

# **THE INDIAN INSTITUTE OF WELDING**

## **Associate Membership Examination**

**Summer Session, June 2021**

**Sub: Physics (AM-102)**

Full Marks: 100

Time: 3 hours

Pass Marks: 40

**Answer Q.No.1 and any eight from the rest**

**Answer any ten from Q.No.1**

**Parts of a question should be answered at one place**

1. Select the correct alternatives from the following

- a) The period of oscillation of a simple pendulum when immersed in water from air  
a) increases    b) Decreases    c) Remains same    d) Oscillates
- b) If  $l_1$  and  $l_2$  be the sizes of the images of an object for two conjugate positions of the lens, the object size is  
a.  $l_1 l_2$     b.  $\sqrt{l_1 l_2}$     c.  $\sqrt{l_1/l_2}$     d.  $\sqrt{l_2/l_1}$
- c) A spring of force constant  $K$  is cut into three equal pieces, spring constant of each piece will be  
a)  $K/3$                       b)  $K$                       c)  $3K$                       d)  $K/\sqrt{3}$
- d. Path difference between two light beams produced from the same monochromatic source acquiring phase difference of  $\lambda/2$  is  
a.  $\lambda$                       b.  $\lambda/2$                       c.  $2\lambda$                       d.  $\lambda/4$
- e) In a double slit experiment if the widths of the slits are in the ratio 1:9, the ratio of intensities of the minima to maxima is  
a) 1:3                      b) 1:9                      c) 1:4                      d) 1:8
- f. Alternating current is converted to direct current by  
a. dynamo    b. rectifier    c. transformer    d. inverter

- g) A.C. can be measured with the help of
- a) Moving coil galvanometer
  - b) Hot wire voltmeter
  - c) Hot wire ammeter
  - d) Tangent galvanometer
- h) Power factor is one for
- a) Pure inductor
  - b) Pure capacitor
  - c) Pure resistor
  - d) Either of inductor or capacitor
- i) If the frequency of ac supply increases the impedance of an L-C-R series circuit
- a. increases
  - b. decreases
  - c. remains same
  - d. first increases then decreases
- j) 5A current flows through a circular coil of radius 5cm having 200 turns. The magnetic field at the centre of the coil in A/m is
- a) 10
  - b)  $10^2$
  - c)  $10^3$
  - d)  $10^4$
- k. A good choke coil should have
- a. low inductance, high resistance
  - b. low resistance, high inductance
  - c. low resistance, low inductance
  - d. high resistance, high inductance
- l) Spherical aberration of a thin lens can be reduced by
- a) Increasing the size of lens
  - b) Decreasing the size of lens
  - c) using annular mask over the lens
  - d) using doublet combination
- m. Two waves of intensities I and 4I produce interference, the intensities of dark and bright spots will be
- a. 3I, 5I
  - b. 1.5I, 2.5I
  - c. 9I, 25I
  - d.  $\sqrt{3}I$ ,  $\sqrt{5}I$
- n) Light propagates through optical fiber by
- a) Double refraction
  - b) Partial refraction
  - c) Total internal reflection
  - d) Full refraction
- o. Phase difference introduced to the light reflected from a glass plate coming from air is
- a.  $\pi/2$
  - b.  $\pi$
  - c.  $2\pi$
  - d. 0

2. a. Explain with neat diagram lateral and longitudinal chromatic aberrations. 3<sup>1/2</sup>+3<sup>1/2</sup>+3
- b. How it be minimized with a system of two thin lenses I) of different materials and II) of same material
3. a) Sketch the ray diagram and explain how alternate dark and bright rings are produced in Newton's ring set up. 2+3
- b) The diameter of 10th dark ring produced by reflected light in Newton's ring experiment is 5mm with green light of wave length 500mm, find the radius of curvature of the plano-convex lens. When a liquid is introduced between the plane and curved surface it is changed to 5.5 mm. What is the refractive index of the liquid. 3+2
4. a. Write down the condition for sustained interference. 3+3+4
- b. Explain with neat diagram how coherent sources are produced in Lloyd's mirror experiment.
- c. A Lloyd's mirror of length 5cm illuminated with red light of wavelength  $\lambda=600$  nm from a slit 0.1mm above the mirror plane. Calculate the fringe width on a screen 100cm from the slit.
5. a. How do you distinguish between interference and diffraction fringes? State the conditions to produce Fraunhofer diffraction pattern in laboratory. 2+2
- b. Show that a grating with 5000 lines/cm can not give 4th or higher order diffraction fringes when illuminated with Na-light ( $\lambda=5890\text{\AA}$ ) 3
- c) Calculate the minimum number of lines a plane transmission grating should have to resolve the Na D-lines ( $\lambda_1 = 5890\text{\AA}$  and  $\lambda_2 = 5896\text{\AA}$ ) in 1st order. 3
6. a. Explain mathematically that a circularly polarized light is the combination of two linearly polarized light of same amplitude. 3+4+3
- b. Write the principle of Babinet compensator.
- c. Determine the thickness of a half wave plate for yellow light of wavelength  $\lambda= 5000\text{\AA}$ . Refractive indices of O-ray and e-ray in the crystal are 1.544 and 1.555 respectively.

7. a) How will you differentiate between a plane polarized and circularly polarized light ? State the conditions to get circularly polarized light in a birefringent crystal. 2+2
- b) Calculate the thickness of the quartz slab that will produce circular polarization in Na - light of wavelength ( $\lambda = 5890 \text{ \AA}$ ). Refractive index in quartz for e-ray  $\mu_e = 1.553$  and o-ray  $\mu_o = 1.544$ . 3
- c) State the working principle of bi-quartz polarimeter. 3
8. a. In an optical fibre the refractive index of the core material is 1.43 and that of the cladding is 1.4. Find the propagation angle and the numerical aperture of the fibre. 3+2+5
- b. Explain the necessity of the cladding in an optical fibre.
- c. Describe the application of optical fibre as intensity modulated temperature sensor.
9. a) Compare an A.C. circuit with a vibrating spring. Use this analogy to determine impedance of the A.C. circuit. What will be the value of impedance at resonant condition ? Find the resonant frequency. 2+1+1+2
- b) Show that energy loss in a period is equal to the average work done against friction in damped vibration. 4
10. a. State Biot Savart's Law and use it to find the magnetic field on the axis of a narrow circular coil. (2+4)+4
- b. Two straight conductors each 10cm long are parallel to one another and separated by a distance of 10cm. They carry current of 30A and 40A in opposite directions. Calculate the force on each wire.
11. a) Draw phasor diagram of an L-C-R series circuit. Find impedance triangle from it. Determine the expression for impedance, phase angle and resonant frequency from it. 1+1+3
- b) Calculate resonant frequency and quality factor of a series L-C-R circuit with  $R = 1\text{K}\Omega$ ,  $L = 100 \text{ mH}$ ,  $C = 10\text{pF}$ . Also find power factor at resonance. 2+2+1
12. a. Draw the phasor diagram of a series L-C-R circuit and determine its impedance from it. 4+4+2
- b. Solve it to find the power factor.
- c. At what condition power factor will be minimum ?

