

THE INDIAN INSTITUTE OF WELDING

Associate Membership Examination

Summer Session, June 2016

Sub : Physics (AME - 02, A-02 (R))

Full Marks : 100

Time : 3 Hours

Pass Marks : 40

Answer any ten questions

Parts of a question should be answered at one place

1. a) What are the characteristics of SHM ? 2
- b) Prove that in SHM average potential energy is half of the total energy. 4
- c) The motion of a particle is represented by $x = 3 \cos 5\pi t + 4 \sin 5\pi t$. Find the total energy of the particle if the mass of the particle is 5 gm and x is in cm. 4
2. a) Set up the equation of motion of a particle executing damped vibration and solve it for critical damping. 2+2
- b) The displacement of a body of mass m executing underdamped SHM is given by $x = Ae^{-bt} \cos (pt - \theta)$, where $p = \sqrt{\omega^2 - b^2}$, ω being the natural frequency of the body and b is the damping factor. Calculate A and θ subject to the conditions : at $t = 0, x = 0$ and $\dot{x} = v_0$. 3
- c) Prove that for an oscillator resonance is sharper with lower damping constant than that with higher damping constant when it is subjected to an external periodic force. 3
3. a) Explain spherical aberration ? How can it be removed ? 2+3
- b) Two convex lenses of focal length f_1 and f_2 are placed at a distance 'd' apart. Find the equivalent focal length of the combination and its power. 3+2
4. a) What should be the phase relation between two waves to produce constructive and destructive interference ? 2
- b) The amplitudes of two interfering waves are in the ratio 1:2. What will be the ratio between the maximum and minimum intensities ? 4
- c) What is meant by coherent sources ? Mention two methods of producing coherent source. 2+2

5. a) In a Newton's ring set up the radii of the 9th and 24th ring are 4mm and 10 mm respectively. If the wavelength of the light used is 5839\AA . Find the radius of curvature of the plano-convex lens used. 3
- b) What will be the conditions of maxima and minima for interference fringes formed in a parallel sided thin film ? Give reasons for your answer. 2+2
- c) Draw the diagram representing interference by a Fresnel biprism. What is the nature of the coherent source here ? 2+1
6. a) State the differences between interference and diffraction. 2
- b) In a grating diffraction pattern 698 secondary interference maxima are obtained within two consecutive primary interference maxima. If the width of the grating is 5mm, find the grating element. 4
- c) Using Raleigh criterion of resolution and find an expression for the chromatic resolving power for single slit diffraction. 4
7. a) Explain why longitudinal waves can not be polarized. 2
- b) Draw and explain the principle of action of a Half shade polarimeter. 4
- c) As linearly polarized light is normally incident on the principal section of a birefringent crystal for which the refractive index corresponding to the o-ray is 1.51 and that corresponding to the e-ray is 1.62. What should be the minimum thickness of the crystal along the direction of incidence to render the emergent light linearly polarized in the same direction ? Wavelength of light used is 5800\AA . 4
8. a) Differentiate between spontaneous and stimulated emission? 2
- b) Sketch the energy level diagram and explain the lasing action in Ruby laser. 4
- c) What are the characteristics properties of laser beam ? Mention some of its important applications. 2+2
9. a) Describe a typical optical fibre with a diagram and describe how light propagates through with no loss of energy. 2+2
- b) A single clad optical fibre has a refractive index of 1.62 for the core and 1.52 for the cladding ? Find its acceptance angle when laid in air. What is its maximum acceptance angle ? 2+2
- c) Name different types of optical fibres. 2

