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Corporate Office: 44-A/4, Kalu Sarai (Near Hauz Khas Metro Station), New Delhi-110016
E-mail: infomep@madeeasy.in
Contact: 011-45124660, 08860378007
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SSC-Junior Engineer : Mechanical Engineering Previous Year Solved Papers
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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 three stages as shown in the table given below.

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**Note:** In Paper-I, every question carries 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, shortlisted candidates are called for Personal Interview.

In the second edition, the book has been thoroughly revised and Reasoning-Aptitude section is also added. 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 a good source of study and quality guidance. I hope this book will prove as an important tool to succeed in SSC-JE and other competitive exams. Any suggestion from the readers for improvement of this book is most welcome.

With Best Wishes

B. Singh
CMD, MADE EASY
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.


**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).


**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.


**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.
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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

[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 : 2015]

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 Which of the following is nonchip removal process?
(a) spinning on lathe (b) milling
(c) thread cutting (d) gear hobbing

[SSC-JE : (Forenoon) 3.3.2017]

1.49 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]

1.50 Raw material for all iron and steel product is _____.
(a) Cast iron    (b) wrought iron
(c) Pig iron    (d) Steel

[SSC-JE : (Afternoon) 3.3.2017]

1.51 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]

1.52 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]

1.53 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]

1.54 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]

1.55 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]
1.56 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]

1.57 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]

1.58 Noise level in case of an aircraft is
(a) generally less than 100 db
(b) generally more than 100 db
(c) always more than 100 db
(d) in the range of 60-80 db

[SSC-JE : (Forenoon) 24.01.2018]

1.59 Foundry crucible is made up of
(a) Graphite  (b) Lead
(c) Cast iron   (d) Mild steels

[SSC-JE : (Forenoon) 25.01.2018]

1.60 Investment casting is also known as
(a) Hot investment casting
(b) Lost wax casting
(c) Lost pattern casting
(d) All of these

[SSC-JE : (Afternoon) 27.01.2018]

1.61 For the production of quality part of the following casting method is normally employed
(a) centrifugal casting
(b) continuous casting
(c) green sand casting
(d) pressure die casting

[SSC-JE : (Afternoon) 27.01.2018]

2.3 In resistance welding, the pressure is released
(a) just at the time of passing the current
(b) after completion of current
(c) after the weld cools
(d) during heating period.

[SSC-JE : 2007]

2.4 Oxygen to acetylenes ratio is case of oxidizing flame is
(a) 1 : 1  (b) 1.2 : 1
(c) 1.5 :1  (d) 2 : 1

[SSC-JE : 2007]

2.5 The material used for coating the electrode is called:
(a) protective layer   (b) binder
(c) slag               (d) flux

[SSC-JE : 2008]

2.6 Which of the following welding processes uses non-consumable electrode?
(a) Laser welding (b) MIG welding
(c) TIG welding  (d) Ion beam welding

[SSC-JE : 2008]

2.7 Which of the following is not a welding accessory?
(a) Cable  (b) Electrode holder
(c) Hand screen    (d) Gloves

[SSC-JE : 2008]

2.8 The transformer used for AC welding sets is:
(a) booster type   (b) step up type
(c) step down type (d) equal turn ratio type

[SSC-JE : 2008]

2.9 In which type of welding is a pool of molten metal used?
(a) Electro slag (b) Submerged arc
(c) MIG         (d) TIG

[SSC-JE : 2008]

2.10 Plain and butt welds may be used on materials up to approximately:
(a) 25 mm thick  (b) 40 mm thick
(c) 50 mm thick  (d) 70 mm thick

[SSC-JE : 2008]

2.11 In arc welding, arc is created between the electrode and work by:
(a) flow of current   (b) voltage
(c) material thickness (d) contact resistance

[SSC-JE : 2008]
2.12 For arc heating, the electrodes are made of:
(a) copper  (b) aluminium  
(c) graphite  (d) ACSR conductor  
[SSC-JE : 2008]

