execution cycle of an instruction of a stored program computer. Illustrate with the help of RTL specification. [5+3]

2. What is the use of Program Counter and Stack Pointer registers of 8085 microprocessor? How these registers get affected during CALL, RET, PUSH and POP instructions explain with suitable examples. [4+4]

3. There are two tables holding twenty data whose starting address is 9000H and 9020H respectively. Write a program to add the content of first table with the content of second table having same array index. Store sum and carry into the third and fourth table indexing from 9040H and 9060H respectively. [8]

4. Describe how 8086 microprocessor is faster than 8-bit microprocessors in terms of its instruction processing. Write in brief about the uses of major registers of 8086 microprocessor. [3+5]

5. Write an assembly language program for 8086 to calculate the addition of 100 natural even numbers and display the result in screen, in decimal format. [8]

6. Explain single handshaking and double handshaking technique used in parallel interfacing with a microprocessor? Design an address decoding circuit to interface two 8k*8 ROM chips at address starting at 4000H. [3+5]

7. What do you mean by Machine cycle and T-states? Draw a bus timing diagram for an instruction ANI 55H of 8085 microprocessor. Calculate the time required to execute such instruction, if microprocessor is operating at 2MHz clock frequency. [2+5+1]

8. What are the software interrupts of 8085? Discuss the different hardware interrupts available in 8086. Write down the steps, sequentially carried out by the systems when an interrupt occurs. [3+3+2]

9. What do you mean by accumulator based microprocessor? Compare RISC and CISC architecture. [2+6]

10. Write short notes on any two: [2×4]
    a) Flags in 8086 Microprocessor
    b) DMA Controller
    c) Deadlock and its Remedies

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Exam.	Regular		
Level	BE	Full Marks	80
Programme	BEL, BEX, BCT	Pass Marks	32
Year / Part	II / II	Time	3 hrs.

Subject: - Instrumentation I (EE552)

✓ Candidates are required to give their answers in their own words as far as practicable.
✓ Attempt **All** questions.
✓ The figures in the margin indicate **Full Marks**.
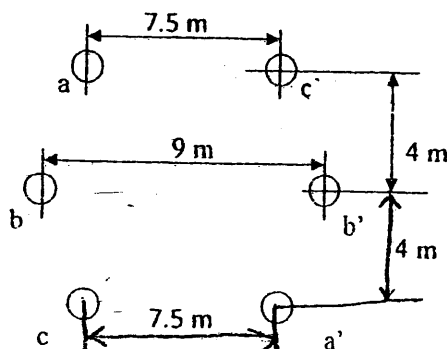✓ Assume suitable data if necessary.

1. a) What do you understand by an instrumentation system, explain the function of each of its component with the help of a block diagram? [6]

   b) The wire in a strain gauge is 0.1 m long and has an initial resistance of 120Ω. On application of a force the wire length increases by 0.1 mm and resistance increases by 0.21Ω, determine the gauge factor of the device. [4]

   c) How do you define error in a measurement system? How the Gaussian curves can be used to explain the normal distribution of random errors in a measurement. Also state the properties of the curve. [6]

2. a) Explain how magnitude and direction of displacement can be measured with the help of inductive sensor. [6]

   b) What do you mean by piezoelectric effect? Explain how this effect can be the design basis of piezoelectric pressure transducer. Define voltage sensitivity and charge sensitivity. Give its equivalent circuit and derive the expression for the output voltage by making suitable assumptions. [6]

   c) A linear resistance potentiometer is 50 mm long and is uniformly wound with a wire of total resistance 5000Ω. Under normal conditions, the slider is at the centre of the potentiometer. Determine the linear displacement when the resistance of the pot as measured by a wheatstone bridge is 1850 Ω. If it is possible to measure a minimum value of 5 Ω resistence with the above arrangement determine the resolution of the pot in mm. [4]

3. a) Why signal conditioning is done in instrumentation system? Derive the expression for closed loop gain of op-amp in inverting mode. Also explain ideal characteristics of operational amplifier. [6]

   b) Design an integrator circuit which will produce a ramp voltage of -20 V/msec. [4]

   c) Draw the block diagram of optical fiber communication system and write advantages of it. [6]

