2015 – 2016
B.TECH. WINTER (IV SEMESTER) EXAMINATION
(ELECTRICAL ENGINEERING):
HIGHER MATHEMATICS
(AM – 223)
CREDITS : 04

Maximum Marks: 60

Duration: Three Hours

Note: Answer all questions.

1. (a) Show that both \( u = x^3 - 3xy^2 \) and \( v = y^3 - 3x^2y \) are harmonic but \( w_1 = u + iv \) is not an analytic function of \( z \). Is \( w_2 = u - iv \) an analytic function? If so, express \( w_2 \) as a function of \( z \).

OR

(a') Show that the polar form of Cauchy-Riemann equation is

\[
\frac{\partial u}{\partial r} = -\frac{1}{r} \frac{\partial v}{\partial \theta}, \quad \frac{\partial v}{\partial r} = -\frac{1}{r} \frac{\partial u}{\partial \theta}.
\]

Use the result to show that \( \log z \) is analytic.

(b) If \( u + v = \frac{2 \sin 2x}{e^{2y} + e^{-2y} - 2 \cos 2x} \), and \( f(z) = u + iv \) is an analytic function of \( z \) then find \( f(z) \) in terms of \( z \).

(c) Evaluate by Cauchy's integral formula \( \int_c \frac{\cos \pi z^2}{(z - 1)(z - 2)} \, dz \), where \( C \) is the circle.

(i) \( |z| = 3 \)

(ii) \( |z| = 3 \)

2. (a) State Taylor's series for the function of complex variable \( f(z) \) use it to expand \( \sin z \), about \( z = \frac{\pi}{4} \).

(b) Use residue theorem to evaluate \( \int_c \frac{z \, dz}{(z - 1)^2 (z + 1)} \), where \( C \) is \( |z| = 2 \).

(c) Evaluate by contour integration

\[
\int_0^{2\pi} \frac{d\theta}{(1 - 2a \cos \theta + a^2)}, \quad a^2 < 1.
\]

OR

(c') Show by contour integration that.

\[
\int_0^\infty \frac{dx}{(1 + x^2)} = \frac{\pi}{2}.
\]

Contd.....2
3. (a) Find the root of the equation \(2x = \cos x + 3\), correct to three decimal places using Newton-Raphson method.

(b) Solve the following system of linear equations by Gauss-elimination method:
\[
2x + y + z = 10, \quad 3x + 2y + 3z = 18, \quad x + 4y + 9z = 16.
\]

(c) Prove the following identities.
(i) \((1 + \Delta)(1 - \nu) = 1\)  \quad (ii) \(\Delta \nu = \Delta - \nu = \delta^2\)

(iii) \(\mu = \sqrt{1 + \frac{1}{4 \delta^2}}\)  \quad (iv) \(h_0 = \log (1 + \Delta)\)

Where the operators have their usual meanings.

OR

(c') Find the cubic polynomial which takes the following values \(y(0) = 1\), \(y(1) = 0\), \(y(2) = 1\), \(y(3) = 10\). Hence or otherwise obtain \(y(4)\). [5+5+5]

4. (a) Solve the following differential equation by Taylor series method and find \(y(0.1)\)
\[
y' = x - y^2, \quad y(0.1) = 1
\]
Taking three non-zero terms.

OR

(a') Using Modified Euler method, find \(y(0.02)\) and \(y(0.04)\), given that
\[
\frac{dy}{dx} = x^2 + y, \quad y(0) = 1
\]
Give two iterations at each step. Take \(h = 0.02\).

(b) Use Runge-Kutta fourth order method to find \(y\) at \(x = 0.2\), given that
\[
\frac{dy}{dx} = \frac{y - x}{y + x}, \quad y(0) = 1
\]
Take \(h = 0.2\).

(c) Solve the boundary value problem by finite difference method:
\[
y'' + y + 1 = 0,
\]
with-boundary conditions
\[
y(0) = 0, \quad y(1) = 1 \text{ with } h = \frac{1}{4}.
\]

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B.TECH. (WINTER SEMESTER) EXAMINATION
ELECTRICAL ENGINEERING
ELECTRICAL MACHINE- II
EE 213

Maximum Marks: 60  Credits: 04  Duration: Three Hours

Answer all the questions. Assume suitable data if missing. Notations used have their usual meaning.

Q.No.  Questions  M.M.

