KHULNA UNIVERSITY OF ENGINEERING & TECHNOLOGY
Department of Mechanical Engineering
B. Sc. Engineering 4th year 2nd Term Examination, 2015
ME 4213
(Fluid Mechanics III)

Time: 3 Hours. Total Marks: 210

N.B. i) Answer any THREE questions from each section in separate scripts.
ii) Figures in the right margin indicate full marks.
iii) Assume reasonable data if any missing.

SECTION - A

1(a) Why reciprocating pump is called as a positive displacement pump? Discuss the effect of acceleration of piston on velocity and pressure in a reciprocating pump. 17

1(b) A single acting reciprocating pump runs at 70 rpm. The diameter of the plunger is 0.2m and crank radius is 0.19m. The suction pipe is 10cm in diameter and 7.0m long. Calculate the maximum permissible value of suction lift, if the separation takes place at 2.6m of water absolute. 18

2(a) Discuss how water is lifted by a centrifugal pump? 10

2(b) Deduce the expression for minimum starting speed of a centrifugal pump to lift water. 10

2(c) Determine horse power required to drive a centrifugal pump which delivers 36 liters of water per second to a height of 20m through a 130mm diameter and 105m long pipeline. The overall efficiency of the pump is 70% and Darcy's, $f = 0.03$ for pipeline. Assume inlet losses in suction pipe is equal to 0.45m. 15

3(a) What are the purposes of draft tube to use in turbine? Derive the expression of pressure regained by fitting a draft tube. 17

3(b) Why Pelton wheel is called an impulse turbine? Show the condition for maximum hydraulic efficiency of a Pelton wheel. 18

4(a) What is specific speed of a turbine? Write down its importance. 09

4(b) What is Thoma's cavitation factor? Discuss its importance. 08

4(c) A model Francis turbine ¼th of full size, develops 3.5 kW at 400 rpm under a head of 1.8m. Find the speed and power of full size turbine operating under a head of 8m if; 18

(i) The efficiency of the model and full size turbine are same and
(ii) The efficiency of the model is 75% of the full size considering the scale effect.

SECTION - B

5(a) The flow of an incompressible fluid is defined by $u = 2.1$ and $v = 8x+y$. Find the stream function and velocity potential. 08

5(b) Deduce the expression of Cauchy-Riemann equation in cylindrical polar coordinate. 12

5(c) What are the physical significances of flow net. Derive the expressions for stream function and velocity potential of a Rankine oval. 15

6(a) Derive the expressions of lift and drag for an ideal fluid about a rotating cylinder. 17

6(b) A source having volume flow rate 2.5 m^3/sec at the origin and a uniform flow at 5 m/sec are superimposed. The half body which is formed has a maximum width of 2.1m. Calculate; 18

(i) The location of stagnation point
(ii) Width of the body at the origin and
(iii) The velocity at $(0.7,\pi/2)$.

7(a) What is meant by best economic cross section of an open channel? 08

7(b) Show that the best economic section for a trapezoidal channel is half of a hexagon. 12

7(c) A trapezoidal channel has a bottom width of 5m and side slopes of 3 horizontal to 1 vertical. If the depth of the flow is 1.5m at a discharge of 12 m^3/sec, determine; 15

(i) The specific energy and
(ii) The critical depth of the flow

8(a) Derive the expression of energy dissipation due to hydraulic jump in terms of conjugate depths. 20

8(b) If the Froude number before the hydraulic jump in a horizontal rectangular channel is 9.0 and the energy loss due to the jump is 3.8m, calculate; 15

(i) The conjugate depths
(ii) The discharge and
(iii) The Froude number after the jump.

KHULNA UNIVERSITY OF ENGINEERING & TECHNOLOGY
Department of Mechanical Engineering
B. Sc. Engineering 4th Year 2nd Term Examination, 2015
ME 4057
(Material Handling & Maintenance Engineering)

Time: 3 Hours. Total Marks: 210

N.B. i) Answer any THREE questions from each section in separate scripts.
ii) Figures in the right margin indicate full marks.
iii) Assume reasonable data if any missing.

SECTION - A

1(a) Write down the importance of material handling. 08

1(b) Classify and briefly describe industrial transports which are used in material handling. 08

1(c) Describe the term mobility and angle of repose. How can you determine angle of repose of a bulk material? 09

1(d) Deduce the relation for calculating the capacity and efficiency of a conveying machine. 10

2(a) Describe general construction of belt conveyor and label its important components? 10

2(b) Why ply is used n rubberized belt conveyor? How belt end can be fastened by vulcanization? Describe briefly. 08

2(c) Why apron conveyor is used? What are the advantages and disadvantages of apron conveyor over belt conveyor? 10

2(d) Describe the function of idler and driving sprockets in an apron conveyor. 07

3(a) Describe the operation principle of a hydraulic loader. 08

3(b) Draw the different types of screw used in screw conveyor. What are the advantages and disadvantages of paddle flight and cut flight screw conveyor over continuous screw conveyor. 14

3(c) A horizontal screw is designed to convey molding sand (of a bulk weight $\gamma = 1.8$ ton/m^3); required capacity Q = 50 ton per hour; the conveying run length L = 25m; calculate the main parameters: μ, D, N, M_g, S, q, P of the conveyor with usual meaning. 13

4(a) Mention working principle of a loader chute with necessary sketches. 07

4(b) Describe the working principle of a V-bucket conveyor. 10

4(c) Sketch and explain different types of feeder used in conveyors. 08

4(d) Draw a typical escalator step and label its important components. 10

SECTION - B

5(a) Explain preventive maintenance and corrective maintenance. Discuss the preventive maintenance of a IC engine. 12

5(b) How fan belt of a power transmission system is checked? What are the adverse effects, if the fan belt tension is over-tight or too-loose. Explain. 07

5(c) What are the possible adverse effects: 10

(i) If daily maintenance is not done for a transport.
(ii) If oil is not changed in due time.
(iii) If fuel tank is not cleaned.

5(d) What are the secondary functions of a maintenance department? 06

6(a) Describe the necessity of using seals in industrial equipment. 05

6(b) What are the common seal and seal materials used in different industrial equipments. 10

6(c) Briefly describe the sequential failure of seals and their remedies for common seal failure. 12

6(d) How would you check and remedy the leakage of ammonia compression through shaft seals (Shaft gland packing)? 08

7(a) What are the important properties of lubricating oil? Briefly explain the terms viscosity, TAN and TBN of lubricating oil and its importance in maintenance engineering. 12

7(b) What are the effects of sulpher contents and humidity of fuel on engine oil? How would you avoid these adverse effects? 08

7(c) Describe the maintenance of the brake system of a vehicle for its proper functioning. 07

7(d) What is meant by engine tune up and mention the steps of tune up of an engine? 08

8(a) What is meant by stand and clearance, wear limit and maximum oil clearance? Briefly explain. 09

8(b) Write down stand clearance between shaft and journal bearing for 25mm shaft, 50mm shaft and 100mm shaft. 05

8(c) What are the usual procedure of checking ; 09

(i) Crankshaft (ii) Cylinder (iii) Engine valve.

8(d) Standard crankshaft diameter of a Hino bus = 100mm 12

Standard bearing clearance = 0.1mm

Standard journal bearing size = 99.9mm

Wear limit = 0.2mm

After three years operation of the bus, the engine is checked for major repairing and following parameters are found;

Crankshaft diameter = 99.98mm

Journal bearing diameter = 99.9mm

Taperness and ovalness are within acceptable limit.

Find out;

(i) Available life of the bearing and crankshaft and

(ii) Do you suggest to use the bearing (old) or new with the reason thereby?