KHULNA UNIVERSITY OF ENGINEERING & TECHNOLOGY
Department of Mechanical Engineering
B. Sc. Engineering 4th Year Backlog Examination, 2020

ME 4207
(Tool Engineering & Machine Tools)

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.

SECTION-A

1(a)	What is a work holder? What are the selection guidelines of a work holder?	10
1(b)	Clearly explain the following terms: (i) Locating, (ii) Clamping. Also write down the principles of clamping.	12
1(c)	State and explain the 3–2–1 principle of work piece location.	13
2(a)	Differentiate Jigs and Fixtures. Describe leaf jig and indexing jig with neat sketches.	15
2(b)	State the essential features of milling fixture.	08
2(c)	Describe various types of drill bushing.	12
3(a)	Sketch a compound die and label it completely.	10
3(b)	What is die clearance? Explain the effect of excessive and insufficient die clearance.	10
3(c)	Write short note on: (i) Piercing; (ii) Lancing.	10
3(d)	What is reducing cutting force in die cutting operation?	05
4(a)	Describe the mathematical procedure to determine the center of pressure for blanking	10
4(b)	What is spring back? How can it be prevented? Explain.	10
4(c)	How can the blank size for cylindrical shells be determined for relatively thin metal?	15

SECTION-B

5(a)	How can you classify machine tools? Explain the essential requirements of machine tool.	11
5(b)	What is a PIV drive? Differentiate stepped drive from stepless drive with examples.	12
5(c)	Enumerate the advantages and disadvantages of hydraulic drive system. Also write down the kinematics of a machine tool.	12

6(a)	Write short note on: (i) Ray diagram, (ii) Saw diagram, and (iii) Speed structure diagram	12
6(b)	Explain with necessary sketches the working principle of a Meander gearbox.	13
6(c)	What is meant by the term 'Numerical control of machine tools'? Mention it's advantages and disadvantages.	10
7(a)	Describe the working principle of NC machines with the help of appropriate diagram.	10
7(b)	Compare and contrast CNC and DNC.	09
7(c)	What is a transfer machine? Mention it's advantages and disadvantages.	10
7(d)	Write short note on: (i) CAM, and (ii) Robot.	06
8(a)	What is meant by maintenance of machine tools? Briefly describe the different types of machine tool maintenance.	10
8(b)	Why cast iron is generally used in Machine tool structure?	07
8(c)	Discuss the essential requirement for designing slide ways.	08
8(d)	What is chatter in machine tools? What are the causes of vibration in machine tools and how does it affect the performance?	10

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KHULNA UNIVERSITY OF ENGINEERING & TECHNOLOGY

Department of Mechanical Engineering

B. Sc. Engineering 4th Year Backlog Examination, 2020

ME 4019

(Aerodynamics)

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) Explain the NACA 0012 airfoil nomenclature with a neat sketch. 08

1(b) Derive an expression of the lift per unit span for a circular cylinder with circulation. 12

1(c) A pitot tube on a Pilatus Aircraft flying at standard sea level reads 1.05×10^5 N/m^2. At a given point on the surface of the wing of the aircraft, the flow velocity is 140 m/sec. Calculate the pressure coefficient at this point. 15

2(a) Define the following terms with sketch: 11
(i) Vortex filament, (ii) Line filament, and (iii) Horseshoe vortex.

2(b) Show that the local jump in tangential velocity across the vortex sheet is equal to the local sheet strength. 12

2(c) What is starting vortex? Show that circulation around the airfoil is equal and opposite to the circulation around the starting vortex. 12

3(a) Define and describe the Kelvin's circulation theorem. 15

3(b) Derive Kutta–Joukowski theorem. 20

4(a) Show that the fundamental equation of the thin airfoil can be expressed by 20

$$\frac{1}{2\pi}\int_0^c \frac{\gamma(\xi)d\xi}{x-\xi} = V_\infty\left(\alpha - \frac{dz}{dx}\right).$$

4(b) Show that the lift co-efficient is linearly proportional to angle of attack. 15

SECTION-B

5(a) Prove that induced drag angle of attack is constant along the span for an elliptic lift distribution. 10

5(b) Show that $V = \frac{\Gamma}{2\pi h}$, for infinite vortex filament and $V = \frac{\Gamma}{4\pi h}$, for semi-infinite vortex filament. Where symbols have their usual meaning. 11

5(c) Estimate the total circulation of symmetric airfoil if the local circulation is $r(\theta) = 2\alpha V_\alpha \frac{(1+cos\theta)}{sin\theta}$, where the symbols have their usual meaning. 14

6(a)	Derive expression of pressure coefficient $C_P = -\frac{2\hat{u}}{v_\infty}$, consistent with linearized perturbation velocity potential equation.	17
6(b)	Derive the velocity potential equation for an inviscid, compressible and subsonic flow over an airfoil.	18
7(a)	What is meant by sound barrier? Explain the methods that are used to break the sound barrier.	15
7(b)	Explain, why and how shock waves and expansion waves are generated in supersonic flow over a body with help of appropriate diagram.	10
7(c)	A given point on the surface of an airfoil, the pressure co-efficient is –0.45 at very low speed. If the free stream Mach number is 0.70, calculate C_P at this point.	10
8(a)	Derive the modified Newtonian law for hypersonic flow. How it is differ from Newtonian Semi-squared law?	20
8(b)	Describe various characteristics and aspect of hypersonic aerodynamics.	15

KHULNA UNIVERSITY OF ENGINEERING & TECHNOLOGY

Department of Mechanical Engineering

B. Sc. Engineering 4th Year Backlog Examination, 2020

ME 4015

(Automobile Engineering)

Time: 3 Hours | Total Marks: 210

N.B.: i) Answer any THREE questions from each section in separate scripts.
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iii) Assume reasonable data if any missing.