1(a)  A 500 V, 50 kVA single-phase alternator has an effective armature resistance of 0.2 \( \Omega \). An excitation current of 10 A produces 200 A armature current on short circuit and an emf of 450 V on open circuit. Calculate the synchronous reactance.  [02]

1(b)  Explain with the help of a phasor diagram, the armature reaction effect in an alternator when the load connected is lagging in nature.  [04]

1(c)  Derive the equation of output and input active and reactive powers in a non-salient pole alternator considering zero armature resistance.  [06]

1'(a)  A 1 MVA, 2.2 kV, star-connected salient pole alternator has per phase reactances \( X_d = 2 \Omega \) and \( X_q = 1.5 \Omega \). Armature resistance is neglected. Calculate the per phase excitation voltage and load angle under rated MVA at a power factor of 0.8 lagging.  [07]

1'(b)  Prove that the reluctance torque in a salient pole synchronous machine is second harmonic of the fundamental torque.  [05]

2(a)  Consider two alternators operating in parallel supplying a common load, what actions need to be taken by the operator for the following operating conditions (explain with the help of suitable diagram):

(i)  Keeping same power sharing by the two alternators and increasing the operating frequency

(ii)  Keeping same frequency of operation and changing the power sharing

Contd.....2.
between the two alternators.

(iii) Keeping the same terminal voltage and changing the reactive power sharing by the two alternator

2 (b) Two alternators are operating in parallel and supplying a common load. Alternator-1 has a no-load frequency of 51.5 Hz and a slope Sp of 1 MW/Hz. Alternator-2 has a no-load frequency of 51 Hz with the same slope. The total load demand is 2 MW at 0.8 pf lagging. Compute the following:

(i) System frequency and power share of each alternator

(ii) If load is suddenly increased to 2.5 MW, what will be the new operating frequency and power share of each alternator

(iii) For part (ii), what will be the system frequency and power share of each alternator if the no-load frequency of Alternator-2 is increased to 51.5 Hz.

OR

2'(a) In a 3-phase, 1500 kVA, 3.3 kV, star-connected alternator, dc resistance measured across any two armature terminals is 0.4 Ω. Assume the effective resistance 1.4 times dc resistance. A field current of 10 A gave an armature current of 263 A during short circuit test and the same field current gave 1.1 kV during open circuit test. Calculate synchronous reactance and the voltage regulation at full load 0.8 p.f. lagging.

2'(b) An alternator has an armature resistance of 0.3 Ω and leakage reactance of 1.22 Ω. The alternator supplies 100 A current to a feeder of resistance 1.5 Ω and reactance of 2 Ω as shown in Fig. 1. The voltage at the far end of the feeder is 3000 V. The load current having a power factor of 0.8 lagging with respect to this voltage find the terminal voltage of the alternator and the emf generated.

\[ R_L = 1.5\Omega \]
\[ X_L = 2\Omega \]
\[ \text{Feeder} \]
\[ R_2 \]
\[ V = 3kV \]

Contd.....3.
3(a) Explain with the help of a suitable phasor diagram that a Synchronous motor when overexcited, supplies reactive power to the utility grid.

3(b) An industrial plant has mostly lagging loads and the overall power factor of the plant is 0.5 lagging with a total load of 1000 kVA. The utility company supplying the plant has sent a notice to improve the operating power factor to unity. For this purpose, the plant requires to install a synchronous condenser. Compute the total kVA rating and operating power factor of the synchronous condenser. Also, total plant load in kW.

OR

3 (a)* A 3-phase 400 V, 50 Hz, Synchronous motor is operating with a load angle of 25°; if the load on the motor is doubled keeping the other parameters constant, then compute the new load angle value.

3 (b)* A 1 MVA, 11 kV, 3-phase star-connected synchronous motor has an armature resistance and reactance per phase of 3.5 Ω and 40 Ω, respectively. Calculate the induced emf phase and line values and load angle for full load 0.8 pf leading.

4 (a) For a commutator machine with 6 poles and 40 coils, determine for simplex lap winding:
   (i) number of commutator segments
   (ii) back pitch and front pitch
   (iii) Commutator pitch

4 (b) A 12 pole dc generator has a wave wound armature containing 144 coils of 10 turns each. The resistance of each turn is 0.011 Ω. Its flux per pole is 0.05 Wb, and it is running at a speed of 200 rpm.
   (i) How many current paths are there in the machine?
   (ii) What is the induced emf?
   (iii) What is the effective armature resistance of this machine?

