L-3/T-2/NAME **Date : 31/12/2012**

BANGLADESH UNIVERSITY OF ENGINEERING AND TECHNOLOGY, DHAKA

L-3/T-2 B. Sc. Engineering Examinations 2010-2011

Sub : **NAME 329** (Heat Transfer)

Full Marks : 210 Time : 3 Hours

The figures in the margin indicate full marks.

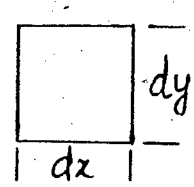
USE SEPARATE SCRIPTS FOR EACH SECTION

SECTION – A

There are **FOUR** questions in this section. Answer any **THREE**.

1. Write all the items on the elemental volume for energy analysis of laminar boundary layer over flat plate. Using continuity equation derive, by energy balance, the energy equation: **(35)**

$$u\frac{\partial T}{\partial x} + v\frac{\partial T}{\partial y} = \alpha\frac{\partial^2 T}{\partial y^2} + \frac{\mu}{\rho C_p}\left(\frac{\partial u}{\partial y}\right)^2$$



2. (a) Air at 27 °C, 1 atmosphere flows over a flat plate at a speed of 2 m/s. Assume unit depth in the Z-direction. The plate is heated over its entire length at 60 °C. Calculate the heat transfer in the first 20 cm and first 40 cm of the plate. Given: **(17)**

$Nu_x = 0.332\, Re_x^{0.5}\, P_r^{0.3}$, $\nu = 17.36 \times 10^{-6}$ m²/s, k = 0.0275 W/m°C, $P_r = 0.7$

Comment on the result.

(b) Air at 27 °C, 1 atmosphere enters a 5 mm dia smooth tube, with a velocity of 3 m/s. Length of the tube is 10 cm. A constant head flux is imposed on the wall of the tube. Exit bulk temperature of the air is 77 °C. Calculate the heat transfer, exit wall temperature and the value of h at exit, $P_r = 0.7$, k = 0.028 W/m°C, $\nu = 18.2 \times 10^{-6}$ m²/s, $\rho = 1.177$ kg/m³, $C_p = 1006$ joules/kg °C, $Nu_d = 4.7$. **(18)**

3. (a) What are the boundary conditions (B.C.) for determining the velocity and temperature profiles for laminar flow over heated flat plate at constant wall temperature? **(12)**

(b) What will be the ratio of hydrodynamic boundary layer thickness for laminar flow (δ) over flat plate at 20 cm and 40 cm distances from the leading edge where x = 0? **(12)**

(c) What are the laws and other relations of thermal radiation? Explain. **(11)**

4. (a) Three infinite parallel plates are placed close to each other. The two outer plates are at 1200 °K and 300 °K with $\epsilon = 0.2$ and 0.5 respectively while the middle plate has $\epsilon = 0.8$. What is the temperature of the middle plate? $\sigma = 5.67 \times 10^{-8}$ W/m² k⁴. **(12)**

(b) A thermometer with $\epsilon = 0.9$ indicates the temperature of room air as 20 °C. If the walls of the room are at 5 °C and h for the thermometer is 8.3 W/m² °C, what is the true temperature of the room air? **(11)**

Contd P/2

NAME 329

Contd ... Q. No. 4

(c) Two very long concentric cylinders are located in a large room (3). Inner cylinder (1) has radius r_1 and outer cylinder (2) has radius r_2. The outer surface of the outer cylinder and inner surface of the inner cylinder are insulated. For values of $\frac{r_1}{r_2}$ in the limit 1 and 0 and in the limit 0.6 and 0.2 write values of the sixteen shape factors F_{xy} (i.e. F_{11}, F_{22}, F_{12}, F_{21}). **(12)**

SECTION – B

There are **FOUR** questions in this section. Answer any **THREE**.

Assume any reasonable value for missing data.

Counter flow chart is supplied.

5. (a) Derive the expression for heat transfer for a long hollow cylinder per meter length exposed to a convection environment on both sides. Thermal conductivity of the material is k and inner and outer dia of cylinder is d_1 and d_2 respectively. Temperatures of the environment on two sides of the cylinder are T_1 and T_2. **(22)**

(b) A 5 mm thick aluminum (k = 204 W/m°C) wall is constructed with identical layers of plastic (k = 0.23 W/m°C) on both sides of aluminum. The overall heat transfer, considering convection on both sides of the plastic is 120 W/m^2°C. If the overall temperature difference across the arrangement is 65 °C, calculate the temperature difference across the aluminum wall. **(13)**

6. (a) For an infinitely long fin coming out from a hot body at temperature, T_0 is exposed to air at temperature, T_∞. Derive an expression for temperature distribution along the length of the fin and hence show that: **(25)**

$$q = \sqrt{hpkA}\,\theta_0$$

where the symbols have their usual meanings.