SECTION-A

1(a)	Outline the major components of an automobile and explain the functions of each of them.	12
1(b)	What are the importance of engine in an automobile? Classify IC engine.	10
1(c)	Draw and label a piston and piston rings of an automobile engine and describe the functions of piston rings.	08
1(d)	Why timing belt is used in an automobile engine?	05
2(a)	What are the basic engine systems of an automobile? Briefly describe the fuel system with neat sketch.	10
2(b)	Describe stoichiometric air-fuel ratio. Why rich mixture is necessary during starting period of an engine?	08
2(c)	What are the different circuits of a carburetor? Describe how accelerating circuit work with necessary diagram.	12
2(d)	Explain the differences between detonation and pre-ignition.	05
3(a)	What is sludge? How and why does it form? How it be prevented?	10
3(b)	What are the purposes of cooling system? Describe and draw the water cooling system mentioning all components with neat sketch.	12
3(c)	What are the functions of lubricating oil? Explain the working procedure of a forced lubrication system in an IC engine with neat sketch.	13
4(a)	Write short notes on: (i) Ampere-hour rating (ii) ECU, (iii) EFI system.	09
4(b)	What are the purposes of battery in an automobile? With a neat sketch describe the process of construction of a lead acid battery.	12
4(c)	What are the functions of ignition system? Briefly explain the working procedure of contact point ignition system with necessary diagram.	14

SECTION-B

5(a)	Describe the necessity of using gear box in a vehicle.	05
5(b)	Why synchronizing is necessary and how does it works in a gear box?	10
5(c)	Draw and label important components in a clutch and write down the functions of the followings? (i) Clutch facing (ii) Torsion spring (iii) Cushion spring (iv) Clutch release bearing.	12
5(d)	What does mean by four wheel drive and what are merits and demerits of using four wheel drive?	08
6(a)	What is planetary gear and how does it works?	09
6(b)	With a neat sketch show the power flow in reverse gear.	06
6(c)	What is master cylinder? Describe the operating principle of a power brake of an automobile.	10
6(d)	What is meant by front-wheel geometry of a car? Explain the different front wheel geometries of a car.	10
7(a)	Why springs are used in the suspension system? Describe the operation principle of a telescope type shock absorber.	10
7(b)	Mention the causes and remedies of a car pulling to one side during normal driving.	07
7(c)	How the tyres of an automobile are designated? Differentiate between bias and radial plies tyre.	10
7(d)	What is catalytic converter? How does it work in the car exhaust system?	08
8(a)	What is meant by pollution control system of an automobile? Describe the pollution control system by catalytic converter and positive crank case ventilation.	12
8(b)	What ideas could be obtained from the conditions of two engines, one giving black exhaust and other white exhaust? Give suggestions for their remedies.	08
8(c)	What is meant by car air conditioning? Describe the operating principle of magnetic clutch used in car air conditioning.	08
8(d)	What is meant by Hybrid car? How does it works?	07

KHULNA UNIVERSITY OF ENGINEERING & TECHNOLOGY
Department of Mechanical Engineering
B. Sc. Engineering 4th Year Backlog Examination, 2019

ME 4229
(Industrial Management)

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 Management. Describe the four basic functions of Management expressed by Henri Fayol. 15

1(b) Write short note on Contingency theory. 06

1(c) Briefly explain the Taylor's principle of scientific management theory with its problems and modifications. 14

2(a) Write short note on Span of control with it's selecting parameters. 10

2(b) Briefly explain the Divisional structure of an Organization with it's positive and negative sides in comparison with the Functional Structure. 15

2(c) Define communication. What are the different types of communication? Describe in brief. 10

3(a) Briefly explain the steps of basic recruitment process of an Organization. 15

3(b) Write short notes on Internal recruitment and External recruitment with the benefits and drawbacks. 12

3(c) What is morale? Briefly explain the impact of high morale of employees in an organization. 08

4(a) What is motivation? Describe the Maslow's Hierarchy of needs theory in short. 10

4(b) Discuss the following wage incentive plan – 10
(i) Helsey 50–50 premium plan and
(ii) Taylor's differential piece rate plan.

