UPPSC-AE

UTTAR PRADESH PUBLIC SERVICE COMMISSION

Combined State Engineering Services Examination

Assistant Engineer

Mechanical Engineering
Previous Years Solved Papers

Objective Papers

General Hindi

General Studies

Practice Questions

MADE EASY
Publications

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UPPSC-AE : Mechanical Engineering Previous Solved Papers

Preface

UPPSC Assistant Engineer Examination has been always preferred by Engineers due to job stability and opportunity to work in home sate. UPPSC Combined State Engineering Services examination is conducted time to time but not every year. MADE EASY team has made deep study of previous exam papers and observed that a good percentage of questions are of repetitive in nature, therefore previous year's papers are advisable to solve before a candidate takes the exam. This book is also useful for MP State Engineering Services, UPSC Engineering Services and other Competitive exams for Engineering graduates.

B. Singh (Ex. IES)

The current edition of this book contains complete solutions to all questions with accuracy. I have true desire to serve student community by providing good source of study and quality guidance. I hope this book will be proved an important tool to succeed in UPPSC and other competitive exams. Any suggestions from the readers for improvement of this book are most welcome.

With Best Wishes

B. Singh

CMD, MADE EASY

UPPSC : Exam Pattern

Combined State Engineering Services Examination
Assistant Engineer examination

Paper I : Objective	
Maximum Time : 2½ Hours • Maximum Marks : 375	
Each question carries 3 marks. There is a penalty of –1 mark for every wrong attempted answer	
General Hindi	25 Questions
Technical Paper I	100 Questions
Total	**125 Questions** (375 Marks)

Paper II : Objective	
Maximum Time : 2½ Hours • Maximum Marks : 375	
Each question carries 3 marks. There is a penalty of –1 mark for every wrong attempted answer	
General Studies	25 Questions
Technical Paper II	100 Questions
Total	**125 Questions** (375 Marks)

Uttar Pradesh Public Service Commission
Combined State Engineering Services Examination

Assistant Engineer

Mechanical Engineering

Paper-I

Engineering Mechanics:
Analysis of force systems, friction, centroid and centre of gravity, trusses and beams, principle of virtual work, kinematics and kinetics of particle, kinematics and kinetics of rigid bodies.

Mechanism and Machines:
Velocity and acceleration of links, cams and followers gears and gear trains clutches, belt drives, brakes and dynamometers, Flywheel and governors, balancing of rotating and reciprocating masses, balancing of multi cylinder engines, Free and forced vibration, damped vibration, whirling of shafts.

Mechanics of Solids:
Stresses and strains, compound stresses strains, Torsion of circular shafts, stresses and deflections in beams unsymmetrical bending, curved beams, Thin and thick cylinders and spheres, Buckling of columns, Energy methods, helical and leaf springs.

Design of Machine Elements:
Design for Static and dynamic loading, Theories of failure, fatigue principles of design of riveted, welded and bolted joints, shafts, springs, bearings, brakes, clutches and flywheels.

Engineering Materials:
Crystal systems and crystallography, crystal imperfections, Alloys and phase diagrams, Heat treatment, ferrous and non ferrous metals and alloys, Mechanical properties and testing.

Manufacturing:
Metal casting, metal forming, metal joining, Mechanics of metal cutting, machining and machine tool operations, unconventional machining methods limits, fits and tolerances, inspection: Surface roughness, comparators, computer integrated manufacturing, Flexible manufacturing systems, jigs and fixtures.

Industrial Engineering:
Production, planning and control, inventory control and operation, research, CPM and PERT.

Mechatronics and Robotics:
Microprocessors and microcontrollers, Architecture, Programming, Computer interfacing Programmable logic controller, sensors and actuators, Piezoelectric accelerometers, Hall effect sensors, optical encoder, resolver, Inductosyn, Pneumatic and Hydraulic Actuators, stepper motor, control system, mathematical modeling, control signals, controllability and observability, Robotics: Robot classification, robot specification. Notation: Direct and inverse kinematics homogeneous co-ordinates and arm equation of four axis SCARA Robot.

Paper-II

Thermodynamics:
Thermodynamic systems and processes, properties of pure substances, concepts and applications of zeroth, first and second law of thermodynamics, entropy, availability and irreversibility, detailed analysis of thermodynamic cycles, ideal and real gases, fuels and combustion.

