SSC-JE

Staff Selection Commission

Junior Engineer

Mechanical Engineering

Topicwise Objective Solved Questions

Volume-II

Previous Years Solved Papers : 2007-2024

*Also useful for **RRB-JE Mains** as well as various* **public sector examinations** and other competitive examinations

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Preface

B. Singh (Ex. IES)

Staff Selection Commission-Junior Engineer has always been preferred by Engineers due to job stability. SSC-Junior Engineer examination is conducted every year. MADE EASY team has deeply analyzed the previous exam papers and observed that a good percentage of questions are repetitive in nature, therefore it is advisable to solve previous years papers before a candidate takes the exam.

The SSC JE exam is conducted in two stages as shown in table given below.

Papers	Subject	Maximum Marks	Duration
Stage 1: Paper-I : Objective type	(i) General Intelligence & Reasoning (ii) General Awareness (iii) General Engineering : Mechanical	50 Marks 50 Marks 100 Marks	2 hours
Stage 2: Paper-II : Objective Type	General Engineering : Mechanical	300 Marks	2 hours
Note: In Paper-I, every question carry one mark and there is negative marking of ¼ marks for every wrong answer. Candidates shortlisted in Stage 1 are called for Stage 2. On the basis of combined score in Stage 1 and Stage 2, final merit list gets prepared.			

MADE EASY has taken due care to provide complete solution with accuracy. Apart from Staff Selection Commission-Junior Engineer, this book is also useful for Public Sector Examinations and other competitive examinations for engineering graduates.

I have true desire to serve student community by providing good source of study and quality guidance. Any suggestion from the readers for improvement of this book is most welcome.

B. Singh (Ex. IES)
Chairman and Managing Director
MADE EASY Group

Syllabus of Engineering Subjects

(For both Objective and Conventional Type Papers)

Mechanical Engineering

Theory of Machines and Machine Design: Concept of simple machine, Four bar linkage and link motion, Flywheels and fluctuation of energy, Power transmission by belts – V-belts and Flat belts, Clutches – Plate and Conical clutch, Gears – Type of gears, gear profile and gear ratio calculation, Governors – Principles and classification, Riveted joint, Cams, Bearings, Friction in collars and pivots.

Engineering Mechanics and Strength of Materials: Equilibrium of Forces, Law of motion, Friction, Concepts of stress and strain, Elastic limit and elastic constants, Bending moments and shear force diagram, Stress in composite bars, Torsion of circular shafts, Buckling of columns – Euler's and Rankin's theories, Thin walled pressure vessels

Thermal Engineering: Properties of Pure Substances : p-v & P-T diagrams of pure substance like H2O, Introduction of steam table with respect to steam generation process; definition of saturation, wet & superheated status. Definition of dryness fraction of steam, degree of superheat of steam. h-s chart of steam (Mollier's Chart). 1st Law of Thermodynamics : Definition of stored energy & internal energy, 1st Law of Thermodynamics for cyclic process, Non Flow Energy Equation, Flow Energy & Definition of Enthalpy, Conditions for Steady State Steady Flow; Steady State Steady Flow Energy Equation.
2nd Law of Thermodynamics : Definition of Sink, Source Reservoir of Heat, Heat Engine, Heat Pump & Refrigerator; Thermal Efficiency of Heat Engines & co-efficient of performance of Refrigerators, Kelvin – Planck & Clausius Statements of 2nd Law of Thermodynamics, Absolute or Thermodynamic Scale of temperature, Clausius Integral, Entropy, Entropy change calculation for ideal gas processes. Carnot Cycle & Carnot Efficiency, PMM-2; definition & its impossibility.

Air standard Cycles for IC engines : Otto cycle; plot on P-V, T-S Planes; Thermal Efficiency, Diesel Cycle; Plot on P-V, T-S planes; Thermal efficiency. IC Engine Performance, IC Engine Combustion, IC Engine Cooling & Lubrication.

Rankine cycle of steam : Simple Rankine cycle plot on P-V, T-S, h-s planes, Rankine cycle efficiency with & without pump work. Boilers; Classification; Specification; Fittings & Accessories : Fire Tube & Water Tube Boilers. Air Compressors & their cycles; Refrigeration cycles; Principle of a Refrigeration Plant; Nozzles & Steam Turbines

Fluid Mechanics & Machinery: Properties & Classification of Fluids : ideal & real fluids, Newton's law of viscosity, Newtonian and Non-Newtonian fluids, compressible and incompressible fluids. Fluid Statics : Pressure at a point. Measurement of Fluid Pressure : Manometers, U-tube, Inclined tube. Fluid Kinematics : Stream line, laminar & turbulent flow, external & internal flow, continuity equation. Dynamics of ideal fluids : Bernoulli's equation, Total head; Velocity head; Pressure head; Application of Bernoulli's equitation. Measurement of Flow rate Basic Principles : Venturimeter, Pilot tube, Orifice meter. Hydraulic Turbines: Classifications, Principles. Centrifugal Pumps : Classifications, Principles, Performance.