(b) A very long fin of 18 mm dia is constructed of a steel (k = 36.0 W/m°C) and placed on the outside of a wall maintained at 195 °C. The environment temperature is 20 °C, and the convection heat transfer coefficient is 60 W/m^2 °C, what is the heat lost by the fin? **(10)**

7. (a) (i) In case of transient heat conduction process, show that **(15)**

$$\frac{T - T_\infty}{T_0 - T_\infty} = e^{-\left[\frac{hA}{\rho CV}\right]\tau}$$

where the symbols have their usual meanings.

(ii) What are the limitations of using this equation? **(3)**

(iii) Draw (nature of) temperature profiles in a flat wall at 100 °C with time; when exposed to air at 30 °C on both sides with low value of k and high value of h'. **(4)**

Contd P/3

NAME 329

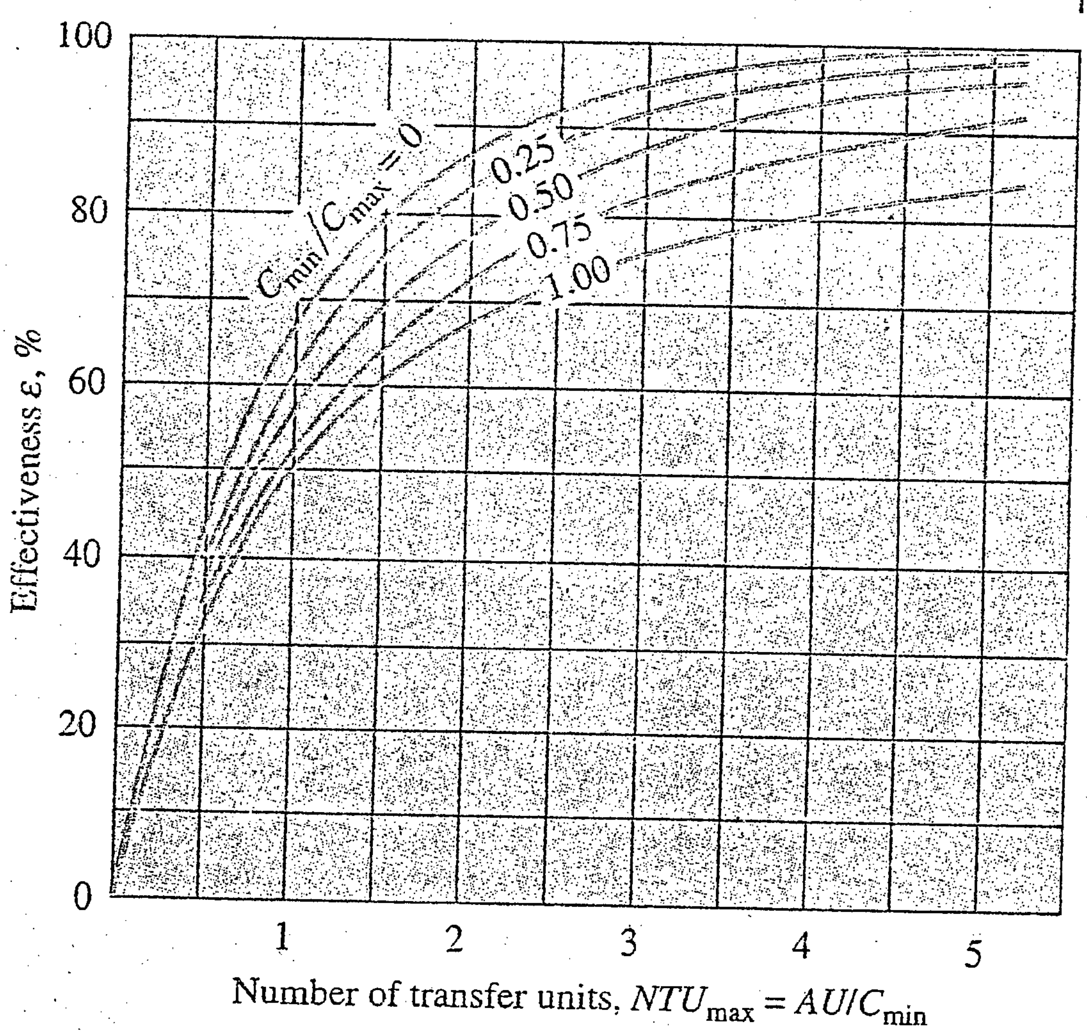
Contd ... Q. No. 7

(b) A 6 cm diameter copper sphere is initially at a uniform temperature of 250 °C. It is suddenly exposed to an environment at 25 °C having a heat transfer coefficient, h = 28 W/m^2 °C. Using lumped-capacity method of analysis, calculate the time necessary for the sphere temperature to reach 90 °C. **(13)**