13. a) An iron ring of mean radius 10 cm is wound uniformly with 200 turns by insulating wire carrying current 2A. Cross section of iron is 10 sq. cm and permeability 1000. Find reluctance and hence magnetic flux density. What will be the flux density if iron is replaced by wood? 2+2+1
- b) Why soft iron is preferred in designing electromagnet? 2
- c) What is eddy current? What measures do you take to reduce it? 1+2

# THE INDIAN INSTITUTE OF WELDING

## Associate Membership Examination

### Summer Session, 2021

#### Sub : Testing & Quality Assurance (AME - 201)

Full Marks : 100

Pass Marks : 40

Time : 3 Hours

**Answer any 5 questions.**

**All question carries 20 marks. All the parts of a question carry equal marks.**

**(20X5)**

1. a) What is Quality Management System? Explain its components.  
b) Explain and compare Quality Assurance, Quality Control and Cost of Quality.
2. a) What is the principle of Brinell hardness test? Explain the differences between Brinell and Rockwell hardness tests.  
b) Draw the creep curve for single specimen at a fixed temperature and show various stages of creep on this curve. What is the significance of these stages?
3. a) Draw the sketches of following welding defects and briefly explain the effect of each of these defects  
i) undercut, ii) overlap, iii) excessive reinforcement, iv) incomplete penetration and v) porosity  
b) Provide source, appearance and remedy of following defects observed in case of Resistance Spot welding  
i) indentation, ii) metal expulsion and iii) porosity / void
4. a) Explain the working methodology and use of following probes in ultrasonic testing  
i) normal probe, ii) angle probe and iii) pitch catch  
b) Discuss what is meant by A, B and C scan in the context of ultrasonic testing.
5. Write short notes on any four of the following:  
a) Statistical Quality Control  
b) Positive material Identification  
c) P-Chart  
d) OC Curve  
e) Sampling Inspection
6. a) What type of load is to be considered in flyover / bridges to carry heavy traffic? Name the type of destructive test for above application.  
b) For welding procedure qualification, which type of test is recommended NDT or DT and why?  
c) What are the advantages of ultrasonic examination over radiographic examination?  
d) Reason out why both a surface and a volumetric NDE method specified for critical welds.

7. a) Draw a neat sketch of the notched specimen for Charpy impact test. How is the test conducted at different temperatures?  
b) Explain what is meant by fatigue during cyclic loading. Bring out the mechanism of fatigue crack growth.
  
8. a) Define with examples Process Control, Inspection and Examination.  
b) Differentiate between Standards, Codes, Regulations and Specifications.



# THE INDIAN INSTITUTE OF WELDING

## Associate Membership Examination

2021

### Sub: Welding & Allied Processes-I (AME-104)

Full Marks: 100

Pass Marks: 40

Time : 3 Hours

#### Answer any five

#### Parts of a question should be answered at one place

- 1 Answer all of the following: 8x2.5
  - a. What is the function of chipping hammer and safety shoe?
  - b. Define role of flux in soldering.
  - c. Name the welding process for which constant voltage (CV) type power sources are mostly preferred.
  - d. Is RSW is a fusion welding? Comment on it.
  - e. Mention limitations of MIG and TIG welding.
  - f. Mention the types of SAW processes.
  - g. Name two welding processes you mostly preferred for aluminium welding and why?
  - h. What are the functions of flux coating on electrode?
- 2
  - a. How can you recognize C<sub>2</sub>H<sub>2</sub> and O<sub>2</sub> cylinder? Describe brazing process with suitable diagram and discuss its advantages and limitations. 10+10
  - b. What is "open circuit voltage"? What is "duty cycle" with reference to a welding power source? What does 60% duty cycle at 400 A mean?
- 3
  - a. Differentiate between solid state and fusion welding process. 5+10+5
  - b. How shielding provide in MMAW, GMAW, FCAW and SAW? Describe different types of flux.
  - c. What is magnetic arc blow? State three methods for reducing it.
- 4
  - a. Describe temperature distribution in arc. 5+5+10
  - b. Compare the application areas with DCSP, DCRP and AC with valid reason.
  - c. Describe types of defects observe in welding.
- 5
  - a. In GTAW process, the arc voltage is 26 Volts, the arc current is 250 Amperes, voltage drop at cathode and anode are 10 and 6 volts respectively and 75% of the arc column energy is untransferred. The work function for Tungsten is 4.5eV and Boltzmann's constant = 8.62x10<sup>-5</sup> eV/K. Find out the arc efficiency. 5+10+5
  - b. Define welding arc? Explain the mechanism of arc initiation and its maintenance.
  - c. How GTAW and GMAW differentiated from each other on the basis of process, parameters, equipments, uses and applications ?
- 6
  - a. Describe types of "Metal Transfer" in GMAW with suitable schematic diagram. 10+10
  - b. What is the difference between solid and flux cored filler wire? Explain in detail the working principle of FCAW process.
- 7 Write short notes on **any four** from the following: 4x5
  - a. Pulsed GTAW.
  - b. Soldering.
  - c. Inverter based power sources.
  - d. Safety measures in SMA welding.