Contd... 4.
(iv) If a 1 kΩ resistor is connected to the terminals of this generator, what is the resulting induced torque?

4 (c) Draw the magnetization and load characteristics of a DC shunt generator. [03]

5(a) Write a short note on the principle of operation, construction and applications of a synchronous reluctance motor. [04]

5(b) A 10hp, 115V DC series motor takes 40A at its full load speed of 1800rpm. What is the torque at 30A? [03]

5(e) A 220V DC shunt motor draws 10A at 1800 rpm. The armature resistance is 0.2Ω and field winding resistance is 440Ω. What is the torque? What will be the speed and line current at a torque of 20 N·m (if field current is constant)? [05]
Answer all the questions.
Assume suitable data if missing.
Notations and abbreviations used have their usual meaning.

1(a) What are standards? What are the different types of standards? [4]
1(b) Explain the following terms: (a) Sensitivity (b) Resolution (c) Linearity (d) Zero drift. [4]
1(c) What are the different types of systematic errors in a measurement system? Explain briefly. [4]
2(a) What are the different methods used for the measurement of power in the three phase circuits? Explain them briefly. [6]
2(b) What are the different types of errors in electrodynamometer instruments? Explain them briefly. [6]

OR

2(b') What is D' Arsonval galvanometer? Write the different types of torque acting on its moving system and also draw its different dynamic behaviour. [6]
3(a) An inductance of 0.22H and resistance is measured by comparison with a fixed standard inductance of 0.1H and 40Ω resistance. They are connected as shown below. The unknown inductance is in arm ab and the standard inductance is in arm bc, a resistance of Rs= 750Ω is connected in arm cd and a resistance R2 whose amount is not known is in arm da. Find the resistance of arm da and show any necessary and practical additions required to achieve both resistive and inductive balance.

Contd.....2.
3(b) What is phantom loading? Explain the meter testing technique with the help of a diagram where phase shifting device is in pressure circuit.

OR

3(b') Explain the working of Megger with the help of the diagram.

4(a) Explain step by step method of determining the B-H curve.

4(b) What is rectified capacitor charging current method? Explain with the help of a diagram.

OR

4(b') What is synchroscope? How is it used to synchronize the incoming machine with the busbar by using the electrodynamometer type synchroscope.

5(a) What is instrumentation amplifier? Explain its first stage.

5(b) Draw the block diagram of CRO and explain its working.

OR

5(b') What is lissajous pattern? Explain.
B. Tech. (WINTER SEMESTER) EXAMINATION

ELECTRICAL ENGINEERING
MATLAB FOR ENGINEERS
EE-278

Maximum Marks: 60
Credits: 04
Duration: Three Hours

Answer all the questions.
Assume suitable data if missing.
Notations used have their usual meaning.
Grading will be done on correct and complete answers only.
Write detailed comments for each MATLAB code
Try to attempt questions in sequence preferably starting each question from a new page.

Q.No.  Question                        M.M.
1      Give a one line command that, for an array a, determines the number of elements in
       a are greater than 5. Write execution steps of MATLAB for your command with the
       following arrays.
       i)  a = [1 2 3; 4 5 6; 7 8 9]
       ii) a = 1:10
       iii) a = 10 * rand (6,6)

OR

1'(a)  Give a one line command that, for an array a, calculates the mean value of elements
       in a. Write execution steps of MATLAB for your command with the following
       arrays.
       i)  a = [1 2 3; 4 5 6; 7 8 9]
       ii) a = 1:10
       iii) a = 10 * rand (6,6)

2 (a)  Write a MATLAB code to approximate the zero(s) of the function
       \[ f(x) = x^3 - x^2 - 3 \arctan(x) + 1 \]

Contd.....2.
2(b) Write a MATLAB code to determine the extrema of the following function on the interval \([0, \pi]\):
\[
 f(x) = 2xe^{-x} - \sin(x)
\]

2(c) Explain the result of the command >> sqrt(x^2)

3 Write a MATLAB code to enter the following matrix:
\[
 A = \begin{bmatrix}
  1 & 2 & a \\
  b & -3 & 2 \\
  3 & 1 & c \\
\end{bmatrix}
\]

i) Determine the matrix \(B\) which is transpose of the matrix \(A\)
ii) Determine the matrix \(C\) which is product of matrix \(A\) and transpose of matrix \(A\).
iii) Check whether \(C\) is symmetric.
iv) Determine matrix \(D = 3A + 5B^3\)

OR

3' Consider the initial value problem:
\[
 x = \frac{tx}{(1 + x^2)}, \quad x(0) = 3
\]
Write a MATLAB code to calculate \(x(t)\) on the interval \([0, 2]\). How many steps are used to obtain this result?