[ρ = 8954 Kg/m^3, c = 383 J/kg °C]

8. (a) Derive the expression for LMTD of parallel flow arrangement. What are the assumptions considered for the derivation of LMTD? **(25)**

(b) A counter flow heat exchanger area 9.0 m^2 with U = 350 W/m^2 °C. Water at 90 °C enters with flow rate of 0.5 kg/sec (C_p = 4.18 kJ/kg °C) and oil enters at 10 °C with flow rate of 90 kg/min (C_p = 1900 J/kg °C). Find the outlet temperature of fluids. What is the heat transfer? [Chart for counter flow is supplied]. **(10)**



Effectiveness for counterflow exchanger performance.

Figure for Q. 8 (b).

L-3/T-2/NAME **Date : 24/12/2012**

BANGLADESH UNIVERSITY OF ENGINEERING AND TECHNOLOGY, DHAKA

L-3/T-2 B. Sc. Engineering Examinations 2010-2011

Sub : **NAME 325** (Shipbuilding Technology II)

Full Marks : 210 Time : 3 Hours

The figures in the margin indicate full marks.

USE SEPARATE SCRIPTS FOR EACH SECTION

SECTION – A

There are **FOUR** questions in this section. Answer any **THREE**.

1. (a) What are classification societies? Discuss briefly the history of these. List renowned classification societies. **(10)**

   (b) Discuss periodic surveys by classification societies. **(10)**

   (c) Discuss ship contract. **(15)**

2. (a) What factors should be considered during planning of an ideal layout for a modern shipyard? With neat sketch show such a layout of a shipyard. **(15)**

   (b) Discuss different machines which are used for material preparation in a shipyard. **(12)**

   (c) Discuss the rate of stockyard. **(8)**

3. (a) What are the advantages of double bottom construction? What are its design considerations? **(12)**

   (b) Discuss the design consideration in center girder. **(12)**

   (c) What are bulkheads? Discuss the spacing of watertight bulkheads for cargo ships. **(11)**

4. (a) What is bulbous bow? Discuss briefly. **(10)**

   (b) Discuss different types of keels with figures. **(8)**

   (c) Show the types of knee bracket connections with neat sketches. **(10)**

   (d) Discuss hatch coaming with figure. **(7)**

SECTION – B

There are **FOUR** questions in this section. Answer any **THREE**.

5. (a) What is corrosion cell? Discuss different types of corrosion that take place in ships. What is galvanic series of metals and alloys in sea water? **(15)**

   (b) Why is surface preparation necessary? Discuss different types of surface preparation techniques and their effectiveness. **(8)**

   (c) Discuss how corrosion can be prevented by good design. **(12)**

Contd P/2

NAME 325

6. (a) What are the influencing factors for choicing framing system in ship construction? With neat sketches discuss different types of framing system used in ship construction. **(12)**

(b) Discuss the prefabrication of ship units. What are its advantages? Define subassembly, assembly and unit. **(18)**

(c) Explain the physical significance of stress concentration factor. **(5)**

7. (a) Identify the special structural arrangement that must be provided in the forward region of ship in case of: **(18)**

    (i) Pounding

    (ii) Panting

Justify your answer with the help of necessary sketches.

(b) Show erection sequence of general cargo ship and bulk oil tanker. **(12)**

(c) Discuss mooring equipment and their arrangement. **(5)**

8. (a) Discuss thermal insulation of ship structure. **(10)**

(b) With neat sketches show the different types of reinforcement used in welded construction. **(10)**

(c) Write short notes on: **(15)**

    (i) Sea inlets

    (ii) Sampson Posts

    (iii) Bulwark

L-3/T-2/NAME Date : 07/01/2013

BANGLADESH UNIVERSITY OF ENGINEERING AND TECHNOLOGY, DHAKA

L-3/T-2 B. Sc. Engineering Examinations 2010-2011

Sub : **NAME 363** (Computational Fluid Dynamics (CFD))

Full Marks : 210 Time : 3 Hours

The figures in the margin indicate full marks.

USE SEPARATE SCRIPTS FOR EACH SECTION

SECTION – A

There are **FOUR** questions in this section. Answer any **THREE**.