Production Engineering: Classification of Steels : mild steal & alloy steel, Heat treatment of steel, Welding – Arc Welding, Gas Welding, Resistance Welding, Special Welding Techniques i.e. TIG, MIG, etc. (Brazing & Soldering), Welding Defects & Testing; NDT, Foundry & Casting – methods, defects, different casting processes, Forging, Extrusion, etc, Metal cutting principles, cutting tools, Basic Principles of machining with (i) Lathe (ii) Milling (iii) Drilling (iv) Shaping (v) Grinding, Machines, tools & manufacturing processes.

■■■■

SSC-JE : Paper-I

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Mechanical Engineering : Volume-II
Previous Years Objective Solved Papers

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CHAPTER 1 Production Engineering

1. Metal Casting

1.1 The purpose of chaplets is
(a) just like chills to ensure directional solidification
(b) to provide efficient venting
(c) to support the cores
(d) to join lower and upper parts of the moulding box **[SSC-JE : 2007]**

1.2 The chief advantage of die casting is
(a) possibility of incorporating thick sections in small castings
(b) casting of inserts is possible
(c) wide tolerances are possible
(d) high production rates are possible **[SSC-JE : 2007]**

1.3 Uniform sand hardness is obtained throughout the mould by which of the following moulding machines?
(a) Diaphragm moulding
(b) Stripper plate
(c) Sand slinger
(d) Squeezing **[SSC-JE : 2008]**

1.4 The main advantage of shell moulding is that:
(a) a metallic pattern is used
(b) the moulds are stronger
(c) thin sections can be easily obtained
(d) high production rate is possible **[SSC-JE : 2008]**

1.5 In sand moulding, the bottommost part of the flask is called:
(a) cope (b) cheek
(c) drag (d) flask bottom **[SSC-JE : 2008]**

1.6 In order to ram the sand softer on the pattern face and harder at the back of the mould, which of the following types of moulding machines is used?
(a) Jolt (b) Sand slinger
(c) Squeezing (d) Stripper plate **[SSC-JE : 2008]**

1.7 The taper provided on pattern for its easy and clean withdrawal from the mould is called :
(a) taper allowance
(b) draft allowance
(c) distortion allowance
(d) pattern allowance **[SSC-JE : 2009]**

1.8 Which of the following is not a casting process?
(a) Carthias process
(b) Extrusion
(c) Semi-centrifuge method
(d) Slush process **[SSC-JE : 2009]**

1.9 Surfaces to be machined are marked on the pattern by the following colour:
(a) Black (b) Yellow
(c) Red (d) Blue **[SSC-JE : 2010]**

1.10 In order to facilitate the withdrawal of pattern:
(a) Pattern is made smooth
(b) Water is applied on pattern surface
(c) Allowances are made on pattern
(d) Draft is provided on pattern **[SSC-JE : 2010]**

1.11 Which of the following is not a casting defect?
(a) Hot tear (b) Blow hole
(c) Scab (d) Decarburisation **[SSC-JE : 2010]**

1.12 Cope in foundry practice refers to:
(a) Bottom half of moulding box
(b) Top half of moulding box
(c) Middle portion of the moulding box
(d) Coating on the mould face **[SSC-JE : 2010]**

1.13 Shrinkage allowance is made by:
(a) Adding to external and internal dimensions
(b) Subtracting from external and internal dimensions
(c) Subtracting from external dimensions and adding to internal dimensions
(d) Adding to external dimensions and subtracting from internal dimensions
[SSC-JE : 2010]

1.14 Hot tears are the result of which of the following?
(a) Lower permeability
(b) Lower green strength
(c) More fins
(d) Restraint of contraction **[SSC-JE : 2011]**

1.15 Which of the following is not a foundry tool?
(a) Riddle (b) Arbor
(c) Slick (d) Trowel
[SSC-JE : 2012]

1.16 The vertical passage for bringing molten metal to mould cavity is called:
(a) Riser (b) Sprue
(c) Runner (d) Gate
[SSC-JE : 2012]

1.17 The process of pouring molten metal in the cavity of a metallic mould by gravity is known as :
(a) Permanent mould casting
(b) Pressed casting
(c) Shell moulding
(d) Die casting **[SSC-JE : 2012]**

1.18 Cupola is best suited for melting
(a) Non-ferrous metals
(b) Aluminium alloys
(c) Alloys of Copper
(d) Ferrous metals **[SSC-JE : 2012]**

1.19 Permeability of a foundry sand is :
(a) Porosity to permit the escape of gases/air
(b) Fineness of sand
(c) Distribution of binder in sand
(d) Capacity to hold moisture **[SSC-JE : 2012]**

1.20 Permeability is poor for-
(a) Fine grains (b) Medium grains
(c) Coarse grains (d) Rounded grains
[SSC-JE : 2013]

1.21 Metal patterns are used for-
(a) small castings
(b) large castings
(c) precise and intricate castings
(d) large scale production of castings
[SSC-JE : 2013]

1.22 The binder in case of synthetic sand used for moulding is-
(a) Clay (b) Molasses
(c) Water (d) Bentonite and water
[SSC-JE : 2013]

1.23 The shape and size of sand grains affects the following property :
(a) Adhesiveness (b) Porosity
(c) Refractoriness (d) Strength
[SSC-JE : 2014 (E)]

1.24 Cereals are added to the moulding sand to improve the following :
(a) Porosity (b) Green strength
(c) Hot strength (d) Edge hardness
[SSC-JE : 2014 (E)]