10. a) Use Bio-Savarts Law to find out an expression for magnetic field at a distance at a point on the axis of a current carrying solenoid of length 'L' with 'n' turns per unit length. 4
- b) Find an expression of force between two straight parallel conductors carrying current in the same direction 4
- c) Two straight wires are kept 2m apart in air carrying currents 80A and 30A in same direction. Calculate the force between them and specify its nature. 2
11. a) With a suitable diagram explain the principle of action of a Nicol prism. 4
- b) Find the state of polarization of a resultant wave when two orthogonally polarized waves travelling in same direction superpose with a phase difference of $\pi/2$. Under what condition will the resultant be circularly polarized ? 4+2
12. a) Draw the phaser diagram of a series L-R circuit of L = 40mH and R=50 Ω when subjected to an alternating emf $e = 10 \sin 8\pi t$ Volt. Use it to calculate current in the circuit. 2+2
- b) Find the phase lag/lead between current and applied emf. 2
- c) Find the power factor and loss factor for the above circuit. 2+2
13. a) Compare an electric and a magnetic circuit. 3
- b) Write down an expression of reluctance and state its unit. 3
- c) A solenoid of length 0.5m, cross section 0.008 m² having 500 turns is carrying 4 Amp current. Calculate magnetomotive force and total flux. (Consider air medium) 2+1
14. Write short notes on : - 2+2
- a) Characteristics of ideal auditorium b) Semiconductor Laser 5+5

THE INDIAN INSTITUTE OF WELDING

Associate Membership Examination

Summer Session, June 2016

Sub : General English (AME-4, A-04 (R))

Full Marks : 100

Time : 3 Hours

Pass Marks : 40

Answer all questions

Parts of any question should be answered at one place

1. Write an essay in about 300 words on any one of the following topics :- 20
 - a. Role of media in safeguarding democracy
 - b. Technologies of the twenty first century
 - c. Relevance of corporate Social accountability

2. Read the passage below and answer the questions given below 20
(any five) (4x5)

When a person stands before an x-ray machine or undergoes C.T. Scan, he or she is exposed to dangerous radiation each time. But we may have a chance to avoid such exposures in near future if what a joint team of Indian and south Korean researchers has achieved is translated into reality.

The scientists, led by Physicist Devki Nandan Gupta of the University of Delhi, have devised a scientific instrument that among other things, can replace x-rays in investigations.

To do this, the researchers worked upon what they call a Particle accelerator. Particle accelerators are devices that accelerate particles such as electrons and protons to very high energy levels. These high energy particles are then harnessed to conduct exciting scientific experiments, apart from having medical and other industrial applications.

Such particle accelerators, for example are at the heart of the most well known scientific instrument in the world, the Large Hadron Collider (LHC) famed for discovering the mysterious Higgs Boson, two years ago. The particle accelerator designed by the Indian and the South Korean researchers is vastly different from the one used in LHC. It is tiny in size and requires only one thousandth of the distance required by a conventional accelerator to accelerate particles. The LHC uses a track of 27 kilometres long for accelerating the particles.

This class of accelerator is called laser wake field accelerator because here a laser is used in place of an electric field or radio waves. This largely improves the quality of beam for acceleration.

“We hope to design diagnostic machines that can replace the x-ray source in five to ten years”, says Gupta. According to him, many developed countries, such as the U.K. and Japan are also in the race to develop such medical diagnostic device.

- a. What are the causes of harmful radiation to human beings ?
 - b. Who is Devika Nandan Gupta and what is his field of research?
 - c) Why is the LHC so famous today ?
 - d) What is a particle accelerator ?
 - e) How does the particle accelerator designed by the joint team of Indian and South Korean researches differ from the LHC ?
 - f) To what extent is a laser wake field accelerator different from other conventional accelerators ?
 - g) What are the different developed countries trying to achieve in the medical field ?
3. Make a Precis of the passage given above in about one third of its length and suggest a suitable title for it. Use your own language as par as possible. 15
(13+2)
4. Write a report on any one of the following topics in about 200 words. 20
- a. Some senior welders of your firm complain to you that most of the new recruits are irregular and lack seriousness. As a result of which the unit often fails to complete the scheduled target. As unit head you make a review of the situation and prepare a report to be submitted to the next higher authority for appropriate steps.
 - b. Your organisation suffers from retention problems i.e. employees do not stay long in the company. You as HR manager have been asked to find causes of employees leaving jobs and submit a report to the M.D. (Managing Director)
 - c) Recently, there is a considerable increase in the number of break downs in your plant. As maintenance head, you are to prepare a report on the causes of such break downs and possible measures to be taken to reduce such incidents. The report has to be submitted to the plant head