Fluid Mechanics :
Basic concepts and properties of fluids, manometry, fluid statics, buoyancy, equations of motion, Bernoulli's equation and applications, viscous flow of incompressible fluids, laminar and turbulent flows, flow through pipes and head losses in pipes, dimensional analysis, Forces on immersed bodies and boundary layer over a flat plate, isentropic and adiabatic flows, normal shock waves.

Heat Transfer:
Modes of heat transfer, steady and unsteady heat conduction, thermocouple time constant, critical thickness of insulation, heat transfer from fins, momentum and energy equations for boundary layer flow on a flat plate. Free and forced convection, radiation heat transfer, Stefan-Boltzmann law, shape factor, black and grey body radiation heat exchange, boiling and condensation, heat exchanger analysis, LMTD and NTU – effectiveness methods.

Energy conversion:
SI and CI engines, performance characteristics and testing of IC engines, combustion phenomena in SI and CI engines, carburetion and fuel injection systems, emissions and emission control. Reciprocating and rotary pumps, pelton wheel, Francis and Kaplan turbines, velocity diagrams impulse and reaction principles steam and gas turbines; Rankine and Brayton cycles with regeneration and reheat, high pressure boilers, draft, condensers. Unconventional power systems, including nuclear, MHD, biomass, wind and tidal systems, utilization of solar energy; Reciprocating and rotary compressors; theory and applications, Theory of propulsions, pulse jet and ramjet engines.

Environmental control:
Vapour compression, vapour absorption, steam jet and air refrigeration systems, properties of refrigerant and their nomenclature, psychometrics properties and processes, psychrometric relations, use of psychrometric chart, load estimation, supply air conditions, sensible heat factors, air conditioning system layout, comfort chart, comfort and industrial air conditioning.

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Contents
Mechanical Engineering

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Q.1 The [110] direction in a cubic unit cell is parallel to the following :
(a) Face diagonal of unit cell
(b) Edge of the cube
(c) Body diagonal of the cube
(d) None of the above

Q.2 When mechanical properties of a material remain same in all directions at each point, such a material is called
(a) Isotropic   (b) Homogeneous
(c) Orthotropic   (d) Anisotropic

Q.3 German silver is an alloy of
(a) Silver and Tin
(b) Silver and Gold
(c) Nickel and Copper
(d) Nickel, Copper and Zinc

Q.4 Iron is 'Face Centered Cubic (FCC) at which one of the following temperatures?
(a) Room temperature
(b) 1400 °C
(c) 910 °C
(d) None of the above

Q.5 Babbit metal is an alloy of which one of the following?
(a) Lead and Tin
(b) Lead and Magnesium
(c) Tin and Bismuth
(d) None of the above

Q.6 Griffith theory of failure is suitable for
(a) Mild Steel
(b) Low Carbon Steel
(c) Alloy Steel
(d) Glass

Q.7 Mild steel is an example of
(a) Substitution solid solution
(b) Interstitial solid solution
(c) Inter metallic compound
(d) None of the above

Q.8 Bronze contains
(a) 70% Cu and 30% Zn
(b) 90% Cu and 10% Zn
(c) 75% Cu and 25% Zn
(d) None of the above

Q.9 The processes used to make the steel magnetically softer, are
(a) Annealing and Decarburization
(b) Decarburization and Quenching
(c) Annealing, Grain growth and Decarburization
(d) Grain growth and Quenching

Q.10 The ductile-brittle transition temperature
(a) depends on size and shape of material, rate of loading, presence of notches, impurities and operating temperature
(b) depends on size but does not depend on shape of material
(c) does not depend on size of material
(d) does not depend on rate of loading but depends on presence of impurities

Q.11 Match the items in **List-I** to that of the **List-II** and choose the correct alternative.

List-I
A. Alnico V   B. Ferrexodur
C. Nickel Oxide   D. Ferrites

List-II
1. Metallic Magnet
2. Ceramic Magnet
3. Anti ferromagnetic
4. Compounds containing trivalent iron
5. Ferrimagnetic
6. Soft magnetic

Codes:

	A	B	C	D
(a)	1	2	3	4
(b)	6	2	3	4
(c)	4	6	1	2
(d)	2	1	6	1

Q.12 Choose the correct statement from the following:
(a) Ceramic compounds involve simple coordination than their corresponding components.
(b) Ceramic compounds are more ductile.
(c) Ceramic compounds are more stable with respect to thermal and chemical environments than their components.
(d) Ceramic compounds have less resistance to slip.