1.25 Plastic toys are usually produced by using:
(a) shell moulding
(b) green sand moulding
(c) plaster moulding
(d) injection moulding
[SSC-JE : 2014 (E)]

1.26 To improve the surface finish of castings, the following additive is used in the moulding sand:
(a) Resins (b) Oils
(c) Wood flour (d) Sea coal
[SSC-JE : 2014 (E)]

1.27 Non uniform ramming of moulding sand may lead to the following casting defect-
(a) scabs (b) swells
(c) blow holes (d) bends
[SSC-JE : 2014 (M)]

1.28 An important factor to be taken into account while designing a core print is-
(a) Pouring temperature
(b) Pattern material
(c) Type of mould
(d) Moulding sand characteristics
[SSC-JE : 2014 (M)]

1.29 A casting defect which results in general enlargement of a casting is known as-
(a) swell (b) shift
(c) sand wash (d) blow hole
[SSC-JE : 2014 (M)]

1.30 The process of removing unwanted material from the casting is called
(a) blowing (b) cleansing
(c) finishing (d) fettling
[SSC-JE : 2014 (M)]

1.31 Which of the following material is added to base sand to impart bonding strength-
(a) sea coal (b) silica
(c) bentonite (d) wood flour
[SSC-JE : 2014 (M)]

1.32 One direction solidification in casting can be improved by using-
(a) chaplets and padding
(b) chills and chaplets
(c) chills, chaplets and padding
(d) chills and padding
[SSC-JE : 2015]

1.33 The process of making hollow castings of desired thickness by permanent mould without the use of cores is known as-
(a) Die casting (b) Slush casting
(c) Pressed casting (d) Centrifugal casting
[SSC-JE : 2015]

1.34 The purpose of chaplets is-
(a) To support the core
(b) To provide efficient venting
(c) To join upper and lower parts of the moulding box
(d) Just like chills to ensure directional solidification
[SSC-JE : 2015]

1.35 Assumption made in the Fourier's law is that the heat flow
A. Is in steady state
B. Through a solid medium in one dimension
(a) Only (A) (b) Only (B)
(c) Both (A) and (B) (d) None of these
[SSC-JE (Forenoon) 1.3.2017]

1.36 For steel castings, the following type of sand is better _____.
(a) fine-grain
(b) coarser-grain
(c) medium grain
(d) fine-grain, coarser-grain and medium grain all are equally good
[SSC-JE (Forenoon) 1.3.2017]

1.37 Hot tear refers to _____.
(a) casting defect
(b) process of fabrication
(c) process of heat treatment
(d) weathering of non-ferrous materials
[SSC-JE (Forenoon) 1.3.2017]

1.38 Which of the following processes would produce best components?
(a) die casting (b) hot rolling
(c) extrusion (d) forging
[SSC-JE (Forenoon) 1.3.2017]

1.39 A sprue hole is _____.
(a) a casting defect
(b) a hold made for riveting
(c) a blind hole in jigs
(d) an opening in mould for pouring molten metal
[SSC-JE (Forenoon) 1.3.2017]

1.40 Slick in a foundry shop is used to _____.
(a) make and repair corners in a mould
(b) thoroughly mix up moulding sand
(c) make venting holes in the mould
(d) prepare gates
[SSC-JE (Forenoon) 1.3.2017]

1.41 Which of the following is not a casting process?
(a) Carthias process
(b) extrusion
(c) semi-centrifuge method
(d) slush process
[SSC-JE : (Forenoon) 2.3.2017]

1.42 Fluidity is greatly influenced by
(a) carbon content of molten metal
(b) melting temperature of molten metal
(c) inoculant addition
(d) pouring temperature of molten metal
[SSC-JE : (Afternoon) 2.3.2017]

1.43 The hot chamber die casting method is used to cast
(a) Brass
(b) Both brass and Aluminium
(c) Aluminium
(d) alloys of lead, tin and zinc
[SSC-JE : (Forenoon) 3.3.2017]

1.44 Ornaments are cast by_____.
(a) continuous casting
(b) slush casting
(c) die casting
(d) centrifugal casting
[SSC-JE : (Forenoon) 3.3.2017]

1.45 Facing sand used in foundry work comprises of
(a) alumina, silica and clay
(b) silica and clay
(c) silica and alumina
(d) clay and alumina
[SSC-JE : (Forenoon) 3.3.2017]

1.46 The mould for casting ferrous material in continuous casting process is made of_____
A. Low carbon steel
B. Medium carbon steel
C. High carbon steel
D. Copper
(a) only A (b) only B
(c) only D (d) None of these
[SSC-JE : (Forenoon) 3.3.2017]

1.47 Match plate pattern is used in
(a) Green sand moulding
(b) Bench moulding
(c) pit moulding
(d) machine moulding
[SSC-JE : (Forenoon) 3.3.2017]

1.48 First product of the blast furnace in the process of converting iron ore into useful metal by reduction is called _____.
(a) Cast iron (b) Wrought iron
(c) Pig iron (d) Steel
[SSC-JE : (Afternoon) 3.3.2017]

1.49 Raw material for all iron & steel products is ____.
(a) Cast iron (b) Wrought iron
(c) Pig iron (d) Steel
[SSC-JE : (Afternoon) 3.3.2017]