# THE INDIAN INSTITUTE OF WELDING

## Associate Membership Examination

### Summer Session, 2020-21

**Sub : Computational Method & Computer Programming (AME - 18)**

Full Marks : 100

Pass Marks : 40

Time : 3 Hours

**Answer any five**  
**Parts of a question should be answered at one place**

1. a. What are different symbols used in a flow chart?  
b. Give an example of pointer in C program. How is multi dimensional array represented in C?  
c. Discuss about ASCII, EASCII and UNICODE.  
d. Briefly state different output devices of a computer. **(5+5+5+5)**
  
  2. a. Write a C program to find out factorial of a given number.  
b. What are the differences between an application software and a system software?  
c. Write a C program to compute compound interest of a given sum of money. **(8+5+7)**
  
  3. a. Find the sum of first n terms of a series:  $1^2 + 2^2 + 3^2 + \dots + n^2$ , when  $n > 0$ .  
b. Write a C program to check whether a given no is a prime number or not.  
c. Write a C program to find out maximum and minimum of some given numbers. **(8+6+6)**
  
  4. a. Write a C program to find average of some given numbers.  
b. What are the advantages and disadvantages of arrays in C language? Give examples.  
c. Write a C program to find out whether a given number is EVEN or ODD. **(7+7+6)**
  
  5. a. What is Break in C programming? Give an example code where Break is used.  
b. What are the differences between machine level, assembly level and high level languages?  
c. Write the functions of input devices of any PC. **(6+8+6)**
  
  6. a. Convert the following Nos.  
i)  $1001_2$  to octal, ii)  $C8_H$  to binary, iii)  $63_D$  to Hexadecimal.  
b. Give a brief discussion on DOS.  
c. Write a C programme to sum up two 4X4 matrices. **(9+3+8)**
  
  7. Write short notes on **any four** from the following: **(4x5= 20)**
    - a. Compilers
    - b. LINUX Operating System
    - c. Internet browser and www
    - d. Functions in C language
    - e. Types of memory of a computer
    - f. AND and OR Logic Gates
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# THE INDIAN INSTITUTE OF WELDING

## Associate Membership Examination

2021

Sub: Material Science (AME-101)

Full Marks: 100

Pass Marks: 40

Time : 3 Hours

**Answer question 1 & 7 and any 3 questions from among the rest questions.  
Parts of a question should be answered at one place**

- 1 Answer all of the following: 8x2.5
  - a. What is the difference between Unit cell and a Primitive cell?
  - b. Explain the eutectic and eutectoid reaction with examples.
  - c. Draw the followings;  $[110]$ ,  $[132]$ ,  $[10\bar{1}]$ ,  $(202)$ ,  $(230)$ .
  - d. Define hardness, resilience and toughness.
  - e. Draw an engineering stress strain diagram of cast iron and Rubber in a single diagram.
  - f. Differentiate between trans-granular and inter-granular propagation of crack diagrammatically.
  - g. Define advantages and limitations of ceramic.
  - h. Classify polymer.
- 2
  - a. Define crystalline imperfections (point, line and volume defects) with suitable diagram. 15+5
  - b. Calculate the radius of a vanadium atom, given that vanadium has a BCC crystal structure, a density of  $5.96\text{g/cm}^3$  and atomic weight of  $50.9\text{g/mol}$ .
- 3
  - a. What is the difference between engineering stress-strain and true stress-strain diagram for metals. Schematically, draw such diagrams for mild steel and copper, explaining the various regions in the diagrams. 10+5+5
  - b. Derive the relation between engineering strain and true strain.
  - c. Define critical resolved shear stress, and derive the expression relating this and the applied stress.
- 4
  - a. Draw a schematic Fe-C phase diagram and indicate temperatures, C compositions, phases and reactions. 10+5+5
  - b. What is stainless steel? Classify stainless steel.
  - c. State the difference between steel and cast iron.
- 5
  - a. Define and classify hardness testing methods. 5+5+10
  - b. Explain Vickers Hardness test in details.
  - c. Why fatigue testing is important. What information we can get from S-N curve? Discuss some factors that affect fatigue life of a metal.
- 6
  - a. Explain the properties, process of making and molecular structure of thermoplastic and thermosetting polymers. Give examples. 10+5+5
  - b. Explain Polymorphism.
  - c. Define polymer composite. Mention some applications of polymer composite material.
- 7 Write short notes on any four from the following: 4x5
  - a. Point defects in ceramics.
  - b. Recovery, recrystallization and grain growth.
  - c. Fatigue endurance.
  - d. Impact toughness testing.

# THE INDIAN INSTITUTE OF WELDING

## Associate Membership Examination

Summer Session, June 2021

Sub: Welding & Allied Processes-II (AME-203)

Full Marks: 100

Time: 3 hours

Pass Marks: 40

Answer **any five (5)** questions

Parts of a question should be answered at one place

1. Illustrate the differences between GMAW & SAW on the basis of following parameters 10 + (2 X5)= 20
  - i) Working principle with neat sketch
  - ii) Mode of metal transfer
  - iii) Electrode used
  - iv) Heat input and its consequence
  - v) Efficiency
  - vi) Applications
  
2. a) What do you mean by carbon-arc cutting and metal arc cutting? State the working principles of each with specific applications.  
b) State working principle of LASER cutting. Describe the advantages and applications of it. 10 + 10 = 20
  
3. a) Classify various brazing processes on basis of heat applied on it. Discuss the salient feature of working method of each type. Indicate application area of each type of brazing. 14  
b) What are the various metals and alloys use as filler materials in brazing? Give their applications. 6
  
4. a) Define cladding. Name different methods by which cladding can be performed. What is the difference between cladding and coating? What are the applications of cladding?  
b) With the help of sketch show different welding positions like i) 4G, ii) 6G, iii) 1F  
c) Discuss briefly the phenomena related with gas cutting method:
  - i) Back fire, ii) reverse flow, iii) sustained back fire, & iv) flash back. 2+2+1+2+6+7=20

5. a) Describe working principle of resistance welding processes. What are the process variables like current, pressure, weld time, hold time, squeeze time and off time on the nugget formed during resistance spot welding? Discuss different problems may arise during resistance spot welding of G.I. sheet.
- b) Explain fundamental differences between solid state welding and fusion welding.
- c) Explain the differences between welding, soldering and brazing.

$$3+6+2+4+5=20$$

6. Write working principles, advantages, disadvantages and applications of following welding processes

$$4 \times 5 = 20$$

- i) Explosive welding
- ii) Ultrasonic welding
- iii) Magnetic pulse welding
- iv) Stud welding

7. a) Discuss working principle of electron beam welding. Elaborate the differences among laser, electron beam & plasma welding with respect to energy, joint preparation and applications.