Note : Q. No 13 to Q.16:
Choose the alternative from the code given below which explains the correct relationship between the Assertion (A) and Reason (R):
Codes:
(a) (A) is true, but (R) is false.
(b) (A) is false, but (R) is true.
(c) Both (A) and (R) are true, but (R) does not explain (A) correctly.
(d) Both (A) and (R) are true and (R) explains (A) correctly.

Q.13 **Assertion (A) :** Metallic magnets cannot be used in high frequency circuits.
Reason (R) : The low resistivity of metallic magnets permits heating from induced currents.

Q.14 **Assertion (A) :** Little energy is required to break materials such as glass, polystyrene and some cast irons. Conversely, rubber and many steels absorb considerable energy in the fracture process.
Reason (R) : The service limit in many engineering products is not the yield or ultimate strength, rather may be the energy associated with fracture propagation.

Q.15 **Assertion (A) :** In general, materials deform more readily at elevated temperature.
Reason (R) : Plastic deformation commonly arises from dislocation movements that involve a continuous displacement of atoms to new neighbours at elevated temperature.

Q.16 **Assertion (A) :** Soft magnets are the obvious choice for AC or high frequency applications.
Reason (R) : They must be magnetised and demagnetized many times per second.

Q.17 Dielectric strength can be reduced by
(a) removing cracks
(b) absence of imperfections
(c) absence of flaws
(d) impurities, cracks and pores

Q.18 Select the correct answer out of the following alternatives about 'Cyclic Stresses'.
(a) That a material can tolerate are much greater than stresses produced under static loading.
(b) Can lead to fatigue if the stress level is above the endurance limit.
(c) Can lead to fatigue if the stress level is below the endurance limit.
(d) Are not introduced in the axle of a running train.

Q.19 Dislocation in material is called
(a) Point defect   (b) Line defect
(c) Plane defect   (d) Volumetric defect

Q.20 Match the items in **List-I** to the corresponding items in the **List-II**.
List-I (Heat Treatment)
A. Annealing
B. Nitriding
C. Martempering
D. Normalising
List-II (Effect on Properties)
1. Refine grain structures
2. Improves the hardness of the whole mass
3. Improves surface hardness
4. Improves ductility
Choose the correct code from the following:

	A	B	C	D
(a)	3	1	4	2
(b)	3	1	2	4
(c)	1	3	4	2
(d)	1	3	2	4

Q.21 The crystal structure of α-iron is
(a) Simple Cubic
(b) Face Centred Cubic
(c) Body Centred Cubic
(d) Close-packed Hexagonal

Q.22 Select the proper sequence for the following:
1. Proportional limit   2. Elastic limit
3. Yield point   4. Fracture/failure point
(a) 1 – 2 – 3 – 4   (b) 2 – 1 – 3 – 4
(c) 1 – 2 – 4 – 3   (d) 2 – 1 – 4 – 3

Q.23 The macro-structure of a material is generally examined by
(a) X-ray techniques
(b) Spectroscopic techniques
(c) Optical microscope
(d) Metallurgical microscope

Q.24 Gradual time dependent deformation under constant load or self weight is called
(a) Erosion
(b) Decay
(c) Tension
(d) Creep

Q.25 Which ingredient is responsible for corrosion resistant capability in Stainless Steel?
(a) Iron
(b) Chromium
(c) Zinc
(d) Sulphur

Q.26 The property of material, which enables it to withstand bending without fracture, is known as
(a) Mechanical strength
(b) Stiffness
(c) Flexural rigidity
(d) Ductility

Q.27 The material commonly used for making machine tool bed is
(a) Mild Steel
(b) Aluminium
(c) Brass
(d) Cast Iron

Q.28 Which one of the following is ferrous material?
(a) Zinc
(b) Iron
(c) Silicon Carbide
(d) Copper

Q.29 Babbit materials are used for
(a) Gears
(b) Bearings
(c) Bolts
(d) Clutch liners