2.13 In arc welding, arc is created between the electrode and work by:
(a) flow of current  
(b) voltage  
(c) material characteristics  
(d) contact resistance  
[SSC-JE : 2009]

2.14 Oxygen to acetylene ratio in case of neutral flame is:
(a) 0.8 : 1.0  
(b) 1 : 1  
(c) 1.2 : 1  
(d) 2 : 1  
[SSC-JE : 2009]

2.15 The phenomenon of weld decay occurs in:
(a) Cast iron  
(b) Brass  
(c) Bronze  
(d) Stainless steel  
[SSC-JE : 2010]

2.16 Projection welding is:
(a) Multi-spot welding process  
(b) Continuous spot welding process  
(c) Used to form mesh  
(d) Use to make cantilevers  
[SSC-JE : 2010]

2.17 Which welding process uses a consumable electrode?
(a) Laser welding  
(b) Thermit welding  
(c) TIG welding  
(d) MIG welding  
[SSC-JE : 2011]

2.18 Welding process using a pool of molten metal is
(a) Carbon arc welding  
(b) Submerged arc welding  
(c) TIG welding  
(d) MIG welding  
[SSC-JE : 2011]

2.19 Which of the following is an example of semi-automatic welding process?
(a) TIG welding  
(b) MIG welding  
(c) Submerged arc welding (SAW)  
(d) Resistance welding  
[SSC-JE : 2011]

2.20 Solder is essentially a
(a) tin-lead base alloy  
(b) silver-lead base alloy  
(c) bismuth-lead base alloy  
(d) tin-silver base alloy  
[SSC-JE : 2011]

2.21 Filler metal is used in:
(a) Spot welding  
(b) Projection welding  
(c) Gas welding  
(d) Seam welding  
[SSC-JE : 2012]

2.22 In Arc welding, the arc length should be approximately equal to:
(a) Diameter of electrode rod  
(b) One and a half time the diameter of electrode rod  
(c) Twice the diameter of electrode  
(d) Half the diameter of the electrode rod  
[SSC-JE : 2012]

2.23 The Soldering Iron is heated in a gas flame until
(a) the bit is the red hot  
(b) the coating of Borax on the bit turns black  
(c) the gas flame appears orange in the colour  
(d) the gas flame appears green in the colour  
[SSC-JE : 2012]

2.24 In which type of welding molten metal is poured for joining the metals?
(a) Arc welding  
(b) Gas welding  
(c) MIG welding  
(d) Thermit welding  
[SSC-JE : 2012]

2.25 The soldering process is carried out in the temperature range-
(a) 15 - 60°C  
(b) 70 - 150°C  
(c) 180 - 250°C  
(d) 300 - 500°C  
[SSC-JE : 2013]

2.26 In electrical resistance welding, both heat and pressure are used to effect coalescence. The pressure necessary to effect the weld varies from-
(a) 50-100 kgf/cm²  
(b) 100 - 200 kgf/cm²  
(c) 250-500 kgf/cm²  
(d) 500 - 850 kgf/cm²  
[SSC-JE : 2013]
2.27 In Thermit welding, Aluminium and Iron oxide are mixed in the proportion of-
(a) 1 : 3 
(b) 1 : 2 
(c) 1 : 1 
(d) 2 : 1 [SSC-JE : 2013]

2.28 Spot welding is most suitable for joining parts having thickness up to-
(a) 50 mm 
(b) 30 mm 
(c) 20 mm 
(d) 10 mm [SSC-JE : 2013]

2.29 Thermit welding differs from other methods of welding in that-
(a) it does not use heat 
(b) it is less time consuming 
(c) it does not require electrodes 
(d) it employs exothermic chemical reaction for developing high temperature [SSC-JE : 2013]

2.30 The commonly used flux for Brazing is-
(a) Slag 
(b) Borax 
(c) Lead 
(d) Calcium chloride [SSC-JE : 2013]

2.31 If electric current is passed through the metals to be joined and heated to the plastic state and weld is completed by the application of pressure, the welding is known as-
(a) Forge weld 
(b) Electric arc welding 
(c) Resistance welding 
(d) Thermit welding with pressure [SSC-JE : 2013]