- b) What do you mean by metal spraying? What are the utility? Compare among spray with powder, plasma spraying, and arc spraying and flame spraying.

$$4+6+1+1+8=20$$

8. a) Define mechanization, automation and robotisation in the field of welding.  $4 \times 5 = 20$
- b) What do you mean by narrow gap welding? Describe narrow gap welding process.
- c) Describe orbital welding done by MIG/Mag welding process. What is its utility?
- d) Depict how the sensors are becoming essential part of automatic/robotic welding.

# THE INDIAN INSTITUTE OF WELDING

## Associate Membership Examination

Summer Session, June 2021

### Sub: Weldment Design & Weld Procedure (AME-23)

Full Marks: 100

Time: 3 hours

Pass Marks: 40

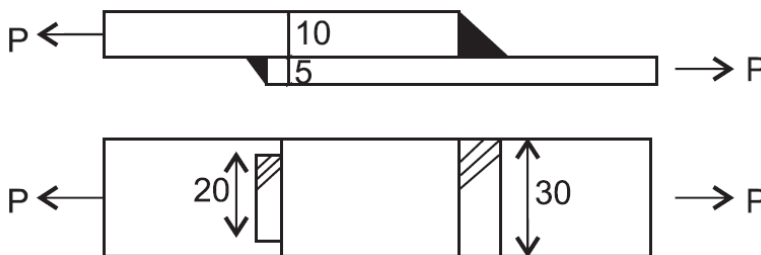
Answer **any five (5)** questions

Parts of a question should be answered at one place

All question carries 20 marks. All the parts of a question carry equal marks.

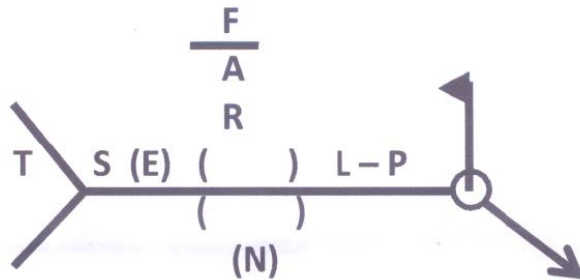
1. a) State what the following codes stand for (full and correct description 2 marks each, short description 1 mark each):
  - i) ISO 5817
  - ii) ISO 9712
  - iii) ISO 15607
  - iv) ISO 3834-2
  - v) IS 7307 (Part I)
  - vi) ASME BPVC Section II Part C
  - vii) ASME BPVC Section VIII Division I
  - viii) ASME B31.3
  - ix) API Standard 1104
  - x) AWS D1.3/D1.3M

2. a) Consider the following joint with dimensions in mm. The fillet welds on either plate are of unequal lengths. Given that the permissible stresses in both the fillets are the same, find the maximum permissible load, if the allowable stress is 10 kg/mm<sup>2</sup>.



- b) Discuss the option for reducing stress concentration in a weld joint between two pipes of wall thicknesses 15 and 25 mm, if their diameters are i) equal and ii) the diameter of the 25 mm thick pipe is greater by 5 mm.
3. Explain with sketches:
    - a) Full penetration and partial penetration butt joints with reinforcement.
    - b) Principal and shear stress as shown in Mohr's circle.
    - c) Fillet weld showing i) actual throat, ii) effective throat, iii) theoretical throat and iv) reinforcement. Which throat should be considered for strength calculations?
    - d) One 500 mm X 250 mm x 12 mm thick plate and one 750 mm x 150 mm x 10 mm thick plate are welded with lap joints having two parallel and one transverse fillet welds. Explain with plan and elevation views.
  4. Write short notes on any four of the following:
    - a) Welding of Aluminium

- b) Preheating and Post weld heat treatment of welds
  - c) WPS and PQR
  - d) Welding Operator Performance Qualification as per ASME Section IX
  - e) NDT of weldrepair
5. a) On the following weld symbol sketch, the standard letters to indicate specific weld related directives to be followed. Elaborate the specific meaning and directive of each letter and the reference line. Also, state the meaning of the circle at the junction of the arrow bend and the flag at the same junction.



- b) State and explain with examples from design point of view the different types of loading and different types of condition a weldment may be subjected to.
6. a) What is weldability of a metal?  
 b) What is carbon equivalent? How can you measure and indicate the CE value of a metal?  
 c) What is dilution? How do you calculate dilution of metals of different compositions?  
 d) Explain how weldability, carbon equivalent and dilution are connected in welding.
7. a) What is residual stress? State the main cause of developing residual stress in a weldment.  
 b) Explain with diagrams to show the distribution of residual stress in a butt joint.  
 c) What are macro, micro and sub-micro stress in a weldment? What are their effects?  
 d) State different methods of stress relieving.
8. a) State and explain different types of variables used to establish a WPS in accordance with ASME Section IX.  
 b) While qualifying a welding procedure, describe the visual examinations to be carried out before, during and after welding.

# **THE INDIAN INSTITUTE OF WELDING**

## **Associate Membership Examination**

**Summer Session, June 2021**

### **Sub: Economics of Welding & Fabrication (AME-106)**

Full Marks: 100

Time: 3 hours

Pass Marks: 40

Answer **any five (5)** questions from the followings.