1.50 Which of the following is not a casting defect?
(a) hot tear (b) blow hole
(c) scab (d) decarburization
[SSC-JE : (Forenoon) 4.3.2017]

1.51 The chief advantage of die casting is:
(a) possibility of incorporating thick sections in small castings
(b) casting of inserts is possible
(c) wide tolerances are possible
(d) high production rates are possible
[SSC-JE : (Forenoon) 4.3.2017]

1.52 For mounting several patterns at a time, which of the following type of pattern is used?
(a) combined pattern
(b) loose, piece pattern
(c) sweep pattern
(d) match plate pattern
[SSC-JE : (Forenoon) 4.3.2017]

1.53 Casting process is preferred for parts having
(a) a few details
(b) many details
(c) no details
(d) non-symmetrical shape
[SSC-JE : (Forenoon) 4.3.2017]

1.54 The main advantage of shell moulding is that
(a) a metallic pattern is used
(b) the moulds are stronger
(c) thin sections can be easily obtained
(d) highly complex sections can be easily obtained
[SSC-JE : (Afternoon) 4.3.2017]

1.55 Strength and permeability of served sand are related to
(a) grain size (b) clay-content
(c) hardness (d) moisture content
[SSC-JE : (Afternoon) 4.3.2017]

1.56 Graphite moulds are generally used for continuous casting method because
(a) The metals wet the mould slightly
(b) only a small of lubricating oil is required
(c) they are self-lubricating
(d) they are comparatively cheaper
[SSC-JE : (Forenoon) 24.01.2018]

Answers Production Engineering

1. Metal Casting

1.1	(c)	1.2	(d)	1.3	(a)	1.4	(c)	1.5	(c)	1.6	(c)	1.7	(b)	1.8	(b)
1.9	(c)	1.10	(d)	1.11	(d)	1.12	(b)	1.13	(a)	1.14	(d)	1.15	(b)	1.16	(b)
1.17	(a)	1.18	(d)	1.19	(a)	1.20	(a)	1.21	(d)	1.22	(d)	1.23	(b)	1.24	(b)
1.25	(d)	1.26	(d)	1.27	(b)	1.28	(d)	1.29	(a)	1.30	(d)	1.31	(c)	1.32	(d)
1.33	(d)	1.34	(a)	1.35	(c)	1.36	(b)	1.37	(a)	1.38	(a)	1.39	(d)	1.40	(a)
1.41	(b)	1.42	(d)	1.43	(d)	1.44	(b)	1.45	(b)	1.46	(c)	1.47	(d)	1.48	(c)
1.49	(c)	1.50	(d)	1.51	(d)	1.52	(d)	1.53	(b)	1.54	(c)	1.55	(d)	1.56	(c)
1.57	(b)	1.58	(d)	1.59	(d)	1.60	(a)	1.61	(c)	1.62	(a)	1.63	(a)	1.64	(d)
1.65	(c)	1.66	(a)	1.67	(c)										

2. Welding

2.1	(d)	2.2	(c)	2.3	(c)	2.4	(c)	2.5	(d)	2.6	(c)	2.7	(a)	2.8	(c)
2.9	(a)	2.10	(a)	2.11	(a)	2.12	(c)	2.13	(a)	2.14	(b)	2.15	(d)	2.16	(a)
2.17	(d)	2.18	(*)	2.19	(b)	2.20	(a)	2.21	(c)	2.22	(a)	2.23	(a)	2.24	(d)
2.25	(c)	2.26	(c)	2.27	(a)	2.28	(d)	2.29	(d)	2.30	(b)	2.31	(c)	2.32	(d)
2.33	(c)	2.34	(a)	2.35	(b)	2.36	(a)	2.37	(*)	2.38	(c)	2.39	(c)	2.40	(d)
2.41	(d)	2.42	(c)	2.43	(c)	2.44	(c)	2.45	(b)	2.46	(c)	2.47	(c)	2.48	(d)
2.49	(d)	2.50	(d)	2.51	(b)	2.52	(d)	2.53	(c)	2.54	(b)	2.55	(d)	2.56	(b)
2.57	(a)	2.58	(a)	2.59	(d)	2.60	(b)	2.61	(b)	2.62	(c)	2.63	(d)	2.64	(d)
2.65	(b)	2.66	(d)	2.67	(b)	2.68	(b)	2.69	(d)	2.70	(a)	2.71	(a)	2.72	(c)

