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M.Sc. IVth SEMESTER EXAMINATION, 2019

MATHEMATICS

Paper – Vth

DSE-06 [Viscous Fluid Dynamics]

Time: Three Hours

Maximum Marks: 80

PART – A (खण्ड – अ) *[Marks: 20]*

*Answer all questions (**50** words each).*

All questions carry equal marks.

*सभी प्रश्न अनिवार्य हैं। प्रत्येक प्रश्न का उत्तर **50** शब्दों से अधिक न हो।*

सभी प्रश्नों के अंक समान हैं।

PART – B (खण्ड – ब) *[Marks: 40]*

*Answer **five** questions (**250** words each),*

selecting one from each unit. All questions carry equal marks.

*प्रत्येक इकाई से **एक–एक** प्रश्न चुनते हुए, कुल पाँच प्रश्न कीजिए।*

*प्रत्येक प्रश्न का उत्तर **250** शब्दों से अधिक न हो।*

सभी प्रश्नों के अंक समान हैं।

PART – C (खण्ड – स) *[Marks: 20]*

*Answer any **two** questions (**300** words each).*

All questions carry equal marks.

*कोई **दो प्रश्न** कीजिए। प्रत्येक प्रश्न का उत्तर **300** शब्दों से अधिक न हो।*

सभी प्रश्नों के अंक समान हैं।

PART – A

Q.1 (i) Write Blasius equation along with boundary parameters.

(ii) Define boundary layer thickness.

(iii) Write the condition for boundary layer separation in terms of both pressure and velocity gradients.

(iv) Write Prandtl- Mises equation.

(v) Write Karman Momentum Integral Equation and state its nature.

(vi) Which two person derived the energy integral equation?

(vii) Write the equation of the thermal boundary layer for an Incompressible in two dimension.

(viii) Show the comparison between velocity and thermal boundary layers when $Pr < 1$ (by graph).

(ix) $[Nu(x)=a(Gx)^b]$ for free convection from a heated vertical plate. Write the value of a and b.

(x) $Nu(x)= a(Gx)^b$ for Pohlhausen's of free convection from a heated vertical plate. Write the value of a and b.

PART – B

UNIT – I

Q.2 Drive Two-Dimensional Boundary Layer Equations for flow over a plane wall.

Q.3 Discuss the Blasius – Topfer solution for the boundary layer on a flat plate and calculate the Coefficient of Skin – friction.

UNIT – II

Q.4 Write a short note on "Boundary Layer Separation".

Q.5 Give a short account of Gortler New Series Method.

UNIT – III

Q.6 Derive the Karman Momentum- Integral Equation for a steady two-dimensional laminar boundary layer flow of a liquid over a plane surface.

Q.7 Discuss Walz- Thwaites Method based Energy- Integral equation.

UNIT – IV

Q.8 Find out the simple integral of thermal boundary layer equation for the flow on an incompressible fluid past a flat plate kept at a Constant temperature when Pr = 1.

Q.9 What is Reynolds Analogy? Drive it.

UNIT –V

Q.10 Drive the thermal- energy integral equation.

Q.11 Discuss the Pohlhausen's method of exact solution for the velocity and thermal boundary layer in free convection from a heated vertical plate.

PART – C

Q.12 What is the meaning of term "Similar Solution'' of the boundary layer equation's in a Steady 2-D incompressible flow. Determine all possible form of the potential flow velocity when Similar Solutions exist for flow over a flat surface.

Q.13 Show that by Prandtl-Mises Transformation the boundary layer equations for a Steady two-dimensional flow of a liquid may be transformed into the form of a generalized heat conduction equation. Hence or otherwise, show that in a two-dimensional free jet flow the stream function is given by

$\psi = 1.651\ (\nu J x/\rho)^{1/3}\ \tanh\left\{0.275\left(\frac{J_0}{\rho\nu^2}\right)^{1/3} y x^{-2/3}\right\}$ Where J denotes the rate at which momentum flow across unit length of a section of the jet.

Q.14 Derive the Energy – Integral Equation.

Q.15 Derive thermal boundary layer equation for a plane wall.

Q.16 Derive the relation between Nusselt number and Grashof Number for free convection from a heated vertical plate.