5. Fill in the blanks with suitable articles (a, an or the) where required. If no article is required, put a cross (X) in the blank space (any five) 5
- a. The wood cutter brought _____ axe to cut wood.
 - b) None but _____ brave deserve the fair.
 - c) I generally go to _____ bed at 10 p.m.
 - d) I met _____ one eyed man in the barzaar.
 - e) I have never seen such _____ man.
 - f) He is _____ stronger of the two.
6. Change the voice of the following sentence (any five) 5
- a. Sugar sells by the kilogram.
 - b. English is spoken all over the world.
 - c. Parents should always be obeyed.
 - d. The bus ran over the dog.
 - e. Do not hate anyone.
 - f. His pocket has been picked.
 - g. People took him as a cheat.
7. Rewrite the following sentences according to the instructions $1 \times 10 = 10$ given in brackets. (any five)
- a. They won the match easily (rewrite the sentence using the noun form of easily)
 - b. The two colours are slightly different (rewrite it using the verb of different)
 - c. My heart is too full for words (Rewrite it removing too)
 - d. This snake is the biggest snake that I have ever seen (Rewrite it using the comparative degree)
 - e. He loves all his sons equally well. (Rewrite in negative form without any change of meaning)
 - f. Oh for a glass of cold water ! (Transform it to an assertive sentence without any change of meaning)
 - g. In addition to fine, he was given punishment. (Connect it into a compound sentence without any change in meaning)
 - h. He owned his fault (Change it into a complex sentence)
 - l. Those who come late will be punished (change it into a simple sentence)
 - j) The man said, "A burglar broke into the office" (Change it into indirect form of speech)
 - k) Anil told me that I had deceived him (Change it into the direct form of speech)

- l) Good students do their hometask regularly (Correct it)
- m) Never speak _____ language (Use the appropriate word from foal, foul, fowl)

8. Select the appropriate phrasal verbs given at the end and replace them with the underlined words of the sentences given below. The number of phrasal verbs are more in number than required (E.g. I have already read the book - I have already gone through the book) (any five)

5

- a. Several weeks have passed by but the culprit is still at large.
- b. He revealed the state secrets to the enemy.
- c. The personal secretary noted the instruments given by the GM.
- d. Good friends never desert in days of adversity.
- e. The factory workers withdrew their strike.
- f. Continue your work please. Don't give up timidly
- g. Oxford University Press has published a new series of English grammar.

[Fall of, brought out, gone by, took down, carry on, put out, called off, gave away, run into.]

THE INDIAN INSTITUTE OF WELDING

Associate Membership Examination

Summer Session, June 2016

Sub : Applied Mechanics (AME - 05, A-5 (R))

Full Marks : 100

Time : 3 Hours

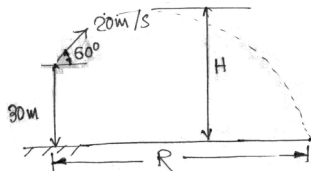
Pass Marks : 40

Group A

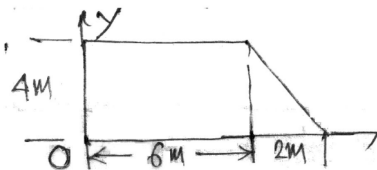
(Answer any ten questions)

Parts of a questions should be answered at one place

- 1.a Maximum value of velocity and its direction for the projectile $10 \times 2 = 20$ given below is