3. Metal Cutting

3.1	(d)	3.2	(c)	3.3	(b)	3.4	(d)	3.5	(b)	3.6	(d)	3.7	(d)	3.8	(d)
3.9	(a)	3.10	(a)	3.11	(a)	3.12	(c)	3.13	(b)	3.14	(a)	3.15	(b)	3.16	(a)
3.17	(d)	3.18	(c)	3.19	(a)	3.20	(d)	3.21	(c)	3.22	(b)	3.23	(c)	3.24	(a)
3.25	(d)	3.26	(d)	3.27	(c)	3.28	(c)	3.29	(b)	3.30	(d)	3.31	(a)	3.32	(d)
3.33	(*)	3.34	(a)	3.35	(b)	3.36	(b)	3.37	(a)	3.38	(c)	3.39	(a)	3.40	(c)
3.41	(c)	3.42	(d)	3.43	(a)	3.44	(a)	3.45	(c)	3.46	(d)	3.47	(a)	3.48	(a)
3.49	(d)	3.50	(b)	3.51	(d)	3.52	(c)	3.53	(b)	3.54	(a)	3.55	(b)	3.56	(b)
3.57	(c)	3.58	(c)	3.59	(d)	3.60	(d)	3.61	(a)	3.62	(a)	3.63	(d)	3.64	(d)
3.65	(c)	3.66	(d)	3.67	(a)	3.68	(d)	3.69	(d)	3.70	(a)	3.71	(b)	3.72	(c)
3.73	(c)	3.74	(c)	3.75	(b)	3.76	(d)	3.77	(d)	3.78	(d)	3.79	(b)	3.80	(d)
3.81	(a)	3.82	(a)	3.83	(a)	3.84	(d)	3.85	(d)	3.86	(a)	3.87	(b)	3.88	(a)

3.89 (b) 3.90 (c) 3.91 (a) 3.92 (d) 3.93 (b) 3.94 (c) 3.95 (d) 3.96 (c)
3.97 (b) 3.98 (a)

4. Metal Forming

4.1 (a) 4.2 (a) 4.3 (b) 4.4 (a) 4.5 (c) 4.6 (b) 4.7 (c) 4.8 (c)
4.9 (a) 4.10 (c) 4.11 (b) 4.12 (b) 4.13 (a) 4.14 (d) 4.15 (d) 4.16 (d)
4.17 (a) 4.18 (c) 4.19 (b) 4.20 (b) 4.21 (b) 4.22 (c) 4.23 (d) 4.24 (b)
4.25 (a)

5. Engineering Metrology and Instrumentation

5.1 (a) 5.2 (d) 5.3 (a) 5.4 (c) 5.5 (a) 5.6 (a) 5.7 (c) 5.8 (d)
5.9 (b) 5.10 (b) 5.11 (a) 5.12 (c) 5.13 (a)

6. Material Science

6.1 (d) 6.2 (b) 6.3 (d) 6.4 (b) 6.5 (a) 6.6 (a) 6.7 (b) 6.8 (d)
6.9 (b) 6.10 (c) 6.11 (a) 6.12 (d) 6.13 (d) 6.14 (c) 6.15 (c) 6.16 (d)
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6.41 (c) 6.42 (c) 6.43 (d) 6.44 (c) 6.45 (b) 6.46 (d) 6.47 (b) 6.48 (b)
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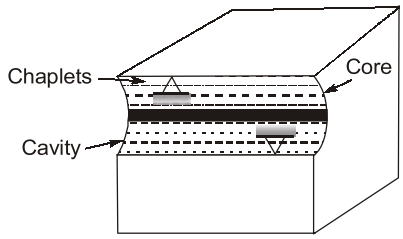
6.57 (c) 6.58 (b) 6.59 (d) 6.60 (d) 6.61 (d) 6.62 (a) 6.63 (b) 6.64 (b)
6.65 (b) 6.66 (a) 6.67 (b) 6.68 (c) 6.69 (d) 6.70 (a) 6.71 (c) 6.72 (b)
6.73 (c) 6.74 (c) 6.75 (c) 6.76 (d) 6.77 (a) 6.78 (c) 6.79 (c) 6.80 (c)
6.81 (b) 6.82 (b) 6.83 (c) 6.84 (d) 6.85 (d) 6.86 (c) 6.87 (d) 6.88 (a)
6.89 (c) 6.90 (c) 6.91 (d) 6.92 (c) 6.93 (c) 6.94 (d) 6.95 (a) 6.96 (c)
6.97 (b) 6.98 (b) 6.99 (d) 6.100 (c) 6.101 (d) 6.102 (c) 6.103 (d) 6.104 (b)
6.105 (d) 6.106 (b) 6.107 (b) 6.108 (d) 6.109 (c) 6.110 (c) 6.111 (d) 6.112 (d)
6.113 (a) 6.114 (a) 6.115 (c) 6.116 (d) 6.117 (b) 6.118 (a) 6.119 (c) 6.120 (d)
6.123 (c) 6.124 (a) 6.125 (d) 6.126 (d) 6.127 (a) 6.128 (b) 6.129 (c) 6.130 (a)
6.131 (b) 6.132 (a) 6.133 (c) 6.134 (c) 6.135 (d) 6.136 (c) 6.137 (a) 6.138 (b)
6.139 (c) 6.140 (c) 6.141 (a) 6.142 (d) 6.143 (d) 6.144 (d) 6.145 (b) 6.146 (c)
6.147 (b) 6.148 (c) 6.149 (c) 6.150 (c) 6.151 (a)

Explanations **Production Engineering**

1. Metal Casting

1.1 **(c)**

These are the metallic objects used to support the core inside the cavity, these are made up of same material as of casting.



1.2 **(d)**

1. Excellent dimensional accuracy.
2. Smooth cast surfaces
3. Thinner walls can be cast compared to sand and permanent mold casting.
4. Inserts can be cast in such as threaded inserts, heating elements, and high strength bearing surfaces.
5. Reduces or eliminates secondary machining operations.
6. Rapid production rates.