Q.30 The ultimate tensile strength of low Carbon Steel by working at high strain rate will
(a) increase
(b) decrease
(c) remain constant
(d) first increase, then decrease

Q.31 Pure iron is the structure of
(a) Ferrite
(b) Pearlite
(c) Austenite
(d) Cementite

Q.32 An example of amorphous material is
(a) Zinc
(b) Lead
(c) Glass
(d) Sulphur

Q.33 Binding material in cemented carbide tool is
(a) Graphite
(b) Lead
(c) Carbon
(d) Cobalt

Q.34 Which of the following are the reasons for reduction of tool life in a machining operation?
1. Temperature rise of cutting edge.
2. Chipping of tool edge due to mechanical impact.
3. Gradual wear at tool point.
4. Increase in feed of cut at constant cutting force
Select the answer from the following codes:
(a) 1, 2 and 4
(b) 1, 2 and 3
(c) 1, 3 and 4
(d) 1, 2, 3 and 4

Q.35 Choose the alternative, which explains the correct relationship between the given statements, (A) and (R) from the code given below :
Assertion (A) : In ECM, the shape of the cavity is the mirror image of the tool, but unlike EDM, the tool wear in ECM is a cathode.
Reason (R) : The tool in ECM is at Cathode.
Code:
(a) Both (A) & (R) are true. (R) is the correct explanation of (A).
(b) Both (A) & (R) are true. (R) is not the correct explanation of (A).
(c) (A) is false, but (R) is true.
(d) (A) is true, but (R) is false.

Q.36 An orthogonal cutting operation is being carried out under the following conditions :
Cutting Speed = 2 m/s, Depth of cut = 0.5 mm, Chip thickness = 0.6 mm.
What is the chip velocity?
(a) 2 m/s
(b) 2.4 m/s
(c) 1 m/s
(d) 1.66 m/s

Q.37 The rake angle of a cutting tool is 15°, the shear angle is 45° and the cutting velocity is 35 mpm. What is the velocity of chip along the tool face?
(a) 28.5 mpm
(b) 27.3 mpm
(c) 25.3 mpm
(d) 23.5 mpm

Q.38 In EDM, metal removal rate is proportional to
(a) Frequency of charging
(b) Energy delivered in each spark
(c) Both (a) and (b)
(d) None of the above

Q.39 Which of the following is <u>not</u> true in case of jigs and fixtures?
(a) Consistency in dimension
(b) Fast production speed is not possible
(c) Auto-location control
(d) None of the above

Q.40 The upper and lower control limits in case of R-chart are given by
(a) $A_2\bar{R}$ and $A_3\bar{R}$
(b) $D_3\bar{R}$ and $D_4\bar{R}$
(c) $\bar{R} \pm D_3\bar{R}$
(d) $\bar{R} \pm A_2\bar{R}$

Q.41 A cutting tool is turning a work piece of 40 mm diameter, revolving at 300 rpm. If tool life is 120 min, find the value of constant C as per the Taylor's tool life equation, Assuming $n = 1/7$.
(a) 85
(b) 80
(c) 70
(d) 75

Q.42 Which of the following should be more to reduce wear of a tool?
(a) Weight
(b) Density
(c) Hardness
(d) Both (b) & (c)

Q.43 Which of the following instruments is used to measure smoothness of a metallic surface?
(a) Talysurf
(b) Coordinate Measuring Machine
(c) Profile Projector
(d) None of the above

Q.44 Life of a single point cutting tool is influenced by which of the following factors?
(a) Cutting speed
(b) Feed rate
(c) Depth of cut
(d) All the above

Q.45 The Plug gauge is used to
(a) Check the size and shape of holes
(b) Measure the diameter of holes
(c) Measure the diameter of shafts
(d) Measure the diameter of shafts & holes

Q.46 The relationship between the shear angle (ϕ), friction angle (β), cutting rake angle (α) and the machining constant (C) for the work material is
(a) $2\alpha + \beta - \phi = C$
(b) $2\alpha + \beta + \phi = C$
(c) $2\alpha + \beta - \alpha = C$
(d) $2\alpha + \beta + \alpha = C$

Q.47 Explosive forming is not used for the following:
(a) Making very small complex parts
(b) For large parts typical of aerospace industry
(c) Both (a) and (b) are correct
(d) None of the above is correct

