KHULNA UNIVERSITY OF ENGINEERING & TECHNOLOGY
Department of Mechanical Engineering
B. Sc. Engineering 1st Year Backlog Examination, 2019
Math 1205
(Mathematics II)

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) Define order and degree of the differential equation with example. Find the differential equation of the curve $y^2 = 4a(x + a)$.   12

1(b) Solve the initial value problem: 12
$$\left(y + \sqrt{x^2 + y^2}\right) dx - x dy = 0, \qquad y(1) = 0.$$

1(c) Identify and solve   11
$$\frac{dy}{dx} + \left(\frac{2x + 1}{x}\right) y = e^{-2x}.$$

2(a) Solve any two of the following differential equations: 22
    (i) $(x^2 + y^2 + 1)dx - 2xy dy = 0$
    (ii) $(12y + 4y^2 + 6x^2)dx + 3(x + xy^2)dy = 0$
    (iii) $(1 + x^2)\frac{dy}{dx} + y = \tan^{-1} x.$

2(b) A metal bar at a temperature of $100°F$ is placed in a room at a constant temperature of $0°\,F$. If after 20 minutes the temperature of the bar is $50°\,F$, then find the time it will take the bar to reach a temperature of $25°\,F$ and the temperature of the bar after 10 minutes.   13

3(a) Solve any two of the following differential equations   24
    (i) $(D^2 - 3D + 4)y = \cos(4x + 5)$
    (ii) $(D^2 + 1)y = \sin 3x \cos x$
    (iii) $\frac{d^2y}{dx^2} - 4\frac{dy}{dx} + 4y = x^2 e^{2x}.$

3(b) Find the particular solution of the differential equation   11
$$\frac{d^2y}{dx^2} - y = 2; \qquad \text{when } x = 2 \text{ then } y = -1, \ \frac{dy}{dx} = 3.$$

4(a) Determine the general solution of the following equation by the method of undetermined coefficients.   17
$$\frac{d^2y}{dx^2} - 2\frac{dy}{dx} - 3y = 2e^x - 10 \sin x$$

4(b) Find the general solution of the following equation by the method of variation of parameters.   18
$$\frac{d^2y}{dx^2} + y = \tan^2 x.$$

SECTION-B

5(a) Determine the polar coordinates of the point $(3, 4, 5)$ so that r may be positive. 10

5(b) What is meant by the direction cosines of a line? Find the distance of $(-1, 2, 5)$ from the line through $(3, 4, 5)$ whose direction cosines are proportional to 2, -3, 6. 13

5(c) A variable plane is at constant distance p from the origin and meets the axes in A, B, C. Show that the locus at the centroid of the tetrahedron $OABC$ is $x^{-2} + y^{-2} + z^{-2} = 16p^{-2}$. 12

6(a) Find the equation of the plane through $(-1, 3, 2)$ and perpendicular to each of the planes $x + 2y + 3z = 5$ and $3x + 3y + z = 9$. 11

6(b) Reduce the line $x + y + z + 1 = 0, 4x + y - 2z + 2 = 0$ in symmetrical form and hence find its direction cosines. 12

6(c) A line makes angle $\alpha, \beta, \gamma, \delta$ with four diagonal of a cube. Prove that , 12
$$\cos^2\alpha + \cos^2\beta + \cos^2\gamma + \cos^2\delta = \frac{4}{3}.$$

7(a) Find the equation of the right circular cone whose vertex is the point $(2, 1, -3)$ whose axis is parallel to oy i.e. y axis, and whose semi-vertical angle is $45°$. 11

7(b) Prove that the lines 12
$$\frac{x-5}{4} = \frac{y-7}{4} = \frac{z+3}{-5} \text{ and } \frac{x-8}{7} = \frac{y-4}{1} = \frac{z-5}{3} \text{ are coplanar.}$$
Also find the equation of the plane in which they lie.

7(c) Find the equation of a sphere for which the circle 12
$$x^2 + y^2 + z^2 + 7y - 2z + 2 = 0, 2x + 3y + 4z = 8 \text{ is a great circle.}$$

8(a) Find the length of the shortest distance between the lines 13
$$\frac{x-1}{2} = \frac{y-2}{3} = \frac{z-3}{4} ; \frac{x-2}{3} = \frac{y-4}{4} = \frac{z-5}{5}.$$

8(b) Prove that the equation $2x^2 - 6y^2 - 12z^2 + 18yz + 2zx + xy = 0$ represents a pair of planes. 12

8(c) Find the equation to the sphere which touches the sphere 10
$x^2 + y^2 + z^2 + 2x - 6y + 1 = 0$ at $(1, 2, -2)$ and passes through the origin.

KHULNA UNIVERSITY OF ENGINEERING & TECHNOLOGY
Department of Mechanical Engineering
B. Sc. Engineering 1st Year Backlog Examination, 2019
ME 1107
(Manufacturing Process)

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) What is meant by production process? What are the importance's of production process? **08**

1(b) Define permeability. Write down the characteristics of a good mould. **10**

1(c) What is casting? Explain sand casting technique with neat sketches. **12**

1(d) What are the significance of moisture in sand mould? **05**

2(a) Which casting method would be appropriate for manufacturing a propeller of a pump? Why? **05**

2(b) What is casting defect? Explain three factors responsible for sand casting defects. **07**

2(c) Distinguish among the three types of centrifugal casting method with examples. **12**

2(d) Define weldability. What are the various zones in a weld joint? Explain weld zone metallurgy. **11**

3(a) Distinguish between soldering, brazing and braze welding. Explain lost wax casting method with the help of necessary sketches. **15**

3(b) Compare TIG and MIG welding processes. **10**

3(c) Describe the properties of neutral, reducing and oxidizing flame used in oxyacetylene gas welding. **10**

4(a) Explain the following processes with figure:
   (i) Piercing (ii) Hot drawing (iii) Swaging. **12**

4(b) Distinguish between Hot and Cold working processes. **10**

4(c) What is bend allowance? Describe three types of bending process with figures. **08**

4(d) What are the metal forming processes involved to manufacture a steel dinner plate from a thick metal sheet? (Sheet thickness 10 mm and plate thickness is 3 mm) **05**

SECTION-B

5(a) What is tool signature? Show the geometry of a single point cutting tool. **10**

5(b) Distinguish between orthogonal cutting and oblique cutting of metal. **08**

5(c) What is chip? Explain different types of chip with necessary sketches. **12**

5(d) Write short note on chip breaker. **05**

6(a) Explain the basic principle of a lathe machine and list five operations that can be performed with a lathe machine.   13

6(b) Differentiate between Turret lathe and Capston lathe. How lathe size is specified?   12

6(c) What is indexing? Describe compound indexing method with necessary figures.   10

7(a) Make a table with the machining operations and machines required to manufacture a Nut and Bolt arrangement.   15

7(b) Describe the working principle of a shaper machine for shaping horizontal and vertical direction.   12

7(c) Write short notes on: 08
    (i) Counter boring   (ii) Tapping   (iii) Up milling and (iv) Knurling

8(a) Describe the centerless grinding method with its advantages and disadvantages.   10

8(b) Explain the following terms: 09
  i) Honing ii) Lapping and iii) Super finishing

8(c) Explain why modern machining process is needed over conventional machining process.   06

8(d) Describe the working principle of Ultrasonic Machining (USM).   10