

KHULNA UNIVERSITY OF ENGINEERING & TECHNOLOGY

Department of Mechanical Engineering

B. Sc. Engineering 4th Year Special Backlog Examination, 2021

ME-3215

(Engineering Metallurgy)

Time: 3 Hours.

Full 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.
iv) Graph paper will be supplied on demand.

SECTION – A

- 1(a) Write down the different types of properties of a material. 12
- 1(b) What is physical metallurgy? Write short notes on the following: 09
(i) Resilience;
(ii) Creep and
(iii) Ductility.
- 1(c) In how many ways temperature can be measured? Explain a suitable one. 14
- 2(a) What is unit cell? Describe BCC and FCC arrangements. 12
- 2(b) What is alloy? Explain solid solution alloy with classifications. 15
- 2(c) Explain the common crystal imperfections. 08
- 3(a) Why is cooling curve important in metallurgy? 05
- 3(b) Lead melts at 400⁰C and Tin melts at 200⁰C. They form a eutectic containing 62% Tin at 150⁰C. The maximum solid solubility of Tin in Lead at this temperature is 20% of Lead in this Tin 4%. Assume solubility of each at room temperature is 1%. 30
(i) Draw the equilibrium diagram labeling all points, lines and areas.
(ii) For alloy containing 40% Tin, give the temperature of initial and final solidification and
(iii) Determine the chemical composition and the relative amount of the phases present at a temperature 20⁰C below the initial temperature of solidification.
- 4(a) How austempering is done? Distinguish between regular tempering and austempering. 07
- 4(b) Write short notes on: 12
(i) Hardening,
(ii) Annealing and
(iii) Normalizing.
- 4(c) What is the significant of T-T-T diagram in heat treatment industries? Draw a T-T-T diagram of eutectoid steel and explain how various structures can be obtained by controlling cooling rates. 16

SECTION – B

- 5(a) Write down the properties and applications of carbon steel with respect to its carbon content. 10
- 5(b) What is slag? How does slag formation happen? Describe with proper chemical reactions. 12
- 5(c) Present a comparative analysis of Gray and White cast iron. 08
- 5(d) What are the limitations of carbon steel? 05
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- 6(a) Which method is generally employed for pure form of steel production? Explain. 13
- 6(b) Classify spring steels with compositions and applications. 12
- 6(c) Explain the mechanism of corrosion resistance for stainless steel. 10
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- 7(a) Explain the production of Aluminum from ores using block diagram. 12
- 7(b) Describe the composition and uses of the following non-ferrous alloys: 12
- (i) Muntz metal,
 - (ii) Nickel Silver and
 - (iii) Gun metal.
- 7(c) Draw a typical Bessemer converter and label its various components. 11
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- 8(a) What is powder metallurgy? Explain atomization process for producing metal powders. 13
- 8(b) What is thermal spraying? Explain metalizing process with neat a sketch. 15
- 8(c) Discuss the process of producing green compact with die compaction. 07

KHULNA UNIVERSITY OF ENGINEERING & TECHNOLOGY

Department of Mechanical Engineering

B. Sc. Engineering 4th Year Backlog Examination, 2021

ME 4113/ME4213(old)

(Fluid Machinery)

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) How air vessels minimize the fluctuations of flow in suction side of a reciprocating pump? 05
- 1(b) Show that the work saved against friction by fitting an air vessel in a single acting reciprocating pump is 84.8%. 15
- 1(c) A single acting reciprocating pump runs at 60 rpm. The diameter of the plunger is 0.15 m, crank radius is 0.20 m. the suction pipe is 0.125 m in diameter and 5.9 m long. Calculate the maximum permissible value of suction lift, if the separation takes place at 2.6 m of water absolute. 15
- 2(a) What is priming? Why priming is necessary in a centrifugal pump? 08
- 2(b) Deduce the expression for the limiting value of suction lift. 12
- 2(c) A centrifugal pump lifts water against a static head of 28 m, where suction lift is 48 m. The suction and delivery pipes are both 75 mm diameter. The head loss in suction and delivery pipe are 2.6 m and 7.2 m respectively. The impeller is 380 mm diameter and 20 mm wide at the mouth; it revolves at 1400 rpm and its effective vane angle at exit is 28° . Assume $\eta_{\text{mano}} = 0.80$ and $\eta_o = 0.74$. Determine– (i) the discharge of the pump; (ii) the power required to run the pump; (iii) the pressure at the outlet of the pump casing. 15
- 3(a) Distinguish between impulse and reaction turbine. Deduce the expression for work done and efficiency of a Francis turbine. 18
- 3(b) A Kaplan turbine produces 9×10^4 kW under a head of 30 m with an overall efficiency of 85%. The hub diameter is 4 times the outer diameter of the runner. Determine (i) diameters, (ii) the speed of the turbine assuming the speed ratio $K_u = 1.5$ and flow ratio = 0.65. 17
- 4(a) Show that in a Pelton wheel maximum efficiency is possible, if the jet velocity is twice the bucket velocity. 17
- 4(b) Design a Pelton wheel to produce 2023 kW power at a head of 300 m with speed of 550 rpm. Ratio of jet diameter to wheel diameter is 1/10. Overall efficiency is 80%. Calculate – (i) the number of jets, (ii) the diameter of the jet, (iii) the wheel diameter, (iv) the quantity of water required. 18