4. a) Explain how analog to digital conversion is achieved by using Dual Ramp ADC. [6]

   b) Explain the operation of sample and hold circuit. Also explain aperture time and acquisition time of the circuit. [6]

   c) What will be a 4-bit successive approximation digital output for an analog input of 4.287V if full range of converter (ER) is 5V? [4]

5. a) What is wattmeter? Write is types. Explain the wattmeter which can measure ac as well as dc power with the help of construction and working principle. [8]

   b) What is data acquisition system? Explain the function of different component of digital data acquisition system. [8]

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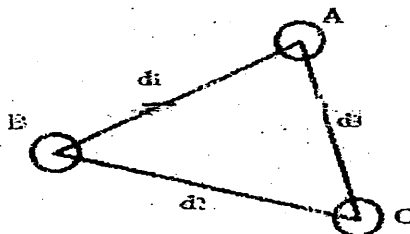| Exam.		Regular	
Level	BE	Full Marks	80
Programme	BEX	Pass Marks	32
Year / Part	II / II	Time	3 hrs.

Subject: - Power System (EE553)

✓ Candidates are required to give their answers in their own words as far as practicable.
✓ Attempt __All__ questions.
✓ The figures in the margin indicate __Full Marks__.
✓ Assume suitable data if necessary.

1. a) What is a single line diagram? Draw a single line diagram of a typical power system network? And list out the advantages of adopting high voltage level for transmission of power. [6]

   b) A transmission line at a river crossing is supported by two towers 50 m and 55 m above water level. The horizontal distance between towers is 300 m. The tension in the conductor is 2000 kg and weight of conductor is 0.85 kg/m [8]

      i) Find the minimum clearance between conductor and water

      ii) Determine the position of minimum air clearance

2. a) What are cable faults? Explain how you can locate a ground fault. [6]

   b) Determine the inductance per km of a transposed double circuit 3-ϕ line shown in figure below. The diameter of the conductors is 2.5 cm. [6]
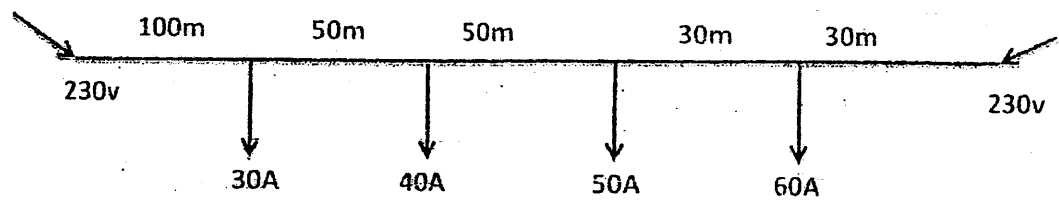

3. a) Calculate the capacitance /phase/km of the transposed line with following configuration. [Take: $r_a = r_b = r_c = 12.5mm, d_1 = 8m, d_2 = 10m$ and $d_3 = 6m$] [6]

   b) How does the earth affect the capacitance of a transmission line? Explain briefly. [4]

4. a) A 200 km 3-ph, 50 Hz transmission line has following data: [6]

$A = D = 0.938 < 1.2°$ $B = 131.2 < 72.3° \Omega$ $C = 0.001 < 90°S$

The sending end voltage is 230 kV. Find

i) V_R on no load
ii) Efficiency of transmission line

b) What is line compensation? Compare shunt capacitor compensation and shunt reactor compensation. [4]

c) Why is it necessary to balance both active and reactive power in an interconnected power system? [4]

5. a) A dc distributor fed at both ends at 230 V with conductor resistance of 0.1 ohm/km is loaded as shown in figure below. Determine the minimum voltage along the distributor and the point of minimum voltage. [8]

b) Draw a neat schematic diagram of differential protection scheme of generator and describe briefly how it operates under faulty condition. [4]

c) Explain the use of PLCC in modern electrical power system. [4]

6. a) Why power flow analysis is made? Describe the various types of buses in load flow analysis of an interconnected power system. [6]

b) What are the differences between a fuse, relay and circuit breaker? [4]

c) List out the major differences in urban and rural power distribution system. [4]

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Exam.		Regular	
Level	BE	Full Marks	80
Programme	BEL, BEX, BCT, BGE	Pass Marks	32
Year / Part	II / II	Time	3 hrs.