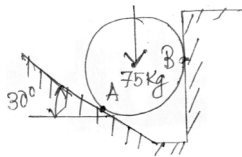


- a) 30m/S, 20° with vertical
 - b) 31.62 m/s, 17.5° with vertical
 - c) 30 m/s, 29° with horizontal
 - d) 31.62 m/s, 17.5° with horizontal
- b. The value of H and R in question number (1A) is given by
- a) 35M, 100M
 - b) 45M, 45M
 - c) 45M, $10(3 + \sqrt{3})M$
 - d) 55M, 45M
- c. Find the centroid of the figure



- a) $\bar{x} = 2.67, \bar{y} = 1.9$
- b) $\bar{x} = 2, \bar{y} = 1.9$
- c) $\bar{x} = 3, \bar{y} = 2.1$
- d) $\bar{x} = 3, \bar{y} = 3$

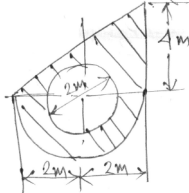
- d. Racing cars travel around a circular track of radius $r = 300\text{m}$ with a speed of 384 km/hr . What angle α should the floor of the track make with horizontal in order to avoid skidding ?
- a) $75^\circ 29'$ b) $76^\circ 45'$
 c) 29° d) $78^\circ 29'$
- e. Under static condition when motion is not impending the friction force F is
- a) $F < \mu s N$ b) $F = \mu s N$
 c) $F > \mu s N$ d) Unpredictable
- f. Varignon's theorem is related to
- a) Moment of forces b) Friction
 c) Deformation of rigid bodies d) Circular motion
- g. Find the reaction of support A and B in the following figure.



- a) $R_A = 800\text{N}$ $R_B = 400\text{ N}$ b) $R_A = 849\text{ N}$ $R_B = 424\text{ N}$
 b) $R_A = 384\text{ N}$ $R_B = 200\text{N}$ d) $R_A = 849\text{ N}$ $R_B = 923\text{ N}$
- h. Motion of a particle is defined by $x = t^4 - 3t^3 + 2t^2 - 8$ x is in meter and t is in seconds. Find the acceleration at $t = 5$ sec
- a) 24 m/s^2 b) 300 m/s^2
 c) 111 m/s^2 d) 214 m/s^2
- i. Rain is falling vertically with 3 m/s in still air, wind is blowing with a speed of 4 m/s , what will be the direction of rain when wind blows.
- a) 5 m/s b) 4 m/s
 c) $\sqrt{12}\text{ m/s}$ d) 6 m/s
- j. For a truss to be over stable and statically indeterminate, the condition for m (number of members) and j (number of joints) is given by
- a. $M > 2j - 3$ b) $m < 2j - 3$
 c) $m = 2j - 3$ d) $m = 2j$
- k. A jet engine works on the principle of conservation of
- a) Energy b) Mass
 c) Momentum d) None of these
- l. For stable equilibrium, the potential energy will be
- a) Maximum b) Zero c) Moderate d) Minimum

Group B
(Answer any 4 questions)

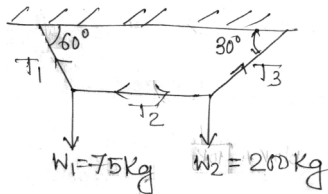
- 2 a. Calculate the moment of inertia with respect to x - axis, (The shaded area as shown in the figure) 7