Parts of a question should be answered at one place

1. a) Explain the importance of Law of Demands. Is there any exception to the Law of Demands ? Explain briefly 10  
b) Distinguish between extension of Demand & increase in Demand 10
2. a) Describe the importance of demand forecasting. How many types of demand forecasting are there based on time period and level of forecast ? 10  
b) What is price discrimination ? What are the essential conditions for price discrimination ? 10
3. a) What is Opportunity Cost ? Gives some examples of Opportunity Cost. How are these Costs relevant for managerial decisions ? 10  
b) Describe Break-even point with the help of diagram and its uses in business decision making. 10
4. a) What is difference between Normal goods and inferior goods? How will the demand for goods changes if price of substitute falls. 10  
b) Distinguish between Contraction in Demand and Decrease in Demand. 10
5. a) What factors are to be considered before fixing price ? Explain the price in strategy. 10  
b) What do you mean by process of Book keeping ? What are the objectives of Accounting ? 10



6. a) Define the features of Money Market. Distinguish between Capital Market and Money Market. 10
- b) What is Working Capital ? What factors are to be considered while estimating Working Capital ? 10
7. a) Describe break even point with the help of diagram & its uses in business in decision making 10
- b) consider the following data and suggest the optimum production mix when plant capacity is 20,000 hrs. 10

	Product X	Product Y
Market demand	3,000 units	3,600 units
Selling price/unit	400	600
variable cost / unit	250	400
Production time/hr.	4	5

8. Write short notes : (answer any four) 5x4
- a) **Steps of estimating inspection and testing of weld**
- b) **Cost of qualification of welder and procedure**
- c) **Parameters to be consider for setting up welding shop**
- d) **Oligopoly & diopoly**
- e) **Capital market & money market**

# THE INDIAN INSTITUTE OF WELDING

Associate Membership Examination

Summer Session, JUNE 2021

Sub : Engineering Economics (AME -17 )

Full Marks: 100

Time: 3 Hours

Pass Marks: 40

Answer any five questions from the following. All questions bears equal marks(a=b, a+b=20)

Parts of question should be written in one place

1. a) What is Cross Elasticity of Demand ? Describe various types of Cross Elasticity of Demand with some examples.
- b) On the basis of following information given in the table compute the Price Elasticity of demand when price rises from Rs.5 per kg to Rs. 7 per kg.

Price per kg (Rs.)	Expenditure (Rs.)
Rs.5.00	Rs.15,000
Rs.7.00	Rs.7,000
Rs.8.00	Rs.0
Rs.4.00	Rs.16,000

2. a) Explain Income demand. How Income demand will affect the following ?
    - i) Demand for normal goods
    - ii) Demand for inferior goods
    - iii) Demand for substitute goods
  - b) Distinguish between extension of Demand & increase in Demand
3. a) What is difference between Normal goods and inferior goods? How will the demand for goods changes if price of substitute falls.
  - b) Distinguish between Contraction in Demand and Decrease in Demand.

4. a. Explain and illustrate the differences between return to a variable factor and returns to scale.  
b. Explain the relationship between.  
i) MC and TC ii) AC, AVC & AFC.
5. a. What is monopolistic competition ? Explain its importance features.  
b. Compare and contrast between Perfect competition & Monopolistic competition
6. a) What factors are to be considered before fixing price ? Explain the price in strategy.  
b) What do you mean by process of Book keeping ? What are the objectives of Accounting ?
7. a. Explain the meaning of business capital. Enumerate any five methods of long term finance of the company. Discuss any one of them in details.  
b. Differentiate between :  
i) Capital Market & Money Market  
ii) Primary & Secondary Market
8. a) Managerial Economy is a multi dimensional discipline. Explain.  
b) Discuss the scope of Managerial Economy

# THE INDIAN INSTITUTE OF WELDING

## Associate Membership Examination

Summer Session, 2021

Sub : Occupational Health & Safety in Welding (AME - 205)

Full Marks : 100

Pass Marks : 40

Time : 3 Hours

Parts of a question should be answered at one place

Answer Question no.12 (20 marks) and any 8 Questions (10 marks each) from the rest.

All the parts of a question carry equal marks.

1. a) Write short notes on
  - i) ILO
  - ii) Factories Act 1948
  - iii) ISO 45001
  - iv) National Safety Council, India
2. What is Occupational Hazard? Describe classification of Occupational Hazards with three examples each.
3. Discuss all the major elements of working environment which are responsible for workplace incidents or accidents, and how to mitigate the risks.
4. a) What is Industrial Safety? Explain the terms risk, hazard, and safety.  
b) Name the main hazards in welding and describe general safety guidelines during welding.
5. a) What is PPE? Name all the PPEs which should be used during welding.  
b) What is a Confined Space? What considerations are required during welding in a Confined Space?
6. a) What is welding smoke and its elements? Discuss about the carcinogenic particulates present in welding smoke.  
b) Explain health hazards due to welding fumes for short-term exposure and long-term exposure. Also explain short term-effect and long-term effect due to welding fumes.
7. Discuss in detail the sources of fumes and gas hazards in welding.
8. a) What is fire triangle? Explain with examples.  
b) What are the different types of Fire Extinguishers and their uses?
9. a) What are the sources of electrical hazards in welding? Explain the response required for an electrical shock.  
b) What is First Aid? Explain the 3Ps in First Aid.

10. a) What are the nonionizing radiations due to welding and its effect in human body?  
b) What is musculoskeletal disorder? Discuss objectives and problems of ergonomics.
11. a) What is flashback arrestor? Discuss in detail the safety measures to be taken during gas cutting.
12. Fill in the blanks / complete the sentence as required (any ten):
- i) When using a Fire Extinguisher to extinguish a fire, it should be \_\_\_\_\_.
  - ii) Vaporized metals, such as zinc, cadmium, lead, chromium and beryllium \_\_\_\_\_.
  - iii) One should never enter a welding shop without wearing \_\_\_\_\_.
  - iv) One should never cut or weld directly against \_\_\_\_\_.
  - v) The form used to provide about the hazardous information of a product is called a \_\_\_\_\_.
  - vi) The welding procedure which is safe to perform in wet conditions is \_\_\_\_\_.
  - vii) In case of flashback during cutting, immediately shut the \_\_\_\_\_.
  - viii) The most important reason why all accidents should be investigated and recorded is to \_\_\_\_\_.
  - ix) Safe Oxygen level range in air for human is \_\_\_\_\_.
  - x) During cutting, oxygen and fuel gas cylinders must be kept in \_\_\_\_\_.
  - xi) Ear plugs are used where the noise level reaches or exceeds \_\_\_\_\_.
  - xii) OSHA proposed an 8-hour TWA (Time Weighted Average concentration) of welding fumes, measured as total particulate inside the welder's breathing zone, as \_\_\_\_\_.

# THE INDIAN INSTITUTE OF WELDING

## Associate Membership Examination

Summer Session, June 2021

### Sub: Strength of Materials (AME-102)

Full Marks: 100

Time: 3 hours

Pass Marks: 40

Answer **Question No. 1** and **any four (4)** questions from the followings.