Subject: - Applied Mathematics *(SH551)*

✓ Candidates are required to give their answers in their own words as far as practicable.
✓ *Attempt All questions.*
✓ *The figures in the margin indicate Full Marks.*
✓ *Assume suitable data if necessary.*

1. a) Define harmonic function of complex variable. Determine the analytical function

   $$f(z) = u + iv \text{ if } u = y^3 - 3x^2 y$$ [1+4]

   b) Derive Cauchy-Reimann equations if function of complex variable $f(z) = u + iv$ is analytic in cartesian form.   [5]

2. a) What do you mean by conformal mapping? Find the linear transformation which maps points $z_1 = 1, z_2 = i, z_3 = -1$ into the points $w_1 = 0, w_2 = 1, w_3 = \infty$.   [1+4]

   b) State and prove Cauchy's integral formula.   [5]

3. a) State Taylor's theorem. Find the Laurent's series representation of the function

   $$f(z) = \frac{z}{(z+1)(z+2)} \text{ in the annular region between } |z| = 1 \text{ and } |z| = 2.$$ [1+4]

   b) Define zero of order m of function of complex variable. Determine the poles and residue at poles of the functions $f(z) = \frac{1+z}{(z+2)(1-z)^2}$.   [1+4]

   OR

   Evaluate the real integral $\int_{-\infty}^{\infty} \frac{x^2}{(1+x^2)^3} dx$ by contour integration in the complex plane.   [5]

4. a) Define z-transform. How does it differ from Fourier transform? Obtain z-transform of

   (i) $t^2 a^t$ (ii) $\cos at$ [1+1+1.5+1.5]

   b) State initial value theorem for z-transform. Find the initial value x(0) and x(1) for the function.   [1+4]

   $$X(z) = \frac{(1-e^T)z^{-1}}{(1-z^{-1})(1-e^{-T}z^{-1})}$$

5. a) Obtain the inverse z-transform of $X(z) = \frac{3z^3 + 2z}{(z-3)^2(z-2)}$ by using inversion integral method.   [5]

   b) Apply method of z-transform to solve the difference equation   [5]

   $$x(k+2) - 4x(k+1) + 4x(k) = 0; x(0) = 0, x(1) = 1$$

6. Solve completely one-dimensional wave equation $\dfrac{\partial^2 u}{\partial t^2} = c^2 \dfrac{\partial^2 u}{\partial x^2}$ under the conditions: [10]

   $u(0,t) = 0, u(l,t) = 0, u(x,0) = 0$ and $\left(\dfrac{\partial u}{\partial t}\right)_{at\ t=0} = 3(lx - x^2)$

7. Derive one dimensional heat equation and solve it completely. [10]

8. a) State convolution theorem for Fourier transform. Give its importance with suitable example. [2+3]

   b) Find the Fourier cosine integral of the function $f(x) = e^{-kx} (x > 0, k > 0)$ and hence

   show that $\displaystyle\int_0^\infty \dfrac{\cos \omega x \, d\omega}{k^2 + \omega^2} = \dfrac{\pi}{2k} e^{-kx}; x > 0, k > 0$ [5]
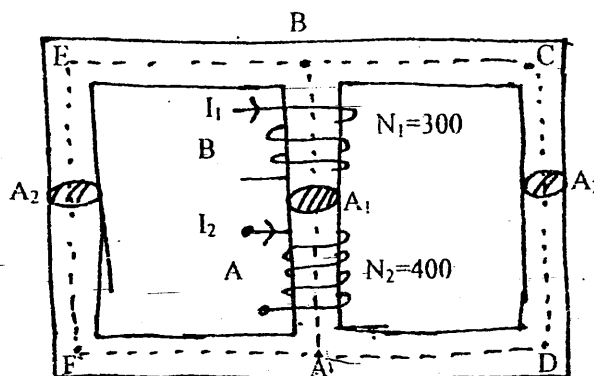
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Exam.		**Regular**	
Level	BE	Full Marks	80
Programme	BEX, BCT,BME, BIE	Pass Marks	32
Year / Part	II / II	Time	3 hrs.

