APPLIED MATHEMATICS WITH OCEANOLOGY AND COMPUTER PROGRAMMING [P.G.]

M.Sc. Fourth Semester End Examination-2024

[Regular & Supplementary]

PAPER-MTM-404

Full Marks: 100 ***Time: 03 Hrs***

The figures in the right-hand margin indicate marks
Candidates are required to give their answers in their own words as far as practicable
Illustrate the answers wherever necessary.

[Use separate answer script for each group]

404 A

[Dynamical Oceanography]

F.M. - 50

Answer any five questions of the following: **5x8=40**

1. Derive the equations of motion of Inertia Currents. Hence calculate the inertial periods at the equator and at the pole.
2. Derive the equations of geostrophic motion.
3. Discuss the motion of ocean when the wind driven into the baroclinic ocean.
4. Derive the equation thermal wind. Hence derive the Taylor-Proudman theorem.

5. State the assumption of Stommel model and hence derive the equations of motion.
6. Discuss inertial boundary layer theory.
7. Derive the nodes of Poincare-Kelvin waves.

[Internal Assessment – 10]

404 B

[Operation Research]

F.M. - 50

Answer question no 1 and any four from the rest

1. **Answer any four questions of the following:** **4x2= 8**
   a) State karlin's constraint Eualification.
   b) Define bi-matrix game with an example.
   c) State weak dualits theorem in connection with Dualits in guadratic programming.
   d) What is the degree of difficulty in connection with geometric programming?
   e) Write the basic difference(s) between Beale's and Wolfe's method for solving quadratic programming problem.
   f) Under what condition(s) the Kuhn-Tucker conditions for quadratic programming problem are necessary and sufficient.

2. When $n > Kcl$, solve the problem
   Min $z_1 = 5x_1x_2{}^1 + 2x_1{}^1x_2 + 5x_1 + x_2{}^1$ 8

3. Solve the following quadratic programming problem by Beale's method $z_x = 10x_1 + 25x_2 - 10x_1^2 - x_2^2 - 4x_1x_2$ 8

4. Solve NLPP

   Optimize $z = 4x_1^2 + 2x_2^2 + x_3^2 - 4x_1x_2$

   Sub to $x_1 + x_2 + x_3 = 15$

   $2x_1 - x_2 + 2x_3 = 20$
   $x_1, x_2, x_3 \geq 0$ 8

5. Derive the necessary condition for optimality for quadratic programs problem by Wolfe's method. 8

6. a) Define the following:
   i) Minimization problem;
   ii) Local Minimization problem;
   iii) Kuhn-Tucker stationary point problem;
   iv) Fritz-John stationary point problem.

   b) State and prove Weak duality theorem in connection with duality in non-linear programming. 4+4

7. a) Use the chance constrained programming to find an equivalent deterministic problem to Following stochastic programming problem, when c_j is a random variabl:

Minimize $F(x) = \sum_{j=1}^{n} a_j x_j$

Subject to $\sum_{j=1}^{n} c_{ij} x_j \leq b_i$

$x_j \geq 0, i, j = 1, 2, \cdots, n.$

b) Define the following terms:

The (primal) quadratic minimization problem(QMP)

The quadratic dual (maximization) problem (QDP). 6+2

[Internal Assessment – 10]