SECTION-B

5(a)	Show that for irrotational flow velocity is zero.	06
5(b)	What are vorticity and circulation? Show that circulation around a contour is equal to the product of the vorticities within the area of the contour.	12
5(c)	Deduce the Cauchy – Riemann relations in cylindrical polar co-ordinates.	10
5(d)	For a two-dimensional flow field, $\phi = 3xy$ and $\psi = y^2 - 2x^2$, show that the flow field is rotational and irrotational?	07

6(a)	What is Magnus effect? Write its importance.	08
6(b)	Deduce the expression of stream function and velocity potentials for a doublet.	12
6(c)	Consider the lifting flow over a circular cylinder with a diameter of 0.5 m. The freestream velocity is 25 m/s, and the maximum velocity on the surface of the cylinder is 75 m/s. Calculate the lift per unit span on the cylinder for freestream conditions are those for a standard 3 km altitude, assume $\rho = 0.901 \text{ kg/m}^3$.	15

7(a)	What is meant by best economic cross section of an open channel.	08
7(b)	Deduce the condition for the most economic section of a triangular channel.	12
7(c)	A trapezoidal channel having bottom width 7 m and side slopes 3 horizontal to 2 vertical is laid on a bottom slope of 1 in 2000. If it carries a uniform flow of water at the rate of $9.5 \text{ m}^3/\text{s}$, determine – (i) the normal depth, (ii) the mean velocity of flow. Take Manning's n as 0.03.	15

8(a)	Show from the specific energy diagram that the hydraulic jump is an irreversible process.	12
8(b)	What are the applications of hydraulic jump?	08
8(c)	A rectangular channel carries a discharge of $2.5 \text{ m}^3/\text{sec}$ for unit width. If the losses of energy in the hydraulic jump is found to be 3.0 m, determine the conjugate depths of flow before and after the jump.	15

KHULNA UNIVERSITY OF ENGINEERING & TECHNOLOGY

Department of Mechanical Engineering

B. Sc. Engineering 4th Year Special Backlog Examination, 2021

ME 4057

(Material Handling & Maintenance Engineering)

Time: 3 Hours.

Full Marks: 210

- N.B. i) Answer any THREE questions from each section in separate scripts.
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SECTION – A

- 1(a) Define material handling. Discuss the objectives of material handling. 08
- 1(b) Classify with examples conveying machines which are used in material handling. 09
- 1(c) Write a short note on static and dynamic angle of repose. Mention the characteristics of unit load and bulk load. 08
- 1(d) State the name of components of conveying machine. What factors are considered for selection of a conveying component? 10
- 2(a) How can sustainability and environmental considerations be integrated to material handling? 10
- 2(b) Why ply is used in rubberized belt of belt conveyor? How belt ends are fastened by vulcanization? Describe briefly. 10
- 2(c) A conveyor is designed to deliver hot casting from the shake out of a fitting shop. The casting has a diameter of 600 mm, height of 260 mm and a piece weight $G = 180$ kg. The conveyor capacity z is 300 pieces per hour. The factor allowing for irregular feed of the casting to the conveyor is $k' = 2$. Calculate the theoretical capacity, conveyor speed and running meter. 15
- 3(a) Differentiate between apron conveyor and flight conveyor. 08
- 3(b) What are the advantages and disadvantages of swing tray conveyor? 09
- 3(c) Draw different types of screw used in screw conveyor. 09
- 3(d) Describe the applications, advantages and disadvantages of flight conveyor. 09
- 4(a) What is hopper? Differentiate between hopper gates and feeders. Draw five types of hopper gates. 08
- 4(b) Describe the working principle of ladder chute with necessary sketches. 10
- 4(c) Draw a typical escalator step and label its important components. 10
- 4(d) Discuss the purpose of industrial trucks and tractors. 07

SECTION-B

- 5(a) What are meant by preventive maintenance and corrective maintenance? Discuss preventive maintenance for plain bearings. 14
- 5(b) What are the causes, corrections and prevention of belt wear and belt slipping? 13
- 5(c) Discuss the factors that are essential in developing a sound maintenance department of an organization. 08
- 6(a) What is meant by repair complexity? Why is the concept of repair complexity used in maintenance department? 10
- 6(b) Explain different types of lubrication for bearings. 15
- 6(c) How does friction modifier work? Explain. 10
- 7(a) Explain the key considerations while choosing different types of mechanical seals for pumps. 10
- 7(b) How can maintenance engineering contribute to improving equipment reliability and lifespan? 10
- 7(c) How is a hydraulic system monitored? Explain with necessary diagram. 15
- 8(a) Write down the differences between grease and oil. 10
- 8(b) What are the main challenges and risks associated with maintenance engineering and how can they be mitigated? 10
- 8(c) Describe the typical causes and remedies of the following faults. 15
- (i) Engine always overheats.
 - (ii) Excessive oil consumption in an engine.
 - (iii) Poor ignition.