The chief advantage is high production rates are possible.

1.3 **(a)**

It consists of a bed resembling the shape of a trolley. The match plate and the moulding flask are mounted on a trolley that can be shifted along the machine bedways. An air actuated piston connected to the trolley actuates the movements of the trolley. An air operated diaphragm is mounted on the machine at a suitable position.

The pattern is placed in a suitable flask at the trolley and filled with sand. The trolley is then shifted under a pressure head. This head carries a rubber diaphragm at the bottom. Air pressure from the cylinder moves the diaphragm downwards helps in the uniform packing of sand. The trolley is then shifted to its original position and the excess sand is removed. It is a very quick process and produces a fair degree of precision.

1.4 **(c)**

The advantage of shell moulding are:

1. Better surface finish
2. Better dimensional tolerances
3. Reduced machining
4. Less foundry space required
5. Low labour costs
6. Can be easily automated for mass production
7. High productivity
8. Complex shapes can be made as there is no need to withdraw the pattern
9. Very fine details and thin sections can be obtained.

High production rate can also be associated with other special casting process, thus, answer is (c).

1.5 **(c)**

In sand moulding, the bottom most part of the flask is called drag, the uppermost one is called cope and any intermediate between cope and drag is called cheek.

1.6 **(c)**

In order to ram the sand softer on the pattern face and harder at the back of the mould, squeeze ramming is used. In squeeze ramming, a plate slightly smaller than the inside dimensions of the moulding flask is fitted into the flask already fitted with the moulding sand. A uniform pressure is applied on the plate, which compacts the sand uniformly. The sand next to the plate rams hardest while the sand below (face of pattern) is progressively less hard.

1.7 **(b)**

The taper provided on pattern for its easy and clean withdrawal from the mould is called draft allowance.

Draft allowance is also called as taper allowance. The amount of draft allowance will depend upon vertical height of pattern.

Note: For disposable/expandable pattern, draft and shaking allowances are not required.

1.8 (b)

Extrusion is not a casting process.
Extrusion is a process used to create objects of a fixed cross-sectional profile. A material is pushed through a die of desired cross-section. It is used for manufacturing long and straight parts.

1.9 (c)

Pattern colour coding practice is followed in the foundry in order to give the necessary information to the mould maker.

1. **Black :** Surface is not to be finished but left as cast.
2. **Red :** Surface is to be machined.
3. **Yellow :** Core prints
4. **Yellow strips on Red :** Seats for loose pieces.

1.10 (d)

In order to facilitate the withdrawal of pattern, draft is provided on pattern. At the time of withdrawing the pattern from the sand mould, the vertical faces of the pattern are in continuous contact with the mould wall, which may damage the mould cavity. To avoid this, the vertical faces are always tapered from the parting plane. This allowance ranges from 1/2° to 2°. Draft is always provided as extra metal over and above the final dimensions of the pattern.

1.11 (d)

Decarburization is a surface degradation phenomenon in the forging and heat treating of steels.
Decarburization may be described as a metallurgical process in which the surface of steel is depleted of carbon by heating above the lower critical temperature or by chemical action.

1.12 (b)

Cope in foundry practice refers to top half of moulding box. The bottom half is called drag and any intermediate flask used in case of three piece moulding is called cheek.

1.13 (a)

Shrinkage allowance is made by adding to external and internal dimensions.

1.14 (d)

Hot tears is the rupturing of casting during cooling as the metal has restraint to contraction, thus developing residual stress which finally leads rupture of casting.

1.15 (b)

- Arbor is not a foundry tool. It is a shaft on which machining tool is mounted. eg milling machine.
- Shovel tool is used for mixing and tempering moulding sand and for moving the sand pile to flask.
- Trowel tool is used to shape and smooth the surfaces of the mould and for doing small repairs. They are made of steel and are relatively long and narrow.
- Riddle tool is a screen or sieve used to remove small pieces of metal and foreign particles from the moulding sand.

1.16 (b)

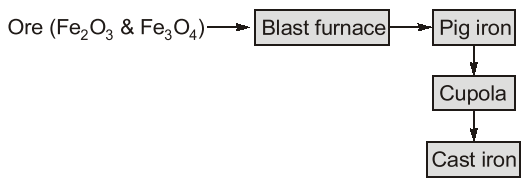
The vertical passage for bringing molten metal to mould cavity is called sprue.
Ideal shape of the sprue is parabolic shape but due to difficulty in manufacturing of parabolic shape, we used tapered shape.

1.17 (a)

The process of pouring molten metal in the cavity of a metallic mould by gravity is called permanent mould casting. Generally two halves of a mould are made from materials such as cast iron, steel, bronze, graphite or refractory metal alloys.

1.18 (d)

Cupola is best suited for melting ferrous metals. It is used to produce cast iron (a ferrous metal). Pig iron is supplied to furnace. Pig iron is produced in blast furnace.



1.19 (a)

Permeability of a foundry sand is the porosity of sand to permit the escape of gases/air.
It is expressed by permeability number.

$$p_n = \frac{VH}{pAT}$$

where, V = Volume of air passing through the specimen
H = Height of cylinder specimen
p = difference of pressure of air passing through the specimen
Unit of p = gm/cm^2
A = Area of cross-section of specimen
T = Time taken by air to pass through the specimen (in minutes)
$H = D$ = 2 inch = 5.08 cm

Note: Generally, permeability number lies between 60 - 120.