2.32 Which of the following is an example of solid state welding?
(a) Gas welding 
(b) Arc welding 
(c) Thermit welding 
(d) Forge welding [SSC-JE : 2014 (E)]

2.33 Generally used fuel gas in gas welding is:
(a) N₂ 
(b) CO₂ 
(c) C₂H₂ 
(d) H₂ [SSC-JE : 2014 (E)]

2.34 Spot welding, projection welding and or seam welding belong to the category of:
(a) electric resistance welding 
(b) forge welding 
(c) thermit welding 
(d) arc welding [SSC-JE : 2014 (E)]

2.35 Electrode used in TIG is-
(a) Copper 
(b) Tungsten 
(c) Aluminium 
(d) Cast iron [SSC-JE : 2014 (M)]

2.36 In arc welding temperature generated is of the order of:
(a) 8000°C 
(b) 1000°C 
(c) 3500°C 
(d) 5500°C [SSC-JE : 2014 (M)]

2.37 Consumable electrodes are used in-
(a) submerged arc welding 
(b) TIG arc welding 
(c) carbon arc welding 
(d) MIG arc welding [SSC-JE : 2015]

2.38 Black colour is generally painted on?
(a) Acetylene cylinder 
(b) Hydrogen cylinder 
(c) Oxygen cylinder 
(d) None of the option [SSC-JE : 2015]

2.39 Stud and projection welding belong to the following category of welding ______.
(a) gas welding 
(b) arc welding 
(c) resistance welding 
(d) pressure welding [SSC-JE (Forenoon) 1.3.2017]

2.40 Electrode gets consumed in the following welding process ______.
(a) gas 
(b) resistance 
(c) thermit 
(d) arc [SSC-JE (Forenoon) 1.3.2017]

2.41 Oxygen to acetylene ratio in case of carburising flame is ______.
(a) 0.5 : 1 
(b) 0.9 : 1 
(c) 1 : 1 
(d) 1 : 1.2 [SSC-JE (Forenoon) 1.3.2017]

2.42 Binding wire used to support the joints for soldering is made of ______.
(a) aluminium 
(b) copper 
(c) soft iron 
(d) mild steel [SSC-JE (Forenoon) 2.3.2017]
2.43 Carburising flame is used to weld metals like _____.
(a) steel 
(b) copper and brass 
(c) aluminium, nickel, monel etc., 
(d) carburised steel

[SSC-JE : (Forenoon) 2.3.2017]

2.44 The most commonly used flame in gas welding is
A. Neutral 
B. Oxidising 
C. Carburising 
(a) only A (b) only B 
(c) only C (d) only A and B

[SSC-JE : (Forenoon) 2.3.2017]

2.45 In braze welding, the filler metal is
A. Distributed by capillary attraction 
B. Melted and deposited at the point where the weld is to be made 
C. Not required 
(a) only A (b) only B 
(c) Both A and B (d) only C

[SSC-JE : (Forenoon) 2.3.2017]

2.46 Magnetic arc blow is _____.
(a) a recent welding technique 
(b) used to weld materials 
(c) occurs when welding near equator 
(d) phenomenon of occurrence of splatter because of magnetic fields created in d.c. arc welding

[SSC-JE : (Forenoon) 2.3.2017]

2.47 Preheating is essential in welding _____.
(a) high speed steel 
(b) stainless steel 
(c) cast iron 
(d) German silver

[SSC-JE : (Forenoon) 2.3.2017]

2.48 In arc welding operations the current value is decided by _____.
(a) thickness of plate 
(b) length of welded portion 
(c) voltage across the arc 
(d) size of the electrode

[SSC-JE : (Afternoon) 3.3.2017]

2.49 Two sheets of same material but different thickness can be butt welded by _____.
(a) adjustment of the current 
(b) time duration of current 
(c) pressure applied 
(d) changing the size of one electrode

[SSC-JE : (Afternoon) 3.3.2017]