Q.48 In Electro Discharge Machining (EDM), the tool is made of
(a) High Speed Steel
(b) Copper
(c) Cast Iron
(d) Glass

Q.49 The process in which the material removal rate is governed by Faraday's law is?
(a) ECM
(b) EDM
(c) AJM
(d) LBM

Q.50 In USM, the tool is vibrated with the frequency of
(a) 5 kHz
(b) 10 kHz
(c) 15 kHz
(d) 20 kHz

Q.51 Continuous chips will be formed when machining speed is
(a) low
(b) medium
(c) high
(d) independent of speed

Q.52 Profile of a gear tooth can be checked by
(a) Optical projector
(b) Optical pyrometer
(c) Bench micrometer
(d) Sine bar.

Q.53 For TIG welding, which of the following gases are used?
(a) Hydrogen and Carbondioxide
(b) Argon and Helium
(c) Argon and Neon
(d) Hydrogen and Oxygen

Q.54 Which of the following materials require the largest shrinkage allowance while making a pattern for casting?
(a) Aluminium
(b) Brass
(c) Cast Iron
(d) Duralumin

Q.55 Which of the following values of index n is associated with carbide tools when Taylor's tool life equation $VT^n = $ constant is applied?
(a) 0.65 to 0.90
(b) 0.45 to 0.60
(c) 0.20 to 0.40
(d) 0.10 to 0.15

Q.56 In an orthogonal cutting experiment, with a tool of rake angle $\gamma = 75°$ and shear angle $\phi = 22.8°$, then friction angle β will be
(a) 41.9°
(b) 51.4°
(c) 61.2°
(d) None of the above

Q.57 Which of the following operation does not use a jig?
(a) Tapping   (b) Reaming
(c) Drilling   (d) Turning

Q.58 Which of the following are the quality control limits for *p*-charts?

(a) $\bar{p} \pm 3\sqrt{\bar{p}(1-\bar{p})}$ (b) $\bar{p} \pm \sqrt{\bar{p}(1-\bar{p})}$

(c) $\bar{p} \pm \sqrt[3]{\dfrac{\bar{p}(1-\bar{p})}{n}}$ (d) $\bar{p} \pm 3\sqrt{n\bar{p}(1-\bar{p})}$

Q.59 Which is the false statement about electro discharge machining?
(a) It can machine very hard material.
(b) Very good surface finish is obtained.
(c) Section to be machined should be thick.
(d) Metal removal rate is very slow.

Q.60 Choose the false statement from the following:
(a) Control chart indicates whether the process is in control or not.
(b) $\bar{X}$ and R charts are used to evaluate dispersion of measurements.
(c) *P*-chart is a control chart for percentage defective.
(d) *C*-charts are prepared for large and complex components.

Q.61 The following is not the characteristics of explosive forming:
(a) Low capital cost of the set up
(b) Very large components can be formed
(c) Only a simple die is required
(d) The tooling material is very expensive

Q.62 The following is not true for ECM:
(a) It can machine highly complicated shapes in a single pass.
(b) Tool life is very high.
(c) Machinability of the work material is independent of its physical and mechanical properties.
(d) Kerosene is used as electrolyte.

Q.63 Electro-discharge machining uses the following dielectric fluid :
(a) Kerosene   (b) Sodium hydroxide
(c) Water   (d) Aqueous salt solution

Q.64 A good machinability rating would indicate
(a) long tool life, high power requirement and less machining time.
(b) long tool life, low power requirement and a good surface finish.
(c) short tool life and a good surface finish.
(d) long tool life, high power requirement and a good surface finish.

Q.65 In EDM process, the workpiece is connected to
(a) Cathode   (b) Anode
(c) Earth   (d) None of the above

Q.66 A hole of 1 mm is to be drilled in glass. It could be best done by
(a) Laser drilling   (b) Plasma drilling
(c) Ultrasonic drilling (d) Electron beam drilling

Q.67 A comparator for its working depends on
(a) comparison with standard such as slip gauges
(b) accurately calibrated scale
(c) optical device
(d) limit gauge

Q.68 TMU means
(a) Time Motion Unit
(b) Time Method Unit
(c) Time Measurement Unit
(d) Time Movement Unit

Q.69 Choose the correct relationship between the given statements of Assertion (A) and Reason (R).
Assertion (A) : In case of control charts for variables, if some points fall outside the control limits, it is concluded that process is not under control.
Reason (R) : It was experimentally proved by Shewart that averages of four or more consecutive readings from a universe (population) or from a process, when plotted, will form a normal distribution curve.
Code :
(a) Both (A) and (R) are correct. (R) is the correct explanation of (A).
(b) Both (A) and (R) are correct. (R) is not the correct explanation of (A).
(c) (A) is correct, but (R) is incorrect.
(d) (A) is incorrect, but (R) is correct.