1.20 (a)

For fine grains, permeability is poor. Permeability is defined as the porosity of the moulding sand in order to allow the escape of any air, gases or moisture present or generated in the mold when the molten metal is poured into it. Permeability is a function of grain size, grain shape and moisture and clay contents in the moulding sand.

1.21 (d)

Metals like aluminium, brass, cast iron are used for making patterns. The dimensional accuracy is high but the limitation is that a wooden pattern has to be first made to cast the metal pattern, thus expensive, Hence it is used only for higher production rates.

1.22 (d)

Binders are added to give cohesive properties to moulding sand. It provides strength to the moulding sand and enables it to retain its shape as mould cavity. So, synthetic sand, consisting of silica sand, is added with bentonite and water which provides bonding strength to it.

1.23 (b)

The shape and size of the sand grains affects various moulding sand properties. The size can be coarse or fine and the shape can be round or angular. Coarse grains increase permeability and fine grains provide surface finish. Thus porosity of sand is determined by the shape and size of the sand grains.

1.24 (b)

Cereals are added to the moulding sand to improve green strength. The moulding sand containing moisture is termed as green sand. The green sand should have enough strength so that the constructed mould retains its shape.

1.25 (d)

Plastic toys are usually produced by using injection moulding. Both thermoplastics and thermosetting plastics are injection moulded and various products like cups, containers, housings, tool handles, knobs, electrical and communication components, toys and plumbing fittings are made using this.

1.26 (d)

Sea coal is another name of coal dust.

1.27 (b)

Under the influence of the metallostatic force, the mould wall may move back causing a swell in the dimensions of the casting. It is caused due to non-uniform ramming of the moulding sand.

1.28 (d)

For all those castings where coring is required, provision should be made to support the core inside the mould cavity, which is provided by core prints. An important factor to be taken into account while designing a core print is moulding sand characteristics. The general practice of dimensioning the core-print is to make the pressure acting on the core bearing area (core surface area) to be less than 50-75% of the moulding sand compression strength. Also buoyancy force of the molten metal decides the design of core prints.

1.29 (a)

A casting defect resulting is general enlargement of a casting is known as swell. It occurs under the metallostatic forces resulting in mixing back of the mould wall enlarging the casting.

1.30 (d)

The process of removing unwanted material from the casting is called fettling.

1.31 (c)

The popular type of clay - BENTONITE, is the material which is added to impart bonding strength.

1.32 (d)

In casting, chills and padding are used to improve directional solidification.

Note: Chills and padding are the metallic objects with high melting point and high thermal conductivity.

1.33 (d)

Centrifugal casting is the process of making hollow castings of desired thickness by permanent mould without use of cores.

1.34 (a)

In casting process, the purpose of chaplets is to support the core.

Note: Chaplets are made up of same material as that of casting i.e., these are metallic objects.

1.35 (c)

Assumptions of Fourier's law are given below:

(a) Steady state conduction
(b) One directional heat flow
(c) Bounding surfaces are isothermal
(d) Isotropic and homogeneous material
(e) No internal heat generation
(f) Linear temperature profile

1.36 (b)

For uniform casting, we need the heat transfer from the casting to be low and uniform. If we use fine grains then heat transfer rate will be high and if we use coarser grains then air resistance between voids of coarse grain sand plays an important role to reduce the heat transfer from the casting to get uniform solidity.

1.37 (a)

Hot tear is a casting defect. Causes of this defects are given below:

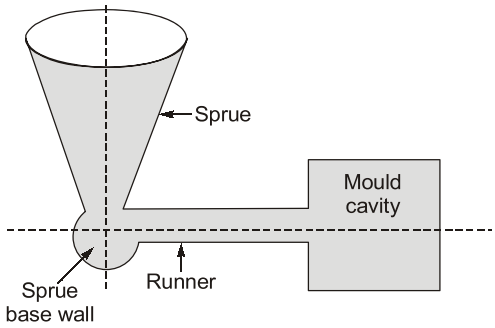
1. Cold dies
2. Low metal temperature
3. Dirty metal
4. Lack of venting

1.38 (a)

Die casting is good for productions of components because we can give any desired shape. But this is not true always like, forging process gives the strongest components.

So, the processes to be used, depend upon the requirement and applications of finished product.

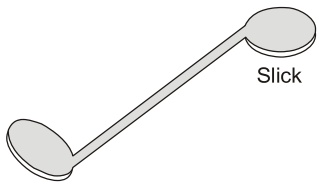
1.39 (d)



1.40 (a)

A slick is a large chisel, characterized by a wide (2 - 4 inches), heavy blade and long, frequently slender socketed handle.

It is always pushed, never struck.



1.41 (b)

In carthias process cavity is filled with a pre-calculated quantity of metal and a core or plunger is inserted to force the metal into cavity.

1.42 (d)

Fluidity is the term used to describe the capability of molten metal to fill the mold cavities. Distance covered by a liquid metal before solidification in a standard spiral will give the value of fluidity. Important factors which influence the fluidity.