1. (a) Transform the following two dimensional Laplace equation for inviscid, irrotational, incompressible and steady flow from the physical domain (x, y) to the computational domain (ξ, η). **(17)**

$$\frac{\partial^2 \phi}{\partial x^2} + \frac{\partial^2 \phi}{\partial y^2} = 0$$

where ϕ is the velocity potential function.

(b) Show that the following transformation parameters can be expressed in terms of direction cosine (α), grid aspect ratio (AR), Jacobian (J) and the angle (θ) between ξ and η directions. **(18)**

$$x_\xi = \frac{\cos\alpha}{(AR.J.\sin\theta)^{1/2}} \qquad y_\xi = \frac{\sin\alpha}{(AR.J.\sin\theta)^{1/2}}$$

$$x_\eta = \left(\frac{AR}{J\sin\theta}\right)^{1/2}\cos(\theta-\alpha) \qquad y_\eta = \left(\frac{AR}{J\sin\theta}\right)^{1/2}\sin(\theta-\alpha)$$

2. (a) Compare the advantages and disadvantages of elliptic, hyperbolic and parabolic PDE grid generation method. **(18)**

(b) Derive the first order free surface boundary condition for incompressible, irrotational, inviscid and steady flow. **(17)**

3. (a) Define free surface. Why is it called free surface? Compare free surface properties with gravity waves. **(15)**

(b) Discuss briefly the surface tracking and surface capturing method for free surface flow modeling. **(20)**

4. (a) Deduce the mathematical expressions of Reynolds Average Momentum equation for turbulent flow modeling. **(18)**

(b) Derive Reynolds Average transport equation for turbulent flow problem. **(17)**

Contd P/2

NAME 363

SECTION – B

There are **FOUR** questions in this section. Answer any **THREE**.

Symbols have their usual meaning. Assume reasonable value of any missing data.

5. (a) Describe different types of finite volume method for one-dimensional steady state diffusion that includes a source. **(25)**

   (b) Prove that the summation of rate of increase of a property (ϕ) of a fluid element and the net rate of flow of ϕ out of fluid element equals to the rate of increase of ϕ for a fluid particle. **(10)**

6. (a) Describe the upwind differencing scheme for solving convection-diffusion problem. **(15)**

   (b) Consider the problem of source-free heat conduction in an insulated rod of length 0.6 m, whose ends are maintained at constant temperatures of 125 °C and 550 °C respectively. To calculate the steady state temperature distribution in the rod, determine the algebraic equations in the matrix form using 5 intermediate control volumes of equal size. Thermal conductivity of the rod is 995 W/m/K and its cross-sectional area is 10.5×10^{-3} m^2. **(20)**

7. (a) "If the velocities are defined at the scalar grid nodes, the influence of pressure is not properly represented in the discretised momentum equations". Justify this statement with a suitable example. Describe how this problem can be solved by using a staggered grid for the velocity components. **(15)**

   (b) Describe TDMA method for solution of a tri-diagonal system of equations. **(20)**

8. (a) What are the solution algorithms used for pressure velocity coupling? **(7)**

   (b) Solve the following matrix using TDMA. **(20)**

$$\begin{bmatrix} 25 & -6 & 0 & 0 & 0 \\ -6 & 16 & -6 & 0 & 0 \\ 0 & -6 & 16 & -6 & 0 \\ 0 & 0 & -6 & 16 & -6 \\ 0 & 0 & 0 & -6 & 15 \end{bmatrix} \begin{bmatrix} T_1 \\ T_2 \\ T_3 \\ T_4 \\ T_5 \end{bmatrix} = \begin{bmatrix} 1200 \\ 105 \\ 105 \\ 105 \\ 105 \end{bmatrix}$$

   (c) Write short note on 'Post-processor'. **(8)**

Fauida Hayee
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L-3/T-2/NAME

Date : 07/01/2013

BANGLADESH UNIVERSITY OF ENGINEERING AND TECHNOLOGY, DHAKA

L-3/T-2 B. Sc. Engineering Examinations 2010-2011

Sub : **NAME 347** (Design of Special Ships)

Full Marks : 210 Time : 3 Hours

The figures in the margin indicate full marks.

USE SEPARATE SCRIPTS FOR EACH SECTION

SECTION – A

There are **FOUR** questions in this section. Answer any **THREE**.

1. (a) What are the principal requirements of a technical ship design? Draw a preliminary design path of an overall technical design model in deadweight design approach. **(15)**

   (b) Write the type of the ships where you will use the capacity design approach. Estimate the dimensions for a container ship to meet the following requirements: **(20)**

   1400 containers $6.05 \times 2.43 \times 2.43$ m

   Made up by 1000 holds and 400 on deck

   Service draught of 9.0 m

   Service speed of 23 knots

   Assume the containers are 7 high in each cell with 9 cells across the ship.