2.50 Pick up the incorrect statement about MIG welding.
(a) no flux required 
(b) high welding speed 
(c) increased corrosion resistance 
(d) even unclean surface can be welded to obtain sound welds

[SSC-JE : (Afternoon) 3.3.2017]

2.51 The drawing representation shown in die figure given below for welding is used to represent.

(a) field weld  (b) weld all around 
(c) flush contour  (d) chipping finish

[SSC-JE : (Forenoon) 4.3.2017]

2.52 In arc welding, eyes need to be protected against:
(a) intense glare 
(b) sparks 
(c) infrared rays only 
(d) both infrared rays and ultra-violet rays

[SSC-JE : (Forenoon) 4.3.2017]

2.53 The main criterion for selection of electrode diameter in arc welding is
(a) materials to be welded 
(b) type of welding process 
(c) thickness of material 
(d) voltage used

[SSC-JE : (Forenoon) 4.3.2017]

2.54 Open circuit voltage for arc welding is of the order of
(a) 18 - 40 volts  (b) 40 - 95 volts 
(c) 100 -125 volts  (d) 130 -170 volts

[SSC-JE : (Forenoon) 4.3.2017]
2.55 In arc welding, arc is created between the electrode and work by
(a) flow of current
(b) voltage
(c) material characteristics
(d) contact resistance

[SSC-JE : (Afternoon) 4.3.2017]

2.56 Preheating is essential in welding
(a) high speed steel
(b) cast iron
(c) all non-ferrous materials
(d) none of these

[SSC-JE : (Forenoon) 22.1.2018]

2.57 Thermite is a mixture of
(a) five aluminium and iron oxide in the ratio of 3 : 1
(b) five iron and aluminium oxide in the ratio of 3 : 1
(c) five aluminium and iron oxide in the ratio of 3 : 1, with traces of sulphur, phosphorus and manganese
(d) molten iron and aluminium, with the ratio depending upon the type of the surface to be welded

[SSC-JE : (Forenoon) 23.1.2018]

2.58 Plain and butt welds may be used on materials upto approximately
(a) 25 mm thick
(b) 40 mm thick
(c) 50 mm thick
(d) 75 mm thick

[SSC-JE : (Forenoon) 23.1.2018]

2.59 The bonding of a rubber sheet with a metal is done by
(a) Welding
(b) High frequency dielectric heating
(c) Induction welding
(d) Adhesive bonding

[SSC-JE : (Forenoon) 23.1.2018]

2.60 Ceramic tools are fixed to tool by the following process
(a) soldering (b) brazing
(c) welding (d) clamping

[SSC-JE : (Forenoon) 24.01.2018]

2.61 Arc blow is a welding defect which is encountered
(a) in Arc welding using AC current
(b) in arc welding using DC current
(c) in gas welding
(d) in thermit welding

[SSC-JE : (Afternoon) 25.01.2018]

2.62 During soldering
(a) arc is produced between solder iron and to be soldered
(b) Solder iron bit is red hot
(c) joint area must be clean and close fitting
(d) metal is heated from top as well as bottom

[SSC-JE : (Afternoon) 27.01.2018]

2.63 Oxygen cylinders are
(a) cast iron cylinders
(b) steel cylinders, welded structure
(c) die cast
(d) seamless steel cylinders

[SSC-JE : (Afternoon) 27.01.2018]

2.64 Which one of the following methods is generally not used in welding of chromium molybdenum steels?
(a) Oxyacetylene
(b) Submerged arc
(c) Thermite
(d) Resistance

[SSC-JE : (Forenoon) 29.01.2018]

3. Metal Cutting

3.1 Reaming is the operation of:
(a) enlarging the end of a hole cylindrically
(b) cone shaped enlargement of the end of a hole
(c) smoothing and squaring the surface around a hole
(d) sizing and finishing a hole

[SSC-JE : 2008]

3.2 A universal dividing head is used to perform a milling operation by:
(a) plain indexing
(b) direct indexing
(c) differential indexing
(d) compound indexing