Subject: - Electrical Machine *(EE551)*

✓ Candidates are required to give their answers in their own words as far as practicable.
✓ Attempt __All__ questions.
✓ The figures in the margin indicate __Full Marks__.
✓ Assume suitable data if necessary.

1. a) For magnetic circuit shown in figure below, find out the current to be passed through coil B so that magnetic flux in CD section is 2 mWb. Given $\mu_r = 1000$ [8]

Given:
$I_2 = 3$ Amp, $A_1 = 6$ cm^2, A2 = 3 cm^2
AB = CD = EF = 20 cm
BC = AD = BE = AF = 20 cm

   b) Copper loss is assumed to be negligible in no load test and iron loss is assumed negligible in short circuit test. Explain why it is so.   [8]

2. a) The following test result were obtained on 20 KVA, 2200/220 V, 50 HZ single phase transformer   [8]

   Open circuit test: 220 V, 1.1 A, 125 W
   Short circuit test: 52.7 V, 8.4 A, 287 W

   i) Calculate the equivalent circuit parameters referred primary sides and draw the equivalent circuits
   ii) Calculate maximum efficiency at full load
   iii) Calculate the efficiency at half full load with 0.8 power factor lagging

   b) How current transformer is different from conventional transformer. Explain how CT is used to measure high currents. Also explain, what happens if the secondary of CT is open when there is high current flowing in primary side.   [8]

3. a

   b

4. a)

   b)

5. a)

   b)

3. a) Using circuit diagram and graphical representation, explain the characteristics of DC series generator and DC shunt generator. Also mention their applications. [8]

   b) A 220 V, DC series motor draws 100 A current and runs at 1200 RPM. What is value of armature resistance required to run the motor at 800 RMP keeping load torque constant. Given armature resistance = 0.2 ohm, field winding = 0.05 ohm [4+4]

4. a) Explain the torque-slip characteristics of an induction motor. Show the condition for which the maximum torque develops in the induction motor. [5+3]

   b) A 6-pole, 50 Hz, three-phase induction motor has rotor resistance of 0.4 Ω/phase, maximum torque is 200 Nm at 850 rpm. Find (i) torque at 4% slip, and (ii) additional rotor resistance to get $(2/3)^{rd}$ of maximum torque at starting. [8]

5. a) Explain effect of excitation on pf of synchronous motor with necessary diagrams. [8]

   b) Explain double field revolving theory refer to single phase induction motor and prove that a single phase induction motor is not self starting. [8]
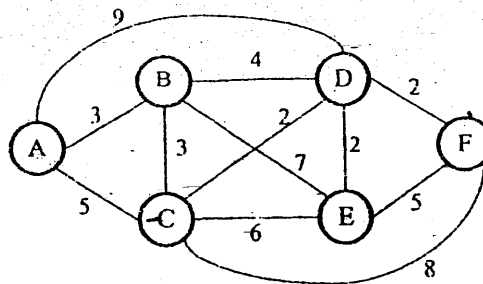
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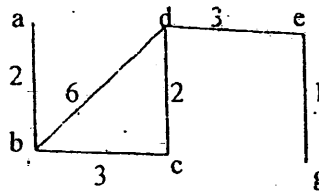| Exam.		**Regular**	
Level	BE	Full Marks	80
Programme	BEX, BCT	Pass Marks	32
Year / Part	II / II	Time	3 hrs.

Subject: - Discrete Structure *(CT551)*

✓ Candidates are required to give their answers in their own words as far as practicable.
✓ Attempt **All** questions.
✓ The figures in the margin indicate **Full Marks**.
✓ Assume suitable data if necessary.

1. Using rules of inference, prove that the *hypotheses "If I get my Christmas bonus and my friend are free, I will take a road trip with my friends.", "If my friends don't find a job after Christmas, then they will be free."* and *"I got my Christmas bonus and my friend did not find a job after Christmas."* Lead to the conclusion "I will take a road trip with my friends." [8]

2. State the principle of strong induction. Prove the formula for the sum of a finite number of terms of Geometric Progression: $\sum_{j=0}^{n} ar^{j} = a + ar + ar^{2} + ... + ar^{k} = \dfrac{ar^{n+1} - a}{r - 1}$ [3+5]

   when $r \neq 1$, where n is non-negative integer.