Q.70 Which one of the following is most important parameter for EDM?
(a) Thermal capacity   (b) Hardness
(c) Strength   (d) Geometry

Q.71 Which of the following is not the characteristics of work sampling?
(a) Any interruption during study will not affect the results.
(b) The study causes less fatigue.
(c) Uneconomical for short cycle jobs.
(d) A stop watch is needed.

Q.72 Which one of the following statements is not correct regarding simplex method of linear programming?
(a) It is an iterative procedure.
(b) It has a trial basic feasible solution to constraints.
(c) The collection of feasible solution does not constitute a convex set.
(d) It improves the first trial solution by a set of rules.

Q.73 The following is not true for linear programming problems :
(a) Objective function is expressed as a linear function of variables.
(b) Resources are not limited.
(c) Some alternative course of actions are also available.
(d) Decision variables are inter related.

Q.74 Which of the following are said to be the benefits of assembly line balancing?
1. It minimises the in-process inventory.
2. It reduces the work content.
3. It smoothens the production flow.
4. It maintains the required rate of output.
Select the correct answer using the codes given below :
Code :
(a) 1, 2 and 3   (b) 2, 3 and 4
(c) 1, 3 and 4   (d) 1, 2 and 4

Q.75 Value Engineering is concerned with the saving of
(a) Unnecessary costs
(b) Administrative difficulties
(c) Overhead costs
(d) Time

Note Q. No 76 to Q.77:
Choose the correct relationship between the given statements of Assertion (A) and Reason (R) :
Codes:
(a) Both (A) and (R) are true. (R) is the correct explanation of (A).
(b) Both (A) and (R) are true. (R) is not the correct explanation of (A).
(c) (A) is true, but (R) is false.
(d) (A) is false, but (R) is true.

Q.76 Assertion (A) : Value analysis is superior to other conventional cost reduction techniques.
Reason (R) : In conventional cost reduction techniques, value is increased by widening tolerance bands.

Q.77 Assertion (A) : Vogel's approximation method yields the best initial basic feasible solution of a transportation problem.
Reason (R) : Vogel's method give allocations to the lowest cost elements of the whole matrix.

Q.78 The following is the general policy for A class items in ABC analysis :
1. Very strict control
2. Frequent review of their consumption
3. Safety stock kept
Which of these statements is/are correct?
(a) 1 only
(b) 1 and 2 only
(c) 2 only
(d) 1, 2 and 3

Q.79 In the EOQ model, if the unit ordering cost gets doubled, then the EOQ will be
(a) reduced to half
(b) doubled
(c) increased 1.414 times
(d) decreased 1.414 times

Q.80 Value engineering is necessary to be used when the following symptoms are indicated
1. New product designs are to be introduced.
2. The firm is unable to meet delivery date.
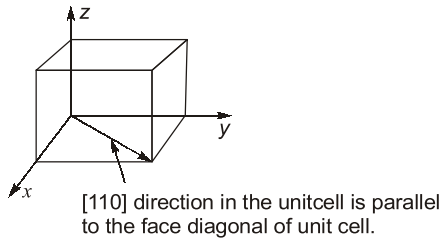3. Rate of return on investment goes down.
Which of the above statements is/are correct?
(a) 1, 2 and 3   (b) 2 only
(c) 1 and 3 only   (d) 2 and 3 only