Parts of a question should be answered at one place

1. Attempt **any ten** questions with proper explanation with proper sketch, if necessary
  - i) What do you mean by true stress of a material? How it is related with FOS?
  - ii) Define malleability of a material. Comment on malleability of cast iron.
  - iii) What do you mean by torsional rigidity?
  - iv) What is the Euler's critical load for a column that's one end hinged and other end fixed?
  - v) State mathematical relation between Y and G.
  - vi) What is the utility of Mohr's Circle diagram?
  - vii) Define polar moment of inertia.
  - viii) What do you mean by thin cylinder? What is the relation between circumferential stress and longitudinal stress for a thin cylinder?
  - ix) The shear force diagram of a simply supported beam looks like a trapezium. Comment on the nature of load applied on the beam.
  - x) State theory of simple bending.
  - xi) What do you mean by long and short columns as per Euler's Theory?
  
2. a) With the help of labeled sketch explain significant points in stress-strain curve for a ductile material and brittle material. 10  
b) Write short notes on 4 X 2.5= 10
  - i) Poisson's ratio
  - ii) Principal stress
  - iii) Bulk modulus
  - iv) Statically indeterminate problem
  
3. A circular copper rod of 20 mm diameter is surrounded by a steel tube having 30 mm of external diameter and 25 mm internal diameter. The rod and the tube have

equal lengths and their both ends are rigidly fixed at temperature of  $22^{\circ}\text{C}$ . calculate stress developed in each member (i.e. the rod and the tube) when the temperature rises to  $122^{\circ}\text{C}$ . 20

Given, co-efficient of thermal expansion of copper =  $17 \times 10^{-6}/^{\circ}\text{C}$

co-efficient of thermal expansion of steel =  $12 \times 10^{-6}/^{\circ}\text{C}$

$E_{\text{Copper}} = 1 \times 10^5 \text{MPa}$

$E_{\text{Steel}} = 2.2 \times 10^5 \text{MPa}$

4. a) How will you find stress of a member subjected by twisting force? With proper discussion derive the formula. 10
- b) A solid circular shaft of a diameter 'x' can transmit maximum power of 320kW when rotating at 110 rpm. If the shear stress of the shaft material is not exceed 85 MPa, find x. Find also the percentage saving of weight if the solid shaft is replaced by a hollow shaft having internal diameter is equal to 0.7 times the external diameter, if the length, material and shear stress of solid and hollow shafts are assumed to be same. 10
5. a) Draw the bending moment and shear force diagram of the beam loaded as shown in Fig.1. Show the point of contra flexure and maximum bending moment. 10

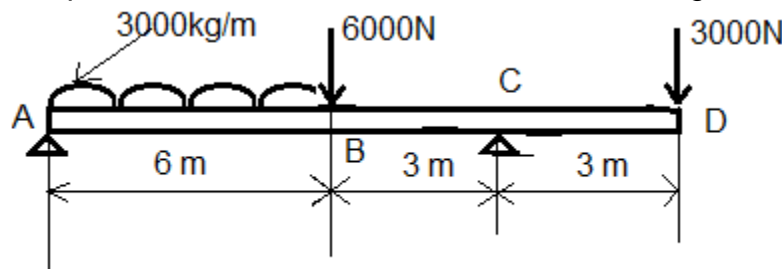


Fig.1

- b) If in problem number 5a) the cross section of beam is taken as 50 x 50 sq mm, find out bending stress corresponding to maximum bending moment. Also show the stress distribution across the solid cross section of the beam. 10
6. a) Derive an expressions for circumferential and longitudinal stresses for a thin cylinder shell of internal diameter 'd' and wall thickness 't' subjected to internal fluid pressure P. Assume efficiencies of circumferential and longitudinal joints are different. 10
- b) A thin cylindrical boiler having internal diameter of 1m, thickness of 12 mm can withstand the permissible stress of 90 MPa. The efficiencies of longitudinal and circumferential joints are 60% and 45% respectively. Calculate, 10
  - i) Permissible steam pressure of the boiler
  - ii) Longitudinal and circumferential stress developed in boiler plate.
7. a) A 2D state of stress of a point is given by 10

$$\sigma_x = 100 \text{MPa}, \sigma_y = 10 \text{MPa} \text{ and } \gamma_{xy} = \pm 30 \text{MPa}$$

Using Mohr's circle diagram or stress transformation equation find the principal stresses at that point. Find also the orientation of principal planes.



b) A bar of 20mm diameter is subjected to a pull of 50kN. The measured extension over a gauge length of 20 cm is 0.1mm along with change in diameter of 0.0035 mm. calculate Poisson's ratio and the Young's modulus if the elasticity is E. 10

8. a) State and explain moment area theorem for the estimation of slope and deflection of a beam. 5

b) A cantilever beam of length L is subjected to linearly varying load with intensity zero at free end and maximum 'w' at fixed end of the beam. The flexural rigidity of the beam is assumed to be same at every cross section, find the maximum deflection and slope of the beam at the mid span. 10

c) A cantilever of 5m span is subjected to a uniformly distributed load of 10kN/m throughout the span. find out the dimension of rectangular cross section of beam, if the permissible flexural stress for the beam material is 12 MPa. Assume width: depth of beam cross section is 1:2.5. 5

# THE INDIAN INSTITUTE OF WELDING

## Associate Membership Examination

Summer Session, June 2021

Sub: Welding & Allied Processes-II (AME-22)

Full Marks: 100

Time: 3 hours

Pass Marks: 40

Answer **any five (5)** questions

Parts of a question should be answered at one place

1. Illustrate the differences between GMAW & SAW on the basis of following parameters 10 + (2 X5)= 20
  - i) Working principle with neat sketch
  - ii) Mode of metal transfer
  - iii) Electrode used
  - iv) Heat input and its consequence
  - v) Efficiency
  - vi) Applications
  
2. a) What do you mean by carbon-arc cutting and metal arc cutting? State the working principles of each with specific applications.  
b) State working principle of LASER cutting. Describe the advantages and applications of it. 10 + 10 = 20
  
3. a) Classify various brazing processes on basis of heat applied on it. Discuss the salient feature of working method of each type. Indicate application area of each type of brazing. 14  
b) What are the various metals and alloys use as filler materials in brazing? Give their applications. 6
  