3. Explain the validity of arguments with suitable example. Use direct proof to prove "if x is odd then x^2 is also odd". [4+4]

4. How do you define a Finite State Automation (FSA)? Design a finite state automation that accepts precisely those strings over {a,b} that end with substring *aa*. Your design should include the proper definition of the finite state automation, transition table and the transition diagram. [2+6]

5. Write a grammar that generates the string having the given property. [4+4]

   i) String over {a,b} ending with ba
   ii) String over {a,b} starting with a

6. Find all the solutions of recurrence relation: [8]

   $a_n = 7a_{n-1} - 12a_{n-2} + 3^n$ with initial conditions $a_0 = 1$ and $a_1 = 4$

7. Draw the figure for the complete graph with 5 vertices (This is usually denoted by K_5). Define the term graph coloring and the chromatic number of a graph in graph coloring. What is the chromatic number of the complete graph K_5 and complete bipartite graph $K_{3,3}$? [2+1+1+2+2]

8. Use Dijkstra's algorithm to find the length of shortest path from vertex A to vertex F in the following weighted graph. Also highlight the shortest path/paths in the graph. [8]

9. Prove that $K_{3,3}$ is not a planar graph. The labeled graph has 3 spanning trees. [4+4]

Find the two spanning trees of given Graph

10. Write short notes on: [4+4]

i) MaxFlowMincut Theroem
ii) Cutsets and Cutvertices

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Exam.		Regular	
Level	BE	Full Marks	80
Programme	BEL, BEX, BCT, B. Agri., BGE	Pass Marks	32
Year / Part	II / II	Time	3 hrs.

Subject: - Numerical Method (SH553)

✓ Candidates are required to give their answers in their own words as far as practicable.
✓ Attempt **All** questions.
✓ The figures in the margin indicate **Full Marks**.
✓ Assume suitable data if necessary.

1. + Discuss the difference between absolute error and relative error with appropriate examples. [4]

2. Write an algorithm of Secant method for finding a real root of a non linear equation. [4]

3. ┌ Find a real root of the equation $\sin x = e^{-x}$ correct up to four decimal places using N-R method. What are the limitations of this method? [8]

4. Apply Gauss Seidal Iterative Method to solve the linear equations correct to 2 decimal places. [8]

$$10x + y - z = 11.19$$
$$x + 10y + z = 28.08$$
$$-x + y + 10z = 35.61$$

5. Find the dominant Eigen value and the corresponding Eigen vector of the given matrix using power-method. [8]

$$\begin{bmatrix} 15 & -4 & -3 \\ -10 & 12 & -6 \\ -20 & 4 & -2 \end{bmatrix}$$

6. ↑ What is the practical significance of the least squares method of curve fitting? Derive the normal equations to fit a given set of data to a linear equation $(y = ax + b)$ [2+6]

7. * Using stirling formula find u_{28}, given; [8]

$$u_{20} = 49225, u_{25} = 48316, u_{30} = 47236, u_{35} = 45926, u_{40} = 44306$$

8. Estimate the value of $\cos(1.74)$ from the following data: [4]

x	1.7	1.74	1.78	1.82	1.86
Sin(x)	0.9916	0.9857	0.9781	0.9691	0.9584

9. Evaluate $\int_{0.2}^{1.5} e^{-(x^2)} dx$ using the 3 point Gaussian quadrature formula. [6]

10. Solve the following simultaneous differential equations using Runge-Kutta second order method at x = 0.1 and 0.2. $dy/dx = xz + 1; dz/dx = -xy$ with initial conditions $y(0) = 0, z(0) = 1$ [6]

11. Write a program in any high level language (C/C++/FORTRAN) to solve a first order initial value problem using classical RK-4 Method. [6]

12. Solve the elliptic equation $u_{xx} + u_{yy} = 0$ on the square mesh bounded by $0 \le x \le 3, 0 \le y \le 3$. The boundary values are $u(x,0) = 10, u(x,3) = 90, 0 \le x \le 3$ and $u(0,y) = 70, u(3,y) = 0, 0 < y < 3$. [10]

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P.5

Exam.	Regular		
Level	BE	Full Marks	80
Programme	BEL, BEX, BCT	Pass Marks	32
Year / Part	II / II	Time	3 hrs.