[SSC-JE : 2009]
## Answers Production Engineering

### 1. Metal Casting

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### 2. Welding

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### 3. Metal Cutting

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| 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 | (c) | 3.21 | (c) | 3.22 | (b) | 3.23 | (c) | 3.24 | (a) |
| 3.25 | (b) | 3.26 | (d) | 3.27 | (c) | 3.28 | (c) | 3.29 | (b) | 3.30 | (d) | 3.31 | (a) | 3.32 | (d) |
| 3.33 | (b) | 3.34 | (b) | 3.35 | (b) | 3.36 | (b) | 3.37 | (a) | 3.38 | (c) | 3.39 | (a) | 3.40 | (c) |
| 3.41 | (d) | 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 | (c) |
| 3.65 | (c) | 3.66 | (d) | 3.67 | (a) | 3.68 | (d) | 3.69 | (d) | 3.70 | (b) | 3.71 | (c) | 3.72 | (d) |
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### 4. Metal Forming

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### 5. Engineering Metrology and Instrumentation

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### 6. Material Science

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1. Metal Casting

1.1 (c)

The purpose of chaplets is to support the cores.

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.

The chief advantage is high production rates are possible.

But main advantage is that high production rate is possible.

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 soften 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.

1.8 (b)

Extrusion is not a casting process.

1.9 (b)

Pattern colour coding practice is followed in the foundry in order to give the necessary information to the mould maker.
1. Red or Orange : Surface is not to be finished but left as cast.
2. Yellow : Surface is to be machined.
4. Yellow strips on black : Core prints for machined openings.
5. Green : Loose pieces or loose core prints.

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)
Decarburisation is not a casting defect.

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, e.g. 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.

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.

1.19 (a)
Permeability of a foundry sand is the porosity of sand to permit the escape of gases/air.

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 cohesion to moulding sand. It provides strength to the moulding sand and enable it to retain its shape as mould laxity. So, synthetic sand consisting of silica sand is added with bentonite and water which provide 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 (a)

Resins are the additives used in moulding sand to improve the surface finish of castings. Resins, natural or synthetic gum with high melting points like phenol formaldehyde have a good collapsibility, low gassing and is capable of delivering a good surface finish.

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. 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 festling.

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.

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.

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) Isotopic and homogeneous material
(e) No internal heat generation
(f) Linear temperature profile

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
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).

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.

- **Loose Piece Pattern**: If the patterns are having projection & undercuts to get the required shape of cavity. Projection can be removed from the mould 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.

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

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

1.59 (a)
The crucible should essentially be made up of materials with a much higher melting point than that of materials to be melted. The crucible materials should also have good strength even when extremely hot. Furnace crucible comes in a variety of metal constructions such as clay graphites, silicon carbides etc.

1.60 (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.

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

2. Welding

2.1 (d)
Helium arc welding is TIG welding, with helium as shielding gas, uses the electrode made of tungsten.

2.2 (c)
TIG welding uses non-consumable electrodes.

2.3 (c)
In resistance welding, the joining of two sheets is accomplished by heating by passing current through electrodes and after the current is switched off, the pressure is applied to coalesce the two sheets and pressure is released only after the weld (nugget) solidifies.

2.4 (d)
In case of oxidizing flame, oxygen volume is higher than acetylene, hence oxygen to acetylene ratio is 2 : 1.

2.5 (d)
The material used for coating the electrode is called flux.

2.6 (c)
TIG welding uses non - consumable electrode.

2.7 (a)
Cable is not a welding accessory.

2.8 (c)
The transformer used for AC welding sets is step down type transformer.

2.9 (a)
In electroslag welding, a pool of molten metal is used.

2.10 (a)
Plain and butt welds may be used on materials upto approximately 25 mm thick.

2.11 (a)
In arc welding, arc is created between the electrode and work by flow of current.

2.12 (c)
For arc heating, the electrodes are made of graphite.

2.13 (a)
In arc welding arc is created between the electrode and work by flow of current.

2.14 (b)
Oxygen to acetylene ratio in case of neutral flame is 1 : 1. Equal volume of oxygen and acetylene are consumed for neutral flame in oxy-acetylene welding.