4(a) Consider a driven mass-spring-damper system given by the equation
\[
 m\ddot{y} + c\dot{y} + ky = cx + kx
\]
Here \(x\) denotes input of the drive and \(y\) the response of the output. \(m = 870\) kg, \(k = 70000\) N/m, \(c = 5000\) N/ms (you can think of the suspension of your bike/scooter).

For the input suppose \(x(t) = \sin(t)\). Write a MATLAB code to calculate the output.

OR

4(a') Determine how many terms are required for the sum of the series \(10m^2-4m+2\), \(m=1,2,3,...\) to exceed 20,000. What is the sum for this many terms? Write a MATLAB code using While command to calculate and display the output.

4(b) Write a MATLAB code to compute the sum of first 15 terms in series \(5m^2-2m\), \(m=1, 2, 3,...15\) using For command.

\textit{Contd.....3.}
A model of a single neuron cell is given by the following differential equation:

\[
\begin{align*}
\begin{bmatrix}
\dot{x} \\
\dot{y} \\
\dot{z}
\end{bmatrix}
&= \begin{bmatrix}
-ax^3 + bx^2 + \varphi_1 x + \varphi_2 + g_{jy} y - g_z z + \alpha \ln p \\
-c - dx^2 - \varphi_3 x - \beta y \\
-r s(x + x_0) - z
\end{bmatrix}
\end{align*}
\]

In this model, the state \( x(t) \) represents the electric potential the neuron produces. Parameters \( a, b, c, d, r, s, x_0, g_{jy}, g_z, \alpha, \beta, 1, 2 \) and \( 3 \) are constants. \( \text{Inp} \) is the input of the model. Draw a step wise Simulink model that can simulate this system for 1000ms with initial conditions \( x_0 = 0, y = 0 \) and \( z = 0 \).
2015-2016
B. TECH. WINTER SEMESTER EXAMINATION
ELECTRICAL ENGINEERING
Signals & Systems
EE-282N

Maximum Marks: 60 Credit: 04 Duration: Three Hours

1(a) Find and sketch the even and odd component of
   (i) \( x(t) = \cos^2 \left( \frac{\pi}{2} t \right) \) and
   (ii) \( x[n] = e^{-n/4} u[n] \)

(b) Prove that power of the energy signal is zero and that energy of the power signal is
    infinite over infinite time.

OR

1'(a) Let \( y(t) = x(t-2) + x(2-t) \), where \( x(t) \) and \( y(t) \) be the system input and output
    respectively. Determine whether the system is (i) stable (ii) linear (iii) time-invariant

(b) Describe the relationship between the impulse response and LTI system properties:
    Stability and Invertibility.

2(a) Determine and sketch the convolution of the following two signals:

\[
x(t) = \begin{cases} 
1 & -1 < t < 1 \\
0 & \text{elsewhere}
\end{cases}
\]

\( h(t) = \delta(t+1) + 2\delta(t+2) \)

(b) Find the unit impulse response of an LTIC system specified by the equation

\( (D^2 + 6D + 9)y(t) = (2D + 9)f(t) \)

3(a) Describe the relationship between the coefficients of Trigonometric Fourier Series,
    Compact Trigonometric Fourier Series and Exponential Fourier Series.

(b) Let \( f(t) = \sum_{n=-\infty}^{\infty} u(t - nT) - u(t - nT - \frac{T}{4}) \) for some constant ‘T’. Find the
    coefficients \( D_n \) in the exponential Fourier Series expansion of \( f(t) \).
3'(a) Let the exponential Fourier series coefficients of the signal \( f(t) \) be denoted by \( D_n \). If \( g(t) = f(-t) \) be the time-reversed version of \( f(t) \) and its exponential Fourier series coefficients be denoted by \( E_n \). Find the relationship between the coefficients \( D_n \) and \( E_n \).

(b) State and prove the duality property of Fourier Transform. Find Fourier transform of \( f(t) = e^{-|t|} \). Use the result to find the Fourier transform of \( x(t) = \frac{1}{1 + t^2} \).

4(a) Determine the Laplace Transform, pole-zero location and associated ROC of the following: (i) \( \cos(\omega_0 t + b) u(t) \) and (ii) \( \sin(\omega_0 t + b) e^{-mt} u(t) \).