Subject: - Instrumentation I *(EE552)*

✓ Candidates are required to give their answers in their own words as far as practicable.
✓ Attempt **All** questions.
✓ The figures in the margin indicate **Full Marks**.
✓ Assume suitable data if necessary.

1. a) Point out the difference between analog and digital measurement system. Explain the functional elements of an Instrumentation system with block diagram. [6]

   b) Explain different types of errors in measurement with their remedies. [6]

   c) A capacitive transducer uses two quartz diaphragm of area 600 mm^2 separated by a distance of 2.5 mm. A pressure of 8×10^5 N/m^2, when applied to the top diaphragm causes a deflection of 0.5 mm. The capacitance is 400×10^{-12} F when no pressure is applied to the diaphragm. Determine the value of capacitance after the application of 8×10^5 N/m^2. [4]

2. a) Explain how can the response of capacitive transducer, which works on the principle of variation of capacitance with displacement between two plates, be made linear. Also give the sensitivity of such an arrangement. [6]

   b) Show that Hay's Bridge can be used to measure the value of unknown inductance of a coil having high quality factor. [6]

   c) Determine the thermo electric sensitivity and emf developed in a thermocouple made of copper and constantan for a temperature of 50°C between its junction. Given that thermo electric emf of copper and constantan against platinum are 7.4μv/°C and -34.4 μv/°C respectively. [4]

3. a) Derive voltage gain of 3 Op-Amp Instrumentation amplifiers. Write the advantages of fiber optical communication. [6]

   b)^x Explain how A/D conversion can be achieved by using dual slope analog to digital converter. [6]

   c) The basic step of a 9 bit DAC is 10.3 mV (000000000) represents 0V, what O/P is produced if the input is (101101111)? [4]

4. a)^x Describe the constructional details and working of a ferro dynamic type of frequency meter for the measurement of frequency. [8]

   b) Draw the block diagram of Digital Data Acquisition System (DAS). Explain each block briefly. Differentiate analog DAS and digital DAS in terms of their scope. [6+2]

5. a) Explain the requirement of a sample and hold circuit. Explain its operation and discuss its characteristic waveform to illustrate its specifications. [8]

   b) Explain ideal characteristics of operational amplifier. Also explain different application of operational amplifier in measurement system. [8]

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INSTITUTE OF ENGINEERING
Examination Control Division
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Exam.		Regular	
Level	BE	Full Marks	80
Programme	BEL, BEX, BCT	Pass Marks	32
Year / Part	II / II	Time	3 hrs.

Subject: - Microprocessor *(EX551)*

✓ Candidates are required to give their answers in their own words as far as practicable.
✓ Attempt __All__ questions.
✓ The figures in the margin indicate __Full Marks__.
✓ Assume suitable data if necessary.

1. Explain RTL based on any 8085 instruction. Define Stored program concept. [4+4]

2. What are the characteristics of 8085 microprocessor? Discuss all the input and output signals that are originated from microprocessor. [2+6]

3. How are the flags of 8085 processor affected during the usage of arithmetic and logic instructions? Explain with examples. Explain the following instructions with example program (i) DAA (ii) SPHL (iii) XTHL (iv) PCHL [4+4]

4. Draw the internal architecture of 8086 microprocessor. Explain each block in detail. [8]

5. Write an assembly language program for 8086 to find the largest and smallest numbers of an array having 10 numbers. Display the found numbers in the clear screen. [8]

6. Explain bus timing diagram. Draw and explain the timing diagram of the 8085 instruction STA 8050 H. [2+6]

7. Design an interfacing circuit for following problem. [8]
   i)   74LS138:3 to 8 Decoder
   ii) 2732 (4K*8): EP-ROM address range should begin at 0000H and additional 4K memory space should be available for future explanation
   iii) 6116(2K*C):CMOS R/W memory

8. Differentiate between maskable and non-maskable interrupts. Explain how different interrupt pins of 8085 are used. [2+6]

9. What is interprocess communication? How does dead lock occur? How can it be solved? [2+3+3]

10. Write short notes on: [4×2]
    i)   USART
    ii) RISC

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