2. (a) How does the choice of fuel system affect a ship design? Describe a system of rapid fueling. **(20)**

   (b) Describe the various elements of a ship weapon system and how they interact. **(15)**

3. (a) Describe the hydrodynamic characteristics of displacement, high speed displacement or semi planing and planing hulls. **(15)**

   (b) Describe the advantages and disadvantages of flat-bottomed and deep vee planing hulls. **(10)**

   (c) Draw a force and moment equilibrium diagram for a planing hull and hence derive the equations. **(10)**

4. (a) Write the four fundamentals that you must achieve to establish the lines and body plan. Describe how you will modify the sectional area curve. **(15)**

   (b) Describe the principal properties of main propulsion machinery and also the factors that affect the choice of machinery for a ship. **(20)**

SECTION – B

There are **FOUR** questions in this section. Answer any **THREE**.

Assume suitable values for missing data if any.

5. (a) How the trawlers are classified depending on the fishing ground? Mention the probable length of each class of vessel. **(7)**

   (b) Draw a typical general arrangement plan of a Factory Stern Trawler and discuss the main features. **(28)**

Contd P/2

NAME 347

6. Design of a Dock tug having engine power 1100 KW is required. **(35)**

   Calculate:

   (i) length using GRIEG's formula

   (ii) breadth, draft, depth and speed

   (iii) displacement using POSDUNINE's formula

   (iv) block coefficient and prismatic coefficient

   (v) metacentric height

   Assume:

   $KG = 0.8 \times \text{Depth}$

   $$BM = 0.9 \times \frac{(\text{Breadth})^2}{\text{Draft}}$$

   Water plane area coefficient, $C_w = 0.7$

   Comment on the stability criteria of the vessel.

7. (a) Discuss the growth in the size of oil tankers after World War II. Mention the reasons for the growth. **(7)**

   (b) Draw the profile of an oil tanker and discuss the important design features. **(21)**

   (c) Estimate the length of an oil tanker of total deadweight 120,000 tonne and draught 16 m. **(7)**

8. (a) A guided missile destroyer of displacement 6200 tonf, speed 30 knots and S.h.p. 62,500 at full power, has an endurance of 5000 miles at 18 knots. The group weights are: **(25)**

   Hull 2400 tonf, machinery 1500 tonf, armament 700 tonf, fuel 1200 tonf and equipment 400 tonf

   Estimate the displacement and group weights of a similar ship with an additional 100 tonf of armament and a full power speed of 28 knots. The endurance is to be 5500 miles at 20 knots.

   Assume:

   (i) S.h.p. varies as $(\text{speed})^{2.8}$ at full power and $(\text{speed})^3$ at 18–20 knots.

   (ii) Saving of 5% are expected on both hull and machinery groups due to advances in design and materials.

   (iii) Fuel consumption rate is reduced by 3%.

   (b) Provide the diagrammatic arrangement of a conventional submarine. **(10)**

14.01.13

L-3/T-2/NAME **Date : 19/11/2012**

BANGLADESH UNIVERSITY OF ENGINEERING AND TECHNOLOGY, DHAKA

L-3/T-2 B. Sc. Engineering Examinations 2010-2011

Sub : **MATH 381** (Fourier Analysis, Harmonic Function, Complex Variable and Laplace Transformations)

Full Marks: 280 Time : 3 Hours

USE SEPARATE SCRIPTS FOR EACH SECTION

The figures in the margin indicate full marks.

SECTION – A

There are **FOUR** questions in this Section. Answer any **THREE**.

1. (a) Given $z_1 = -1 + i\sqrt{3}$, $z_2 = \sqrt{3} + i$, find $\arg z_1$, $\arg z_2$, $\arg\left(\frac{z_1}{z_2}\right)$ and verify $\arg\left(\frac{z_1}{z_2}\right) = \arg z_1 - \arg z_2$. **(13⅔)**

(b) If $f(z) = u + iv$ is an analytic function then prove that in polar form Cauchy-Riemann equations are $u_r = \frac{1}{r} v_\theta$ and $v_r = -\frac{1}{r} u_\theta$. **(16)**

(c) Find an analytic function $w = u + iv$ given that $v = \frac{x}{x^2 + y^2} + \cosh x \cos y$. **(17)**