Property	Fluidity	
1. Pouring temperature	increases	increases
2. Viscosity	increases	decreases
3. Density	increases	decreases
4. Surface finish of cavity	increases	increases

1.43 (d)

Hot chamber die casting - used for low melting point materials like Lead, Tin and Zinc.
Cold chamber die casting - used for Al, Cu and Brass.

1.44 (b)

Slush casting is used to produce thin casting, hollow thin casting, toys, lamp shades, thin ornaments etc.

1.45 (b)

The facing sand is used directly next to the surface of the pattern and comes into contact with the molten metal when the mould is poured. It is subjected to the severest conditions and must possess high strength and refractoriness. It is made of silica sand and clay, and some additives without the addition of used sand.

1.46 (c)

Continuous casting is a casting method in which the steps of pouring, solidification and withdrawal of casting from an open end mould are carried out continuosly. Mould material mostly used in continuous casting are graphite and copper. This is so because one of the most important requirement for mould material in this process is high thermal conductivity.

1.47 (d)

To produce the complex shape of the object in mass production, this pattern can be used. Number of patterns will be split along the parting line and they will be added on both sides of match plate along the parting line.

1.48 (c)

Pig iron is crude impure iron, which is extracted from iron ores and it forms the basic material for the manufacture of cast iron, wrought iron and steel.

1.49 (c)

Raw material for all iron and steel products, the pig iron is used.
The pig iron is produced in the blast furnace then it is supplied to furnaces to get different types of iron and steel products.

1.50 (d)

Decarburization is the process opposite to carburization namely the reduction of carbon content. The term is typically used in metallurgy, describing the reduction of the content of carbon in metals (usually steel).

1.51 (d)

Advantages of die casting are
(a) Production rate is high
(b) Unit cost per component is less
(c) Edged gated components can also be placed symmetrically around injection center line

Disadvantages of die casting are
(a) Initial investment is more
(b) With increase in number of cavities, the feed balancing and thermal balancing becomes more complicated.

1.52 (d)

- **Loose Piece Pattern :** If the patterns are having projection & undercuts to get the required shape of cavity. Projection can be removed from the would after removing the main part of pattern in the form of loose piece pattern.
- **Sweep Pattern :** To produce three dimensional complex shape cavity sweep pattern is used. It is used for symmetrical shape objects only.
- **Match plate pattern :** If patterns are more complex they can split into two pieced and they will add on both sides of match plate along with gating element.

1.53 (a)

- Patterns are made in two pieces, one piece mounted on one side and the other on the other side of the plate called match plate.
- The plate may carry one or group of patterns mounted on match plate.

- Along with the pattern, gates and runners are also attached.
- Produces accurate castings at faster rates.
- One advantage of using a match plate is that several patterns can be moulded in the single flask, thus saving much time and labour.

1.54 (c)

Applications of shell moulding are
(i) Cylinder heads
(ii) Rocker arms
(iii) Valve plates of refrigerators

Following are the main advantages of shell moulding:
1. Good surface quality
2. High dimensional accuracy
3. Less man power and moulding skill requirement.
4. Thin wall thickness and complex castings.

1.55 (d)

Strength: To retain size and shape of the mould cavity and to withstand force applied by liquid. On mould surface, mould must have sufficient strength.

On the basis of moisture content and the strength of sand, it can be classified as green sand, dry sand and hot sand.

Permeability is the ability of moulding sand to allow the gases to escape.

Permeability first increases with moisture and then decreases.

1.56 (c)

There are several reasons to use graphite moulds for continuous casting method.
(i) Low wettability
(ii) High thermal conductivity
(iii) Low coefficient of thermal expansion
(iv) High thermal shock resistance
(v) Self lubrication

1.57 (b)

The noise levels in case of an aircraft is generally more than 100 db.

Take-off and landing are most loud moments when noise levels can reach 110 decibels (db). At cruising, noise drops to around 85 db.

1.58 (d)

Investment casting is a casting technique for making small, accurate castings in refractory alloys using a mould formed around a pattern of wax or similar material which is then removed by melting.

1.59 (d)

For the production of quality part pressure die casting is normally employed, because it provides very good surface finish and dimensional accuracy.

1.60 (a)

Plasticity is the tendency of material to fracture without appreciable deformation.

1.61 (c)

Chaplet is a small metal insert or spacer used in moulds to provide support to the core during casting process. Usually it is made of same material as that of casting product.

1.63 (a)

Die casting is a metal casting process where molten metal is injected under high pressure into a mold cavity, producing precise, complex shapes with smooth surfaces and excellent dimensional accuracy. Die casting uses permanent metal molds, typically made of steel or other durable alloys, to produce multiple identical castings with high precision.

1.64 (d)

In investment casting, a pattern is typically made from wax or a polymer, which is then coated with a ceramic shell. The pattern is melted out, leaving a cavity for metal casting.

1.65 (c)

Types of patterns in the casting process include solid patterns, split patterns, match plate patterns, cope and drag patterns, sweep patterns. Each type is used for specific casting needs. Investment patterns are used in Investment casting patterns.

1.66 (a)

In green sand moulding, mould material consists of silica sand and mixed with a suitable bonding agent (usually clay) and moisture.