| **Answers** | **UPPSC-AE Paper-I : 2012** |

1.	(a)	2.	(a)	3.	(d)	4.	(c)	5.	(d)	6.	(d)	7.	(b)	8.	(d)
9.	(c)	10.	(a)	11.	(b)	12.	(c)	13.	(a)	14.	(a)	15.	(a)	16.	(a)
17.	(d)	18.	(b)	19.	(b)	20.	(d)	21.	(c)	22.	(a)	23.	(b)	24.	(d)
25.	(b)	26.	(c)	27.	(d)	28.	(b)	29.	(b)	30.	(b)	31.	(a)	32.	(c)
33.	(d)	34.	(d)	35.	(b)	36.	(d)	37.	(a)	38.	(c)	39.	(b)	40.	(b)
41.	(d)	42.	(d)	43.	(a)	44.	(d)	45.	(b)	46.	(c)	47.	(d)	48.	(a)
49.	(a)	50.	(d)	51.	(c)	52.	(a)	53.	(b)	54.	(a)	55.	(c)	56.	(d)
57.	(d)	58.	(∗)	59.	(d)	60.	(d)	61.	(a)	62.	(d)	63.	(a)	64.	(b)
65.	(b)	66.	(d)	67.	(a)	68.	(c)	69.	(b)	70.	(a)	71.	(b)	72.	(c)
73.	(b)	74.	(c)	75.	(a)	76.	(a)	77.	(d)	78.	(b)	79.	(c)	80.	(a)
81.	(d)	82.	(c)	83.	(a)	84.	(b)	85.	(b)	86.	(a)	87.	(d)	88.	(c)
89.	(a)	90.	(∗)	91.	(c)	92.	(d)	93.	(d)	94.	(d)	95.	(b)	96.	(c)
97.	(b)	98.	(a)	99.	(a)	100.	(d)	101.	(b, d)	102.	(c)	103.	(a)	104.	(d)
105.	(a)	106.	(a)	107.	(b)	108.	(d)	109.	(b)	110.	(b)	111.	(c)	112.	(d)
113.	(a)	114.	(c)	115.	(b)	116.	(c)	117.	(d)	118.	(a)	119.	(c)	120.	(b)
121.	(a)	122.	(c)	123.	(b)	124.	(a)	125.	(d)	126.	(b)	127.	(c)	128.	(a)
129.	(a)	130.	(c)	131.	(b)	132.	(d)	133.	(c)	134.	(b)	135.	(d)	136.	(d)
137.	(a)	138.	(b)	139.	(c)	140.	(a)	141.	(b)	142.	(c)	143.	(c)	144.	(d)
145.	(c)	146.	(a)	147.	(d)	148.	(a)	149.	(d)	150.	(c)	151.	(b)	152.	(c)
153.	(c)	154.	(b)	155.	(a)	156.	(d)	157.	(c)	158.	(a)	159.	(a)	160.	(b)
161.	(d)	162.	(c)	163.	(c)	164.	(a)	165.	(b)	166.	(d)	167.	(b)	168.	(a)
169.	(d)	170.	(d)	171.	(b)	172.	(a)	173.	(c)	174.	(d)	175.	(b)	176.	(a)
177.	(a)	178.	(d)	179.	(d)	180.	(c)	181.	(c)	182.	(c)	183.	(b)	184.	(a)
185.	(a)	186.	(c)	187.	(a)	188.	(b)	189.	(d)	190.	(d)	191.	(d)	192.	(a)
193.	(c)	194.	(a)	195.	(b)	196.	(b)	197.	(c)	198.	(c)	199.	(c)	200.	(b)

MADE EASY

Explanations

1. **(a)**

[110] direction in the unitcell is parallel to the face diagonal of unit cell.

3. **(d)**

German silver is an alloy of Nickel, Copper and Zinc.

4. **(c)**

Iron is FCC austenite at 910°C.

5. **(d)**

Babbit metal is an alloy of tin antimony and copper.

6. **(d)**

Griffith theory of failure is suitable far brittle material like glass.

7. **(b)**

Mild steel is an example of interstitial solid solution. In this case carbon dissolved in iron is an interstitial solid solution.

8. **(d)**

Bronze contains generally Cu(88%) and Sn(12%).

12. **(c)**

Ceramic compounds are more stable with respect to thermal and chemical environment than their components.

17. **(d)**

Dielectric strength can be reduced by impurities, cracks and pores.