2. (a) In the transformation $w = i\frac{1-z}{1+z}$, show that the interior of the circle $|z| = 1$ is represented in the w-plane by the plane above the real axis, the upper semi-circle into positive half of real axis and lower semi-circle into negative half of the real axis. **(18)**

(b) Determine the integral $\int_C \frac{1}{(z^2+1)(z^2+9)} dz$ where C denotes the square whose sides lie along the lines $x = \pm 2$, $y = \pm 2$, describe in the positive sense. **(13⅔)**

(c) Determine the integral $\int_0^{1+i} (x - y + ix) dz$ along the real axis from z = 0 to z = 1 and then along a line parallel to the imaginary axis from z = 1 to z = 1 + i. **(15)**

3. (a) State and prove the Cauchy's Integral formula. Hence evaluate $\oint_C \frac{e^{2z}}{(z+1)^4} dz$, where C is the circle $|z-1| = 2$. **(16⅔)**

(b) Expand $f(z) = \frac{z}{(z-1)(2-z)}$ in Laurent series valid for (i) $|z| > 2$, (ii) $0 < |z-2| < 1$. **(10)**

(c) Evaluate the integral using the Cauchy's residue theorem: **(20)**

(i) $\int_C \frac{\sin 3z}{\left(z - \frac{\pi}{4}\right)^4} dz$, $C = \{(x, y) : |x| \le 2, |y| \le 2\}$, positively oriented.

(ii) $\int_C \frac{2z^2 - z + 1}{(2z-1)(z+1)^2} dz$, $C : r = 2\cos\theta, 0 \le \theta \le 2\pi$.

Contd P/2

MATH 381

4. Evaluate the following integral using the method of contour integration. **(23⅓+23⅓)**

(i) $\int_0^{2\pi} \frac{\sin 2\theta}{5-3\cos\theta}\,d\theta$ (ii) $\int_0^{\infty} \frac{2x^2}{(x^2+9)(x^2+4)^2}\,dx$

SECTION – B

There are **FOUR** questions in this Section. Answer any **THREE**.

5. (a) Find $L\left\{\frac{\cos at - \cos bt}{t}\right\}$ **(10⅔)**

(b) Show that $L\{J_0(t)\} = \frac{1}{\sqrt{1+s^2}}$ and also find $L\{tJ_0(at)\}$. **(20)**

(c) If $L\{F(t)\} = \frac{e^{-\frac{1}{s}}}{s}$, find $L\{e^{-t}F(3t)\}$. **(16)**

6. (a) Find $L^{-1}\left\{\frac{s}{(s^2+a^2)^2}\right\}$ **(11⅔)**

(b) Find $L^{-1}\left\{\frac{s^2+2s+3}{(s^2+2s+2)(s^2+2s+5)}\right\}$ **(18)**

(c) Solve the following differential equation by using Laplace Transform: **(17)**

$Y'' + 2Y' + 5Y = e^{-t}\sin t,\ Y(0)=0,\ Y'(0)=1.$

7. (a) Prove that for $0 \le x \le \pi$, $x(\pi - x) = \frac{\pi^2}{6} - \left(\frac{\cos 2x}{1^2} + \frac{\cos 4x}{2^2} + \frac{\cos 6x}{4^2} + \cdots\right)$ and hence evaluate $\sum_{n=1}^{\infty} \frac{1}{n^2}$. **(23⅔)**

(b) Find the Fourier transform of $F(x) = \begin{cases} 1-x^2 & , |x|<1 \\ 0 & , |x|>1 \end{cases}$ and also evaluate $\int_0^{\infty} \left(\frac{x\cos x - \sin x}{x^3}\right)\cos\frac{x}{2}\,dx$. **(23)**

8. (a) Use finite Fourier transform to solve $\frac{\partial U}{\partial t} = \frac{\partial^2 U}{\partial x^2}$, $0<x<6,\ t>0$ subject to the conditions $U(0,t)=0$, $U(6,t)=0$, $U(x,0)=\begin{cases} 1, & 0<x<3 \\ 0, & 3<x<6 \end{cases}$ and interpret physically. **(26⅔)**

(b) Find the temperature for a steady flow of heat in a semicircular plate of radius r. The circumference is kept at a temperature v_0 and the diameter at a temperature zero. **(20)**

L-3/T-2/NAME

Date : 17/12/2012

BANGLADESH UNIVERSITY OF ENGINEERING AND TECHNOLOGY, DHAKA

L-3/T-2 B. Sc. Engineering Examinations 2010-2011

Sub : **NAME 323** (Resistance and Propulsions of Ships)

Full Marks: 210 Time : 3 Hours

USE SEPARATE SCRIPTS FOR EACH SECTION

The figures in the margin indicate full marks.