4. a) Define cladding. Name different methods by which cladding can be performed. What is the difference between cladding and coating? What are the applications of cladding?  
b) With the help of sketch show different welding positions like i) 4G, ii) 6G, iii) 1F  
c) Discuss briefly the phenomena related with gas cutting method:
  - i) Back fire, ii) reverse flow, iii) sustained back fire, & iv) flash back. 2+2+1+2+6+7=20

5. a) Describe working principle of resistance welding processes. What are the process variables like current, pressure, weld time, hold time, squeeze time and off time on the nugget formed during resistance spot welding? Discuss different problems may arise during resistance spot welding of G.I. sheet.
- b) Explain fundamental differences between solid state welding and fusion welding.
- c) Explain the differences between welding, soldering and brazing.

$$3+6+2+4+5=20$$

6. Write working principles, advantages, disadvantages and applications of following welding processes

$$4 \times 5 = 20$$

- i) Explosive welding
- ii) Ultrasonic welding
- iii) Magnetic pulse welding
- iv) Stud welding

7. a) Discuss working principle of electron beam welding. Elaborate the differences among laser, electron beam & plasma welding with respect to energy, joint preparation and applications.

- b) What do you mean by metal spraying? What are the utility? Compare among spray with powder, plasma spraying, and arc spraying and flame spraying.

$$4+6+1+1+8=20$$

8. a) Define mechanization, automation and robotisation in the field of welding.  $4 \times 5 = 20$
- b) What do you mean by narrow gap welding? Describe narrow gap welding process.
- c) Describe orbital welding done by MIG/Mag welding process. What is its utility?
- d) Depict how the sensors are becoming essential part of automatic/robotic welding.

# THE INDIAN INSTITUTE OF WELDING

## Associate Membership Examination

2021

### Sub: Advanced Welding Technology (AME-24)

Full Marks: 100

Pass Marks: 40

Time: 3 Hours

**Answer any five**

**Parts of a question should be answered at one place**

- 1 Answer all of the following: 8x2.5
  - a. Why CMT is used for joining sheet metals and dissimilar metals?
  - b. Explain the advantages of hybrid welding with examples.
  - c. Why automation is required in welding?
  - d. Define residual stress. How it generates in weld metal?
  - e. What is seam tracking?
  - f. Define degree of freedom.
  - g. Define WAAM.
  - h. State some critical applications of additive manufacturing process.
- 2
  - a. Explain the difficulties involved in fusion welding of Stainless steel, Nickel-chrome alloys and Aluminium and its alloys. 12+8
  - b. Explain with schematic diagrams, working principles of Tandem SAW.
- 3
  - a. State the differences between the flame spraying with powder and plasma spraying. 10+5+5
  - b. Discuss SS cladding on MS with arc welding and its applications.
  - c. Compare the quality of the surfaces produced by laser cladding and plasma spraying.
- 4
  - a. Define Narrow Gap Submerged Arc Welding with suitable diagram. 10+5+5
  - b. What is the difference between K-TIG Welding and Laser Hybrid TIG Welding?
  - c. Discuss about Surface Tension Transfer MIG.
- 5
  - a. What are the applications for a robotic welding system? 5+5+10
  - b. Can an air-cooled robotic MIG gun be used instead of a water-cooled gun?
  - c. Discuss about some devices and sensors that are used for welding automation.
- 6
  - a. Discuss types of defects in products formed by additive manufacturing. 5+5+10
  - b. What is the difference between Wire arc additive manufacturing and Laser enhanced net shaping?
  - c. Discuss with suitable diagram, the effect of WAAM process on microstructure.
- 7 Write short notes on **any four** from the following: 4x5
  - a. Electro-slag welding
  - b. Laser Powder additive manufacturing.
  - c. Robotic welding.
  - d. Friction welding.

# THE INDIAN INSTITUTE OF WELDING

## Associate Membership Examination

Summer Session, June 2021

Sub: Engineering Mathematics (AME-12)

Full Marks: 100

Time: 3 hours

Pass Marks: 40

Answer **any five (5)** questions from the followings.  
Parts of a question should be answered at one place

1. a) Let A be a 3x3 matrix whose first row is (1,2,1). 10  
If  $\text{adj } A = \begin{pmatrix} 1 & a & 1 \\ a & 3 & 1 \\ b & b & a \end{pmatrix}$  find the determinant of A.
- b) Find the inverse of the matrix 10  
 $\begin{bmatrix} 1 & 1 & 1 \\ 1 & -1 & 2 \\ 3 & 5 & -7 \end{bmatrix}$  Hence solve the equation
- $$\begin{aligned} x + y + z &= 3 \\ x - y + 2z &= 2 \\ 3x + 5y - 7z &= 1 \end{aligned}$$
2. a) Solve by matrix inversion method 10  
 $x - 3y + 2z = 0, x + y + z = 3, 3x - y + 2z = 7$
- b) If  $U = \sin^{-1} \left( \frac{x^2 + 3xy + 2y^2}{3x + 2y} \right)$ , prove that 10  
 $x \frac{\partial u}{\partial x} + y \frac{\partial u}{\partial y} = \tan u$
3. a) Find the equation of the tangent plane and normal line to the 10  
surface.  
 $xy + yz + zx = 2$  at (1, 2, 0)
- b) Discuss the maxima and minima of 10  
 $X^2 + y^2 + 6x + 12$