2.15 (d)
Weld decay is a form of intergranular corrosion usually of stainless steels or certain nickel-base alloys, that occurs as the result of sensitization in the heat-affected zone during the welding operation. The corrosive attack is restricted to the heat affected zone (HAZ).
2.16 (a)
Projection welding is a multi-spot welding process. It is an electric resistance welding process that uses small projections, embossments or intersections on one or both components of the weld to localize the heat and pressure. It is a modification of spot welding.

2.17 (d)
MIG welding process uses a consumable electrode.

2.18 (b)
Submerged arc welding uses a pool of molten metal. In SAW, the weld arc is shielded by a granular flux, consisting of lime silica, manganese oxide, calcium fluoride and other compound. The flux is fed into the weld zone by gravitational flow through a nozzle. The thick layer of flux completely covers the molten metal.

2.19 (b)
Although both MIG welding and submerged arc welding (SAW) are semi-automatic welding process, but MIG welding will be chosen as the more appropriate answer.

2.21 (c)
Gas welding uses filler metal, while all others are resistance welding which do not require filler metal.

2.22 (a)
In Arc welding, the arc length should be approximately equal to diameter of electrode rod.

2.23 (a)
The soldering iron is heated in a gas flame until the bit is the red hot. This type of soldering is called gas soldering iron which is usually cordless.

2.24 (d)
Thermit welding is an exothermic welding process in which molten metal is poured for joining the metals.

2.25 (c)
The soldering process is carried out in the temperature range 180–250°C.

2.26 (c)
The electrical resistance welding, both heat and pressure are used to effect coalescence. The process employs currents of the order of few kA, voltages range from 2 to 12 volts and times vary from few ms to few seconds. Force is normally applied before, during and after the flow of current to avoid arcing between the surfaces and to forge the weld metal during post heating. The necessary pressure shall vary from 30 to 60 N/mm² (300 kgf/cm² to 600 kgf/cm²) depending upon material to be welded and other welding conditions.

2.27 (a)
Thermit welding is a process in which superheated molten metal and slag are produced from an exothermic chemical reaction between a metal oxide and a metallic reducing agent. The name thermit usually refers to a mechanical mixture of about one part (by weight) finely divided aluminium and three parts iron oxide (either Fe₂O₃ or Fe₃O₄) plus possible alloy additions.

\[
2Al + Fe₃O₄ \rightarrow 2Fe + Al₂O₃ + Heat \\
2Al + Fe₂O₃ \rightarrow 9Fe + 4Al₂O₃ + Heat
\]

2.28 (d)
Spot welding is most suitable for joining parts having thickness upto 10 mm. Higher thickness spot welded joints will not from a stable weld.

2.29 (d)
Thermit welding differs from other methods of welding in that it employs exothermic chemical reaction for developing high temperature.

2.30 (b)
Brazing fluxes usually take the form of chemical compounds in which the most common ingredients are borates, fused borax, fluoroborates, fluorides, chlorides, acids, alkalies, wetting agents and water. The commonly used flux is borax.

2.31 (c)
If electric current is passed through the metals to be joined and heated to the plastic state and
weld is completed by the application of pressure, the welding is known as resistance welding.

2.32 (d)
Forge welding is an example of solid state welding.

2.33 (c)
Acetylene ($\text{C}_2\text{H}_2$) gas is generally used in gas welding along with oxygen and it is known as oxy-acetylene welding.

2.34 (a)
Spot welding, projection welding and steam welding belong to the category of electric resistance welding.

2.35 (b)
Tungsten electrode is used in TIG welding.

2.36 (c)
In arc welding, temperature generated is of the order of 3500°C – 4000°C.

2.37 (d)
Consumable electrodes are used in MIG arc welding. Other options mentioned uses non-consumable electrodes.

2.38 (c)
Oxygen cylinder is painted with black colour, while acetylene cylinder is pointed with maroon colour, in oxy-acetylene welding.

2.40 (d)
Metal inert gas welding is an example of a welding type in which electrode gets consumed.