SECTION – A

There are **FOUR** questions in this Section. Answer any **THREE**.

Symbols have their usual meaning. Assume reasonable value of any missing data.

1. (a) With a neat sketch of engine and propeller power curves, explain the effect of 'too much pitch or diameter' and 'too little pitch or diameter'. **(13)**

   (b) Define projected area, developed area and expanded area of a propeller. **(10)**

   (c) The cylindrical polar coordinates (r, θ, z) of the trailing edge of a flat faced propeller blade radial section are (1550 mm, -28^0, –375 mm). If the pitch of propeller is 3.0 m and the expanded blade width is 2000 mm, determine the coordinates of the leading edge. **(12)**

2. (a) Describe the Blade Element Theory of propeller action. **(20)**

   (b) A propeller of diameter 4.2 m has an rpm of 175 when advancing into sea water at a speed of 12.0 knot. The element of the propeller at 0.7R produces a thrust of 200 kN per m. Determine the torque, the axial and rotational inflow factors and the efficiency of the element. **(15)**

3. (a) Define cavitation phenomena with respect to ship propellers. What are the detrimental effects of cavitation? Cite an example where cavitation is favorable. **(10)**

   (b) A propeller of diameter 5.5 m and pitch ratio 1.0 has its axis 4.0 m below the water line. The propeller has a speed of advance of 14 knots when running at 120 rpm and produces a thrust of 520 kN. Determine the expanded blade area ratio of the propeller using the Burril criterion for merchant ship propellers. **(20)**

   (c) What is QPC of a marine propeller? **(5)**

4. (a) What are the forces which are normally taken into account in calculating the stresses in a propeller blade? What are the factors which are not taken into account? **(10)**

   (b) A three-bladed propeller of diameter 3.0 m has a thrust of 360 kN and torque of 300 kN-m at 180 rpm. The thrust and the torque may be assumed to be linearly distributed. **(25)**

$$\frac{dk_T}{dx} = k_1 x \quad \& \quad \frac{dk_Q}{dx} = k_2 x$$

   between the root section at x = 0.2 and fip section at x = 1.0. Determine the bending moments due to thrust and torque at the root section.

Contd P/2

NAME 323

SECTION – B

There are **FOUR** questions in this Section. Answer any **THREE**.

5. (a) Classify with figure the various components of resistance of a ship. **(10)**

   (b) Prove that the resistance of a ship is a function of Reynolds no., Froude no. and Euler no. **(25)**

6. (a) Show that the irrotational flow of a non-viscous fluid about a circular cylinder produces no drag on the cylinder. **(20)**

   (b) Define corresponding speed. Explain why both Reynolds and Froude similarity can not exist simultaneously. **(15)**

7. (a) Discuss briefly the effects of trim and shallow water on the resistance of ship. **(20)**

   (b) Write five empirical formulae for the calculation of two dimensional frictional resistance. **(15)**

8. (a) The particulars of an inland passenger vessel are given below. Calculate **(25)**

   (i) The residual resistance, R_R using Taylor standard table.

   (ii) The frictional resistance using ITTC formulation for smooth hull.

   Particulars:
   Length = 75.83 m
   Breadth = 13.462 m
   Depth =2.7 m
   Draft = 1.6 m
   Displacement = 1000 MT
   Midship coefficient = 0.85
   Speed = 10 Knots
   Water density = 996 (kg/m^3)
   Kinematic viscosity = 0.804×10^{-6} m^2/s at 30°C

   (b) Write a short note on viscous pressure drag. **(10)**

Table - 1

Residual Resistance per unit displacement, values given for ($0.2283\ R_R / \Delta$)