21. **(c)**

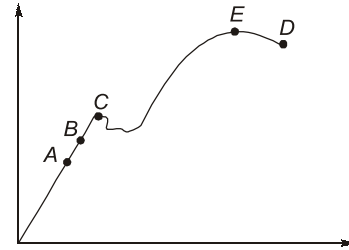Crystal structure of α-Iron is BCC (Body Centered Cubic).

22. **(a)**

A. Proportional limit
B. Elastic limit
C. Yield point
D. Fracture point
E. Ultimate stress

24. **(d)**

Creep is defined as time dependent deformation under constant stress, usually at elevated temperatures.

26. **(c)**

Flexural rigidity is defined as the resistance offered by a structure while undergoing bending.

27. **(d)**

Due to vibration dampening property of cast iron, it is commonly used for making machine tool bed.

30. **(b)**

By working at high strain rate, UTS of low carbon steel will decrease.

33. **(d)**

Cemented carbide cutting tool consist of fine particles of carbide cemented into a composite by a binder metal it commonly use tungsten carbide, titanium carbide or tantalum carbide as metal matrix combined by cobalt binder.

36. **(d)**

$d = 0.5$ mm; $t_c = 0.6$ mm; $U = 2$ m/s

$$r = \frac{t}{t_c} = \frac{V_c}{V}$$

$$\Rightarrow \quad V_c = \frac{t \times V}{t_c} = \frac{0.5 \times 2}{0.6}$$

$$= \frac{5}{3} = 1.66 \text{ m/s}$$

37. **(a)**

$d = t = 0.5$ mm, $\phi = 45°$, $V = 35$ mpm

Chip velocity,

$$V_c = \frac{V\sin\phi}{\cos(\phi - \alpha)} = \frac{35 \times \sin 45°}{\cos(45° - 15°)}$$

$$= \frac{35 \times \dfrac{1}{\sqrt{2}}}{\dfrac{\sqrt{3}}{2}} = 28.57 \text{ mpm}$$

39. **(b)**

Fast production speed is possible by using jigs and fixtures.

41. **(d)**

d = 40 mm; N = 300 rpm; T = 120 min

n = 1/7

$\because$ $\qquad V = \pi DN$

$\qquad\qquad = \pi \times 40 \times 10^{-3} \times 300$

$\qquad\qquad = 37.7 \text{ m/min}$

According to Taylor's tool life equation.

$\qquad\qquad VT^n = C$

$\qquad\qquad C = 37.7 \times (120)^{1/7}$

$\qquad\qquad = 74.7 \approx 75$

44. **(d)**

Life of single point cutting tool is influenced by velocity, feed and depth of cut.

49. **(a)**

In electrochemical machining, material removal rate is governed by Faraday's law.

51. **(c)**

Continuous chips are normally produced when machining steel or ductile metals at high cutting speed.

54. **(a)**

Material	Shrinkage allowance (mm/m)
Aluminium	18
Brass	14
Cast iron	7 - 10.5
Duralumin	13

55. **(c)**

For carbides, n = 0.2 to 0.4

For HSS, n = 0.08 to 0.2

56. **(d)**

Rake angle, $\qquad \gamma$ = 75°

Shear angle, $\qquad \phi$ = 22.8°

$$2\phi + \beta - \gamma = 90°$$

$$\beta = 90° + \gamma - 2\phi$$

$$= 90° + 75° - 2 \times 22.8°$$

$$= 165°$$

58. **(∗)**

Control limits $= \bar{P} \pm 3\sqrt{\dfrac{\bar{P}(1 - \bar{P})}{n}}$

61. **(a)**

In explosive forming there is large set-up cost.

63. **(a)**

Kerosene is used as dielectric fluid in electro discharge machining.

67. **(a)**

A comparator is precision instrument used to compare the dimensions of a given workpiece component with the actual working standards.

72. **(c)**

The collection of feasible solution constitute a convex set.

73. **(b)**

Resources are limited for linear programming problems.

74. **(c)**

Assembly line balancing does not reduce the work content.

77. **(d)**

North west method yields the best initial basic feasible solution of a transportation problem.

78. **(b)**

For A class items, no safety stock is kept.

79. **(c)**

$$EOQ = \sqrt{\frac{2DC_0}{C_h}}$$

$$Q \propto \sqrt{C_0}$$

So, $\qquad Q' = \sqrt{2} \cdot Q$

$\qquad\qquad = 1.414 Q$