4(c) Define and classify job evaluation methods. Briefly describe point rating method of job evaluation. 15

SECTION-B

5(a) Define budget. Describe different types of budget in brief. 12

5(b) Explain the purpose of budgetary control. How budget and budgetary control help in achieving efficiency in management? 15

5(c) Write down the advantages and disadvantages of flexible budget. 08

6(a)	What is meant by ethics? Discuss in brief the social and ethical responsibility of a manager.	12
6(b)	What is product life cycle? Describe its different stages in details.	13
6(c)	Describe and differentiate job enlargement and job enrichment.	10
7(a)	Define marketing. Explain the major concepts of marketing.	12
7(b)	Briefly describe the purchasing methods.	11
7(c)	Write short note on sales promotion techniques	12
8(a)	Compare DSS and MIS. Explain how can design a DSS.	13
8(b)	What is industrial espionage? Write down the characteristics of good management information system (MIS).	12
8(c)	What is strategic planning process? Distinguish between patent and royalty.	10

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KHULNA UNIVERSITY OF ENGINEERING & TECHNOLOGY

Department of Mechanical Engineering

B. Sc. Engineering 4th Year Backlog Examination, 2020

ME 4051

(Operations Research)

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 company produces two product A and B. The sales volume for product A is at least 60% of the total sales of the two products. Both products use the same raw materials, of which the daily availability is limited to 100 kg. Products A and B use this raw material at the rates of 2 kg/unit and 4 kg/unit respectively. The sales price for the two products are \$20 and \$40 per unit. Formulate this problem as linear programming problem and solve it graphically. 35

2(a) While solving a LPP by simplex method, what indicates by each of the following situation? 15
Explain with example:
(i) Unbounded solution,
(ii) Degenerate solution,
(iii) Alternate solution, and
(iv) Infeasible solution.

2(b) Solve the following problem by simplex method: 20

Minimize, $z = x_1 - 3x_2 - 2x_3$

Subject to, $3x_1 - x_2 + 2x_3 \leq 7$

$-2x_1 + 4x_2 \leq 12$

$-4x_1 + 3x_2 + 8x_3 \leq 10$

$x_1,\ x_2,\ x_3 \geq 0.$

3(a) Write down the dual of the problem: 15

Maximize, $z = 5x_1 + 6x_2$

Subject to $x_1 + 2x_2 = 5$

$-x_1 + 5x_2 \geq 3$

x_1 is unrestricted ; $x_2 \geq 0$.

3(b) Solve the following problem by Dual simplex method (show only one iteration). 20

Maximize, $z = 2x_2 - 5x_3$

Subject to $x_1 + x_3 \geq 2$

$2x_1 + x_2 + 6x_3 \leq 6$

$x_1 - x_2 + 3x_3 = 0$

$x_1,\ x_2,\ x_3 \geq 0$.

4(a) Prove that transportation problem is a linear program and assignment problem is a special case of transportation problem. 10

4(b) Solve the following transportation problem 25

Source	Destination				Supply
	Sylhet	Barishal	Dinajpur	Rajshahi	
Gazipur	40	50	60	70	50
Cumilla	30	40	30	40	70
Khulna	60	70	10	30	40
Dhaka	20	55	50	90	90
Demand	100	50	30	70	

SECTION-B

5(a) Define dynamic programming. Write down the name of the basic elements of dynamic programming. Also mention the characteristics of dynamic programming. 10

5b) Three research teams are independently working on the same project. The project is successful if any team does so. Find the distribution of 2 scientists to maximize the probability of success of the project using dynamic programing. 25

New Scientists	Probability of failure		
	Team 1	Team 2	Team 3
0	0.4	0.6	0.8
1	0.2	0.4	0.5
2	0.11	0.2	0.3

6(a) What is meant by game? Discuss it's characteristics. 10

6(b) Solve the following game graphically 25

		Player B			
		1	2	3	4
Player A	1	2	2	3	−1
	2	4	3	2	6

7(a) In each of the following situations, identify the basic elements of the queuing model (i.e. customers, server, design of the facility, service discipline and limits on the calling source and queue): 20

(i) Cars waiting at a stop light
(ii) An outpatient clinic
(iii) Toll gates on a superhighway
(iv) ATM booth.

7(b) The customers arrive at a restaurant according to Poisson distribution at the rate of 20 per hour. The restaurant opens for business at 11:00 AM. Find the following: 15

(i) The probability of having 20 customers in the restaurant at 11:12 AM given that these were 18 at 11:07 AM.
(ii) The probability a new customer will arrive between 11:28 AM and 11:30 AM given that the last customer arrived at 11:25 AM.

8(a) Differentiate between decision under uncertainty and decision under risk. 05

8(b) A person has two independent investments A and B available to him, but he can undertake only one at a time due to certain constraints. He can choose "A" first and then stop or if "A" is successful then take "B" or vice versa. The probability of success of "A" is 0.6, while for "B" it is 0.4. Both investments require an initial capital only TK 10,000 and both return nothing if the venture is unsuccessful. Successful completion of "A" will return TK 20,000 (over cost) and successful completion of "B" will return Tk 24,000 (over cost). 30

(i) Draw and properly label the decision tree,
(ii) Evaluate the decision tree and
(iii) Determine the optimal policy.

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