Preparation For MCQ's for MATH 202 Exam

Concepts

1. **Chap. 1**
   a. Classifications of types of differential equations.
   b. Find all singular solutions of a 1^{st} order DE.
   c. Find a rectangle in which a 1^{st} order IVP has a unique solution.
   d. Given the solution of 2^{nd} or 3^{rd} order Homogeneous LDE, find the solution of the IVP.

2. **Chap. 2**
   a. Solve the following 1^{st} order Separable Eq.
   b. Find integrating factor of 1^{st} order LDE.
   c. Find the continuous solution of a given linear IVP (Simple in Calculation).
   d. Given the Integrating Factor of 1^{st} order LDE., find its general solution.
   e. Find solution of Exact Equation (Simple Form).
   f. Find integrating factor of non-exact DE.
   g. Check if the given DE is Exact, Linear, Homogeneous or Bernoulli or more than one type.
   h. Change the Bernoulli DE to standard form of linear DE.
   i. Solve the equation of the type $y' = f(ax + by + c)$.
   j. Solve a 1^{st} order linear, or exact or separable IVP (*Simple in calculation*).

3. **Chap. 3**
   a. Given the law of growth or decay, find population growth or decay (Simple in Calculation).
   b. Given Newton's law of cooling, a question related to temperature should be solved (Simple in Calculation).

4. **Chap. 4**
   a. Find the Wronskian of given functions.
   b. Reduce the given 2^{nd} order LDE to 1^{st} order LDE when one solution of Homogeneous Eq. is given.
   c. Find the general sol. of 2^{nd} order Homog LDE when one sol. is given (Simple in calculations).
   d. Find the roots of the Auxiliary Eq. of a 3^{rd} order or 4^{th} order (simple) LDE.
   e. Given Lin. Independent Solutions of a 3^{rd} or 4^{th} order Homogeneous LDE, find the DE.
   f. Find the annihilator of a function.
   g. Find the general form of the particular solution when complementary solution and Right hand Side of a 3^{rd} order LDE with constant coefficients are given.
   h. Given y_c of a second or third LDE: L[y] = 0, find the General Solution of L[y] = $f(x)$ (Solving by the method of Undetermined Coefficients or by the Variation of Parameters).
   i. Find the particular solution of a 2^{nd} order LDE with constant coeff. (only requiring the method of variation of parameters)
   j. Find the general solution of a homogeneous Cauchy- Euler (2^{nd} or 3^{rd} Order) DE.
   k. Convert the Cauchy- Euler (2^{nd} or 3^{rd} Order) DE to LDE with constant coefficients.

5. Chap. 6

a. Find the recurrence relation of for a 2nd order Homogeneous LDE by substituting $y = \sum_{n=0}^{\infty} c_n x^n$.

b. Substituting $y = \sum_{n=0}^{\infty} c_n x^n$ in a 2nd order LDE Homogeneous. LDE gives (for example) $2c_2 - c_0 + 6c_3 x + \sum_{k=2}^{\infty}[(k+1)(k-1)c_k + (k+2)(k+1)c_{k+2}]x^k = 0$, then find a power series solution of DE when $c_0 = 1$ and $c_1 = 0$.

c. Given two linearly independent power series solutions of a 2nd order LDE Homogeneous LDE, find the solution of the IVP.

d. Find the regular & irregular singular points of a 2nd order LDE Homogeneous LDE.

e. Find the roots of indicial equation of a 2nd order LDE about regular singular point $x_0 = 0$.

f. Substituting $y = \sum_{n=0}^{\infty} c_n x^{n+r}$ in a 2nd order LDE Homogeneous. LDE gives (for example) $x^r\left[r(2r-1)c_0 x^{-1} + \sum_{k=0}^{\infty}[(k+r+1)(2k+2r+1)c_{k+1} + (k+r+1)c_k]x^k\right] = 0$, then find a power series solution of DE with respect to the larger root of the indicial equation.

6. Chap. 8

a. Find the eigenvalues of a 3x3 matrix

b. Given an eigenvalue of a 4x4 matrix, find the corresponding eigenvector.

c. Given an eigenvalue of multiplicity 2 of a 3x3 matrix, find the corresponding 2 eigenvectors.

d. Given a complex eigenvalue of 2x2 matrix A, find the general solution of the system $X' = AX$.

e. Given an eigenvalue of multiplicity 2 of a 2x2 or 3x3 matrix with single eigenvector, find the general solution of the system $X' = AX$.

f. Given eigenvalues and corresponding eigenvectors of a 2x2 matrix, find the general solution of the non homogeneous system $X' = AX + F(t)$.

g. Given a 2x2 matrix A, find the first 3 terms in the power series expansion of e^{At}.