(b) Let the system response be \( H(s) = \frac{1}{s^2 + 5s + 6} \). Check whether the LTI system is anti-causal, causal or non-causal if ROC is

(i) \( \sigma > -2 \)  
(ii) \( \sigma < -3 \)  
(iii) \( -3 < \sigma < -2 \)

5(a) Given the Z-transform pair \( x[n] \rightarrow \frac{Z}{z^2 + 4} \), \( ROC : |z| < 2 \), use the z-transform properties to find the following signals. Specify ROC in each case.

(i) \( p[n] = 2^n x[n] \)  
(ii) \( q[n] = x[-n] \)  
(iii) \( r[n] = (n-3)x[n-2] \)

(b) Find the inverse z-transform, if \( X[z] = \frac{z^3 - 10z^2 - 4z + 4}{2z^2 - 2z - 4} \), \( ROC : |z| < 1 \).
Given points \( P(-2, 6, 3) \) and vector \( \vec{A} = y\vec{a}_x + (x + z)\vec{a}_y \), express \( P \) and \( \vec{A} \) in cylindrical coordinate system.

Determine the divergence of the given vector fields:

i. \( \vec{P} = x^2yz\vec{a}_x + (xz)\vec{a}_z \)

ii. \( \vec{Q} = \rho \sin \phi \vec{a}_\rho + \rho^2z\vec{a}_r + z \cos \phi \vec{a}_z \)

iii. \( \vec{T} = \frac{1}{r^2} \cos \theta \vec{a}_r + r \sin \theta \cos \phi \vec{a}_\theta + \cos \theta \vec{a}_\phi \)

A charge distribution with spherical symmetry has density

\[
\rho = \begin{cases} 
\rho_0 \frac{r}{R}, & 0 \leq r \leq R \\
0, & r > R 
\end{cases}
\]

Determine \( \vec{E} \) everywhere.

If \( \vec{J} = \frac{1}{r^2} (2 \cos \theta \vec{a}_r + \sin \theta \vec{a}_\theta) \frac{A}{m^2} \), calculate the current passing through:

i. A hemispherical shell of radius 20 cm, \( 0 < \theta < \frac{\pi}{2} \), \( 0 < \phi < 2\pi \).

ii. A spherical shell of radius 10 cm.

State Ampere’s circuit law. Show that magnetostatic field is not conservative.

Planes \( Z = 0 \) and \( Z = 4 \) carry current \( \vec{K} = -10\vec{a}_x A/m \) and \( \vec{K} = 10\vec{a}_x A/m \), respectively. Determine \( \vec{H} \) at

i. \( (1, 1, 1) \)

ii. \( (0, -3, 10) \)

Given that \( \vec{H}_1 = -2\vec{a}_x + 6\vec{a}_y + 4\vec{a}_z \) A/m in region \( y - x - 2 \leq 0, \mu_1 = 5\mu_0 \), calculate:

i. \( \vec{M}_1 \) and \( \vec{B}_1 \)

ii. \( \vec{H}_2 \) and \( \vec{B}_2 \) in region \( y - x - 2 \geq 0, \) where \( \mu_2 = 2\mu_0 \)

Show that the force between two current elements is given by

\[
F_1 = \frac{\mu_0 l_1 l_2}{4\pi} \oint_{L_1} \oint_{L_2} \frac{d\vec{l}_1 \times (d\vec{l}_2 \times \vec{a}_{R_{21}})}{R_{21}^2}
\]

Continued...2.
2'(c) Show that the divergence of magnetic field density is zero.

3(a) A conducting bar can slide freely over two conducting rails as shown in figure 1. Calculate the voltage induced in the bar

i. If the bar is stationary at \( y = 8 \text{ cm} \) and \( \overline{B} = 4 \cos 10^6 t \overline{a}_z \text{ mWb/m}^2 \)

ii. If the bar slides at a velocity \( \overline{u} = 20 \overline{a}_y \text{ m/s} \) and \( \overline{B} = 4 \overline{a}_z \text{ mWb/m}^2 \)

iii. If the bar slides at a velocity \( \overline{u} = 20 \overline{a}_y \text{ m/s} \) and \( \overline{B} = 4 \cos(10^6 t - y) \overline{a}_z \text{ mWb/m}^2 \)

![Figure 1](image)

3(b) Show that the displacement current density is given by \( \overline{J}_d = \frac{\partial \overline{D}}{\partial t} \).