Taylors Standard Series

B / d = 2.25

C_p	$\frac{0.027894}{(L/100)^3}$ \ 1.0724 $V/\sqrt{L}$	0.60	0.65	0.70	0.75	0.80	0.85	0.90	0.95	1.00	1.05	1.10
0.50	50	0.41	0.50	0.69	0.85	1.10	1.20	1.40	1.65	2.00	3.15	5.25
	100	0.53	0.67	0.91	1.09	1.25	1.55	1.75	2.00	2.60	3.95	7.00
	150	0.62	0.78	0.99	1.20	1.40	1.80	2.20	2.55	3.30	4.90	8.40
	200	0.67	0.83	1.03	1.27	1.62	2.20	2.50	3.00	4.00	6.00	9.90
	250	0.71	0.86	1.07	1.29	1.96	2.30	2.90	3.60	4.90	7.50	13.00
0.60	50	0.49	0.62	0.83	1.22	1.61	2.05	2.70	3.80	5.40	6.20	6.80
	100	0.62	0.74	0.99	1.30	1.69	2.15	3.00	4.45	6.70	8.10	9.20
	150	0.68	0.83	1.05	1.34	1.71	2.20	3.20	4.85	7.60	9.00	10.60
	200	0.72	0.88	1.09	1.35	1.74	2.30	3.35	5.20	8.10	9.60	11.00
	250	0.74	0.92	1.12	1.36	1.79	2.48	3.60	5.60	8.50	10.00	11.50
0.70	50	0.80	1.02	1.32	1.83	2.34	3.35	4.70	7.30	11.50	14.30	15.00
	100	0.81	1.03	1.32	1.83	2.46	3.50	5.30	8.90	15.60	20.00	22.40
	150	0.81	1.03	1.33	1.83	2.46	3.50	5.45	9.75	17.80	24.00	28.20
	200	0.82	1.04	1.33	1.83	2.46	3.50	5.50	10.30	19.00	26.80	33.00
	250	0.83	1.06	1.34	1.83	2.50	3.65	5.50	10.60	20.00	28.90	35.70
0.80	50	1.00	1.27	2.00	3.52	6.70	9.30	10.30	13.20	19.30	25.50	28.00
	100	1.00	1.27	2.00	3.52	6.70	10.50	12.00	15.60	24.70	35.30	43.50
	150	1.00	1.27	2.00	3.52	6.70	10.90	12.50	16.80	26.70	40.20	52.50
	200	1.00	1.27	2.00	3.52	6.70	11.10	12.80	17.35	27.70	42.00	57.50
	250	1.00	1.27	2.00	3.52	6.70	11.30	13.20	17.60	28.30	41.50	58.50

B / d = 3.75

C_p	$\frac{0.027894}{(L/100)^3}$ \ 1.0724 $V/\sqrt{L}$	0.60	0.65	0.70	0.75	0.80	0.85	0.90	0.95	1.00	1.05	1.10
0.50	50	0.46	0.52	0.67	0.88	1.20	1.55	1.90	2.40	3.00	4.10	5.80
	100	0.72	0.93	1.16	1.46	1.85	2.40	2.90	3.45	4.30	5.70	8.50
	150	0.80	1.02	1.32	1.73	2.20	2.90	3.50	4.20	5.20	7.20	11.30
	200	0.86	1.05	1.38	1.81	2.30	3.20	3.80	4.45	5.70	8.20	13.10
	250	0.89	1.08	1.43	1.90	2.47	3.40	4.02	4.65	6.50	8.70	14.30
0.60	50	0.55	0.72	0.91	1.28	1.70	2.20	2.80	4.00	5.35	6.60	8.10
	100	0.73	0.92	1.21	1.52	1.85	2.50	3.40	4.85	7.10	9.15	11.10
	150	0.83	1.05	1.37	1.69	2.15	2.70	3.60	5.30	7.80	10.30	12.70
	200	0.88	1.13	1.48	1.88	2.30	2.85	3.80	5.50	8.00	10.80	13.70
	250	0.93	1.20	1.57	1.93	2.45	3.00	4.00	5.60	8.40	11.30	14.20
0.70	50	0.89	1.16	1.66	2.34	3.20	4.40	6.00	8.80	12.20	15.60	17.30
	100	1.00	1.35	1.81	2.52	3.30	4.60	6.60	9.80	15.70	21.20	25.20
	150	1.03	1.39	1.87	2.55	3.35	4.70	6.80	10.60	17.40	24.30	29.20
	200	1.05	1.40	1.86	2.50	3.35	4.65	6.80	10.70	17.50		
	250	1.08	1.41	1.84	2.49	3.35	4.60	6.50	10.30	16.70		
0.80	50	1.63	2.42	3.80	5.60	7.80	10.50	13.50	17.00	22.90	28.20	32.00
	100	1.55	2.35	3.51	5.20	7.75	11.40	15.30	20.30	28.00	37.30	45.00
	150	1.31	1.92	2.77	4.20	6.30	9.70	12.90	17.00	26.00	36.30	
	200	1.27	1.77	2.52	3.60	5.50	8.40	11.00	14.80	23.70		
	250	1.32	1.94	2.50	3.65	6.20	8.20	11.00	14.90	23.70		

Note: R_R = Residual resistance, (N) B = Breadth, (m) V = Speed, (m/s) C_p = Prismatic (longitudinal coefficient.

Δ = Displacement, (MT) d = Draft, (m) L = Length (m)

Table for Question No. 8(a)

NAME 023