2.41 (d)
In case of carburising flame oxygen to acetylene ratio is always less than 1.

2.43 (a)
Neutral flame is a general purpose flame used for welding of mild steel, low C steel, alloy steel and CI etc.

2.46 (c)
Deflection of electric arc from its intended path towards workpiece at the beginning and end due to deflection of magnetic flux line is called magnetic arc blow. Due to arc blow, heat concentration on workpiece will be decreased at beginning and end which caused weld spatter.

2.47 (c)
In case of cast iron if the difference of temperature is very high due to fast rate of cooling, free form of carbon will be converted into carbides. They are more brittle and hard and will not allow the metal to shrink easily, during the process internal stresses can be developed. If these stresses will be more than strength of material, cracks will be formed. To overcome this, it can be easily welded by gas welding with Preheating.

2.51 (b)

2.57 (a)
In thermite mixture ratio of iron oxide to aluminium by mass is 3 : 1.

2.58 (a)
Plain and butt welds may be used on materials upto approximately 25 mm thick.

2.59 (d)
The bonding of rubber sheet with the metal is done by adhesive bonding.

2.60 (b)
Brazing: It is a joining process in which two or more materials are joined together by melting and flowing a filter material into the joint. The filter material has lower melting point than the adjoining material.

2.61 (b)
Arc blow is a welding defect which is encountered in arc welding using DC current. Magnetic arc blow is caused by an unbalanced
condition in the magnetic field surrounding the arc. The arc will be further from one end of the joint than another and will be at varying distances from the workpiece connection.

2.62 (c)
During soldering joint area must be clean and close fitting.

2.64 (a)
In chromium molybdenum steels, if we use oxyacetylene welding then chromium present in the steel will react with oxygen and form chromium oxide. Due to this the corrosion resistance of the steel will decrease and joint will fail easily due to corrosion.

3. Metal Cutting

3.1 (d)
Reaming is operation of sizing and finishing a hole.

3.2 (a)
A universal dividing head is used to perform a milling operation by plain indexing.

3.3 (d)
In grinding operation, for grinding harder material any grain size may be used, because harder material grinding requires softer wheel and vice-versa. The bonding strength of grits is of importance, not the size of grains. Grain size plays role for accommodating chips.

3.4 (d)
When turning long shaft on a lathe, its bending can be prevented by using steady rest.

3.5 (b)
The operation of sharpening a grinding wheel is called dressing. By dressing, grinding wheel is sharpened so that dull grits are removed and new sharp grits emerges out.

3.6 (d)
For thread cutting, the spindle speed will be minimum.

3.7 (d)
For drilling operation, the cylindrical job should always be clamped on a V-block.

3.8 (d)
Slotter, planer and shaper all require quick return mechanism. Broaching does not require quick return mechanism.

3.9 (a)
The spindle on which the milling cutter is mounted may be horizontal for slab milling or vertical for face and end milling. Hence, milling machine is classified as horizontal or vertical type, depending on the position of spindle.

3.10 (a)
Continuous chips are formed when machining ductile materials.

3.11 (a)
Size of shaper is specified by length of stroke.

3.12 (d)
When machining ductile materials, the chips produced are either continuous chips or continuous chips with built-up-edge (BUE), depending upon the cutting speed.

3.13 (b)
Cutting speed is the most significant process variable in tool life although depth of cut and feed rate are also important.

\[ V^x \cdot T^y \cdot f^z = C \]

The value of \( n = 0.15, x = 0.15, y = 0.6 \) found experimentally indicates that cutting speed, feed rate and depth of cut are of decreasing importance.

The above equation can be rewritten as

\[ T = C^x \cdot V^{-1} \cdot f^y \cdot n^z \]

or,

\[ T = C^{-1} \cdot V^{-1} \cdot f^y \cdot n^z \]

3.14 (a)
In a taper turning operation,

\[ \tan \alpha = \frac{D - d}{2L} \]

where
- \( \alpha = \) Half taper angle
- \( D = \) Maximum diameter of job
- \( d = \) Minimum diameter of job