4. a) Find the maxima and minima of the function 10  
 $f(x,y) = x^3 + 3xy^2 - 15x^2 - 15y^2 + 72x$
- b) Solve  $x^2 \frac{d^2y}{dx^2} - 2 \frac{dy}{dx} + y = x$  10
5. a) Find the volume enclosed by  $xy$  - plane the paraboloid 10  
 $z = px^2 + qy^2$  and the cylinder  
 $\frac{x^2}{a^2} + \frac{y^2}{b^2} = 1$
- b) Find the equation of tangent plane and the normal line to the 10  
surface  $2xyz + 3yz + z = 6$  at  $(1,1,1)$
6. a) Solve  $y(1+x) dx + x(1+y) dy = 0$  at  $x=y=1$  10
- b) Solve  $\frac{\partial^2 z}{\partial x^2} - \frac{3\partial^2 z}{\partial x \partial y} + 2 \frac{\partial^2 z}{\partial y^2} = 0$  10
7. a) Find the Fourier series of the function 10  
 $f(x) = -\pi/4$  when  $-\pi \leq x \leq 0$   
 $= \pi/4$  when  $0 < x \leq \pi$
- b) By integral test show that  $\sum_{k=1}^{\infty} k^3 e^{-k}$  is convergent 10
8. a) Show that the series  $\sum_{n=1}^{\infty} \frac{n}{(n^2+1)}$  diverges but the alternating 10  
series  $\sum_{n=1}^{\infty} (-n)^{n+1} \frac{1}{n}$  converges
- b) Test the convergence of the following series 10  
 $\sum_{n=1}^{\infty} \left\{ \frac{2.4.6.8 \dots \dots \dots 2n}{3.5.7.9 \dots \dots \dots (2n+1)} \right\}^2$

# THE INDIAN INSTITUTE OF WELDING

## Associate Membership Examination Summer Session, 2020-21

Sub : PRODUCTION ENGINEERING (AME-10)

Full Marks : 100

Pass Marks : 40

Time : 3 Hours

**Answer any five**

**Parts of a question should be answered at one place**

1. a. State the use of a core in moulding. What is a core print? What is the difference between the composition of core making sand with that of green moulding sand?  
b. With sketches, briefly discuss two types of patterns used in green sand moulding.  
c. Discuss about important pattern allowances.  
d. State the reason of providing tapered shape of the sprue and riser used in sand moulding.  
e. List four possible casting defects. **(2+1+3+6+3+3+2)**

2. a. Explain why after few cold rolling passes, a component is to be annealed for taking up further cold rolling operation, whereas hot rolling does not require any annealing process for successive passes of operations.  
b. Schematically show a rolling, OR, an extrusion process, and briefly describe the operation.  
c. Discuss about the basic principle of operation of any one type of forging press.  
d. How can formability be tested? Briefly mention the procedure. **(4+6+5+5)**

3. a. Explain the term "machinability" and discuss how can this be understood for a workpiece-cutting combine.  
b. State four cutting tool materials and their applications.  
c. What are rake angle, clearance angle and principal cutting edge angle in a cutting tool? State their importance in machining.  
d. State the assumptions of Merchant's Circle Diagram, and draw a typical Merchant's Circle Diagram. **(4+4+6+6)**

4. a. List four machining operations done in a lathe, mentioning the surfaces produced by each of these processes.  
b. What are the ways that a cutting tool can fail? What is tool life? Write and explain Taylor's tool life equation.  
c. What are the differences between turning and milling process?  
d. Draw and label a standard twist drill. **(4+3+2+4+3+4)**

5. a. What are the uses of grinding?  
b. Schematically draw two types of grinding machines showing the movements needed for their operations.  
c. Why is a fluid applied during grinding or machining?  
d. State about lapping and honing process with their applications. **(3+6+4+7)**

6. a. Define welding process.  
b. Differentiate between welding, brazing and soldering.  
c. State the importance of heat treatment in welding.  
d. What are the types of fits? State with the example of a hole and shaft system.  
e. What is GO and NOT GO gauge? Show such a gauge. **(2+6+5+3+4)**

7. a. Compare cladding, hardfacing and coating? Give examples where these are used effectively.  
b. Discuss about carburisation and CVD process.



- c. What is the use of time study? How is it done? (6+6+5+3)  
d. Why is proper assembly sequencing important in a production shop?

8. Write short notes on (**Any Four**): (4x5= 20)

- a. Deep drawing process.
  - b. Blanking and piercing.
  - c. Investment casting process.
  - d. Quick return mechanism.
  - e. Gear machining processes.
  - f. Flatness measurement of a machine tool bed.
  - g. Use of Gantt chart.
  - h. CPM method of scheduling.
-

# THE INDIAN INSTITUTE OF WELDING

## Associate Membership Examination

Summer Session, June 2021

Sub: Welding Metallurgy – II (AME-20)

Full Marks: 100

Time: 3 hours

Pass Marks: 40

Answer **any ten (10)** questions

Parts of a question should be answered at one place

1. Why stainless steel is called stainless Steel? Write name of different types of stainless steels? Give an example for each types of stainless steel. What is Intergranular Stress Corrosion Cracking (IGSCC)? How one can minimize it?  $1+2+2+3+2=10$
2. What is hard facing? How to prevent industrial component from wear and tear? Why welding of cast iron is difficult? Which types of filler wire/ electrode is used for welding of cast iron and why?  $2+3+3+2=10$
3. Draw different region of heat affected Zones along with Fe-C diagram to show the influence of temperature on microstructure. Name ferrite and austenite stabilizing elements. Why preheating of Ferritic steels (9-12Cr) is always done below Ms (martensitic start temperature) temperature of the steel?  $4+2+4=10$
4. How does gas absorption in the weld pool occur during fusion welding of ferrous alloys? How can you preventing gas absorption during manual metal arc welding of steels? 10
5. What is the source of hydrogen and how to avoid dissolve gasses in the weld metal? What is the importance of dissolve gases in the weld metal while welding? On what preheating and post heating temperatures are determined.  $4+3+3=10$
6. Explain the mechanisms of cold cracking and hot cracking of welded steel joints. 10
7. Why cold cracking is a serious concern with increasing carbon content in steel? How cold cracking is different from hot cracking? How to minimize both these problems?  $4+4+2=10$

8. What is precipitate free zone (PFZ)? What is the influence of PFZ on mechanical properties of welding joint? What is the of surfacing on high cycle fatigue life? 3+4+3=10
9. Discuss with the help of neat sketch the working principals and applications of a) radiography test and b) ultrasonic test. 5+5=10
10. What do you mean by liquation cracking? How can it be developed? How can it be minimized? 2+4+4=10
11. Write short notes on the any two of following 2 X 5 = 10
- a) Distortion in weldment
  - b) Modes of metal transfer in arc welding
  - c) Principal of friction welding
12. What do you mean by weld decay? How it is caused? 4 + 6= 10
13. With the help of a neat sketch describe structure of HAZ for carbon steel weldment. 10
14. Explain Schaffeler Diagram with a neat sketch. What is the utility of this diagram in welding of steel? 5 + 5= 10