4(a) A lossy dielectric has an intrinsic impedance of \( 200 \angle 30^\circ \Omega \) at a particular radian frequency \( \omega \). If, at that frequency, the plane wave propagating through the dielectric has the magnetic field component \( \overline{H} = 10 e^{-\alpha x} \cos(\omega t - \frac{1}{2} x) \overline{a}_y \text{ A/m} \). Find \( \overline{E} \) and \( \alpha \). Determine the skin depth and wave polarization.

4(b) A distortionless line has \( Z_0 = 60 \Omega, \alpha = 20 \text{ mNp/m}, u = 0.6c \), where, \( c \) is the speed of light in a vacuum. Find \( R, L, G, C \) and \( \lambda \) at 100 MHz.

OR

4'(a) Write all Maxwell’s four equations in phasor form

4'(b) Show that for lossy dielectric medium the value of attenuation constant and phase constant are respectively given by:

\[
\alpha = \omega \sqrt{\frac{\mu \varepsilon}{2} \left[ \sqrt{1 + \left(\frac{\sigma}{\omega \varepsilon}\right)^2} - 1 \right]}
\]

Contd.....
\[
\beta = \omega \sqrt{\frac{\mu \varepsilon}{2} \left( 1 + \left( \frac{\sigma}{\omega \varepsilon} \right)^2 + 1 \right)}
\]

4'(e) Show that the permittivity of a medium for time-harmonic electromagnetic field is a complex number.

5(a) List the most commonly used numerical techniques in electromagnetism. Determine the potential at the free nodes in the potential system of figure 2 using finite difference method up to third iteration by iteration technique. Also write the equation in matrix form by Band Matrix Technique.

![Figure 2](image-url)
2015-16
B.TECH. (WINTER SEMESTER) EXAMINATION
ELECTRONICS ENGINEERING
LOGIC & DIGITAL CIRCUITS
EL-203

Maximum Marks: 60 Credits: 04 Duration: Three Hours

Answer all the questions.
Assume suitable data if missing.
Notations and symbols used have their usual meaning.

Q.No. Question M.M.
1(a) Implement the basic logic gates using only NAND gates. [03]
1(b) Give the number of Boolean expressions or functions of 4 variables. [02]
1(c) Convert the following numbers to the given bases.
   (i) \((250.3)_{10} = (?)_{7}\) [04]
   (ii) \((4310)_{5} = (?)_{10}\)
1(d) Write the first 15 decimal digits in base 3. [03]

2(a) Give the circuit of a 2-input TTL-NAND (Totem-Pole) gate and describe its operation. [06]
2(b) Give the circuit for ECL OR/NOR gate and explain its operation. [06]

OR

2'(a) Give a comparison of CMOS, TTL and ECL logic families on the basis of Fan-out, Power per gate, Noise immunity and Propagation Delay \((t_{PD})\). [04]
2'(b) Give the circuit to implement the following logic function using CMOS logic. \(Y = A(B + CD)\). [04]
2'(c) Draw the voltage transfer characteristics (VTC) of a CMOS inverter marking all regions of operations of transistors. [04]

3(a) A combinational circuit has three inputs \(A\), \(B\) and \(C\) and output \(F\). \(F\) is True for the following combinations. [06]

Contd.....2.
A is False and B is True.
A is False and C is True.
A, B and C are True.

(i) Write the truth table for F.
(ii) Write the expression for F in SOP form.
(iii) Write the expression for F in POS form.

OR

3(a') Simplify the following Boolean function F, together with the don't care conditions [06]
d, in POS and SOP forms.
F (A, B, C, D) = \sum (1,3,5,7,9,15)
d (A, B, C, D) = \sum (4,6,12,13)

3(b) Design a BCD to Gray code converter using minimum number of logic gates. [06]

4(a) Design a synchronous counter with the following binary sequence: [08]
0,4,2,1,6 and repeat. Use JK flip-flops. Take unused states as don't care.

4(b) Explain the operation of an SR latch constructed with NOR gates. Use SR latch to [04]
obtain an SR flip-flop.

5 Do any two of the following. [12]

(a) Explain the operation of a Binary Weighted Resistor type Digital to Analog [01]
Converter (DAC) using suitable diagram.

(b) Explain the operation of a Digital Ramp Analog to Digital Converter (ADC) using [01]
suitable diagram.

(c) Show the diagrams of the following.
(i) Sample and hold circuit.
(ii) Flash Analog to Digital Converter (ADC).