

2501/305

**PRODUCTION LINE PROCESSES AND  
FOUNDRY TECHNOLOGY**

Oct./Nov. 2022

**Time: 3 hours**



**THE KENYA NATIONAL EXAMINATIONS COUNCIL**

**DIPLOMA IN MECHANICAL ENGINEERING  
(PRODUCTION OPTION)  
MODULE III**

**PRODUCTION LINE PROCESSES AND FOUNDRY  
TECHNOLOGY**

**3 hours**

**INSTRUCTIONS TO CANDIDATES**

*You should have the following for this examination*

*Answer booklet;*

*Drawing instruments;*

*Scientific calculator.*

*This paper consists of **EIGHT** questions in **TWO** Sections; **A** and **B**.*

*Answer **FIVE** questions taking at least **TWO** questions from each section in the answer booklet provided.*

*All questions carry equal marks.*

*Maximum marks for each part of a question are indicated.*

*Candidates should answer the questions in English.*

**This paper consists of 7 printed pages.**

**Candidates should check the question paper to ascertain that  
all the pages are printed as indicated and that no questions are missing.**

## SECTION A: PRODUCTION LINE PROCESSES

*Answer at least TWO questions from this section.*

1. (a) State **two** functions of each of the following as applied to computer programming:
  - (i) simulator;
  - (ii) emulator. (4 marks)
- (b) Explain **three** advantages of computer aided design (CAD). (6 marks)
- (c) Explain **two** methods of specifying the zero point in computer numerically controlled (CNC) machining. (4 marks)
- (d) Explain **three** advantages of computer aided part programming over manual programming. (6 marks)
2. (a) With the aid of a sketch, describe the cylindrical coordinate robot configuration. (5 marks)
- (b) Explain **three** artificial instructions that should be programmed into a robot that is to be used for inspecting quality of manufactured products. (6 marks)
- (c) (i) Differentiate between a gripper and a tool with regard to end effectors of robots.
- (ii) Explain the use of vacuum cup grippers in robotics. (6 marks)
- (d) State **three** factors that should be considered during presentation of work to robots in a production operation. (3 marks)
3. (a) Explain **three** factors that should be considered before adopting CNC technology in manufacturing processes of an organisation. (6 marks)



(c) Explain each of the following stages of product design and development:

- (i) concept generation;
- (ii) concept selection;
- (iii) concept testing.

(6 marks)

### SECTION B: FOUNDRY TECHNOLOGY

*Answer at least TWO questions from this section.*

5. (a) State **four** safety precautions to be observed in a foundry shop. (4 marks)

(b) With the aid of sketches, explain each of the following casting defects:

- (i) swells;
- (ii) warpage;
- (iii) hard spots.

(6 marks)

(c) Explain each of the following cupola activities in a foundry:

- (i) firing;
- (ii) charging.

(4 marks)

(d) Explain each of the following properties of moulding sand:

- (i) flowability;
- (ii) refractiveness;
- (iii) adhesiveness.

(6 marks)

6. (a) State **four** functions of raisers in a gating system. (4 marks)

(b) Describe the procedure for making a core in sand casting. (10 marks)

(c) Explain each of the following types of moulding processes:

- (i) two box moulding;
- (ii) floor box moulding;
- (iii) machine moulding.

(6 marks)

7. (a) Outline **four** steps in the die casting process. (4 marks)

- (b) With the aid of sketches, explain the operation of cold chamber die casting machine. (8 marks)
- (c) With the aid of a diagram, describe the semi-centrifugal casting process. (8 marks)
8. (a) State **four** advantages of investment casting. (4 marks)
- (b) With the aid of a diagram, describe the extrusion moulding process for a plastic component. (9 marks)
- (c) With the aid of a sketch, describe the calendaring procedure for fabricating plastics. (7 marks)

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## ISO- 646 EXTRACT

### APPENDIX 1 G - CODES

G42	Tool radius compensation right. (Modal)
G43	Tool length compensation. (Modal)
G44	Tool length compensation cancellation (Modal)
G50	Loading of values in tool offset table
G51	Scaling on.
G52	local co-ordinate preset
G53	Machine co-ordinate selection.
G54-G59	Machine co-ordinate setting (zero offsets) (Modal)
G70	Programming in inches ( on some machines) Finishing cycle ( on some machines)
G71	Programming in mm ( on some machines)
G72	Scaling factor
G73	Pattern rotation (machining centre)
G74	Peck Face grooving cycle on Z axis
G75	Peck Diameter grooving cycle on X-axis
G76	Single pass threading cycle (lathe)
G80	Canned cycle cancel.
G81	Drilling cycle.
G82	Counter boring cycle.
G83	Peck drilling cycle.
G84	Tapping cycle.
G85	Boring cycle (feed return to reference level).
G86	Boring cycle (rapid return to reference level).
G87	Alternate boring cycle (machining centre).
G88	Boring cycle (manual return).
G89	Boring cycle (dwell before feed return).
G90	Specifies absolute positioning. (Modal)
G91	Specifies incremental positioning. (Modal)
G92	Co-ordinate system preset (machining centre)
G92	Threading cycle. (lathe)
G94	Face cutting cycle on some lathes. Feed rate in mm / min.
G95	Feed rate in mm / min.
G96	Constant surface speed. (Modal)
G97	Constant revolution per minute. (Modal)
G98	Return to initial point level (machining center) (Modal)
G98	Feed rate inch per min. (lathe) (Modal)
G99	Return to reference(R) level, (machining center); (Modal)
G99	Feed rate (inch) per revolution (lathe) (Modal)

## ISO - 646 EXTRACT

### APPENDIX 2 M - CODES

M00	Program stop (temporary).
M01	Optional stop.
M02	End of program
M03	Spindle start clockwise.
M04	Spindle start counter clockwise.
M05	Spindle stop.
M06	Tool change. (machining center)
M07	Mist coolant on (machining center)
M08	Flood coolant on.
M09	Coolant off.
M10	Chuck clamp (lathe).
	Fourth axis clamp (machining center)
M11	Chuck unclamp (lathe)
	Fourth axis unclamp (machining center)
M12	Tail stock spindle out (lathe)
M13	Tail stock spindle in ( on some lathes)
	Spindle on clockwise, coolant on (on some systems)
M14	Spindle on counterclockwise, coolant on.
M17	Tool turret rotation forward
M18	Turret rotation reverse
	Spindle and coolant off
M19	Spindle orientation
M21	Mirror image X axis
	Tail stock forward (lathe)
M22	Mirror image Y- axis
	Tailstock backward (lathe)
M23	Chamfering on (lathe)
M24	Chamfering off (lathe)
M25	Tailstock spindle out (on some lathes)
M26	Tailstock spindle in
M30	Program end (reset)
M38	Door open
M39	Door close
M41	Spindle speed-low range
M42	Spindle speed ( high range)
M48	Feed rate override cancel function off
M49	Feed rate override cancel function on.
M73	Parts catcher out (lathe)
M74	Parts catcher in (lathe)
M78	B axis clamp
M79	B axis unclamp
M85	Automatic door open, (lathe)
M86	Automatic door close, (lathe)
M98	Call subprogram
M99	End subprogram

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