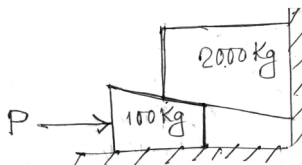
- b. State and prove Varignon's Theorem 1+3=4
- c. State D'Alamber Principle 2
- d. State the Laws of friction 3
- e. A pulley is driven by a rope, a man pulls a weight of 100 kg fixed at one end of rope, in opposite end of rope. Find the effort required by the man to pull the weight. Assume pulley and rope has friction co-efficient 0.35 4
- 3 a. An automobile starting from rest increases its speed from 0 to v with a constant acceleration a_1 , runs at this speed for a time and then comes to rest with constant retardation a_2 . If the total distance traversed by the car is S . Prove that total time required 8

$$t = \frac{S}{v} + \frac{v}{2} \left(\frac{1}{a_1} + \frac{1}{a_2} \right)$$

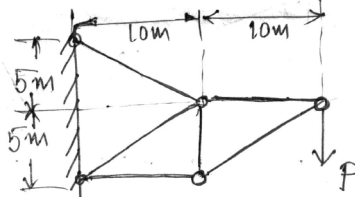
- b. State and Prove Lami's theorem 2+3=5
- c. Find the tensions and T_1 , T_2 and T_3 , the string 7



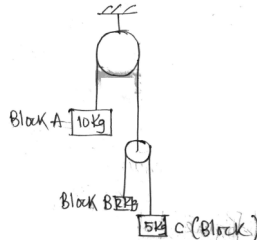
- 4 a. Find the minimum force P required to keep the bodies in equilibrium in the figure below. take $\mu_s = 0.3$ for all surfaces. 10



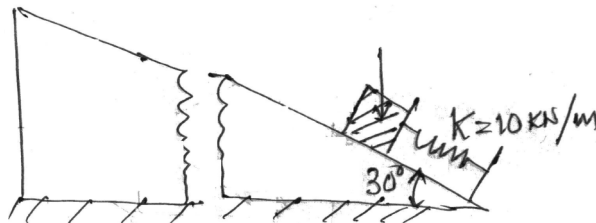
- b. Determine the axial force in each bar of the plane truss loaded with force P. 10



- 5 a. Find the acceleration of Block A, B, C and tension in each string 10



- b. A string of spring constant 10KN/M is compressed by 5cm by a block is inclined plane. The block and floor has $\mu_k = 0.28$. Find after how much distance block with stop. 10



- 6 a. When a particle is moving in curvilinear path, what type/types of acceleration act on it. Define them. 1+2=3
- b. Prove that for a body falling under its own weight in an inclined plane of angle θ , the mechanical energy is conserved. 5
- c. What is angle of friction 2
- d. Prove the formula 3
- $$S = ut + \frac{1}{2} at^2$$
- e. What do you mean by mechanical advantage and efficiency of a machine 2+2=4
- f. Why banking of roads are done. Explain with mathematics 3

THE INDIAN INSTITUTE OF WELDING

Associate Membership Examination

Summer Session, June 2016

Sub : Industrial Sociology (AME - 06, A-06 (R))

Full Marks : 100

Time : 3 Hours

Pass Marks : 40

Answer any five questions

Parts of a questions should be answered at one place

1. Define the term 'Sociology'. Explain the relation of sociology with Political Science and Economics 2+18=20
2. Define the terms 'Customs' and 'Conventions'. Discuss the role and impact of customs and conventions on the social process in Indian Society. 2+18=20
3. What are meant by 'Science' and Technology ? Critically analyse the impact of science and technology on civilization. 3+17=20
4. Define the term 'Economic Development'. Discuss the socio-economic problems associated with economic development. 3+17=20
5. What is meant by the term 'Environment'? Discuss the negative effects of technology on environment. 2+18=20
6. Discuss in details the socio-economic hazards of women workers in Indian Society. 20
7. Critically analyse the positive and negative effects of workers adjustment and maladjustment 20
8. Explain the present reality of workers participation in management of modern industrial set up. 20

THE INDIAN INSTITUTE OF WELDING

Associate Membership Examination

Summer Session, June 2016

Sub : Strength of Materials (AME - 07, A-07 (R))

Full Marks : 100

Time : 3 Hours

Pass Marks : 40

Answer any five questions.

**Parts of a questions should be answered at one place
Figures in the right hand margin indicate marks**

5x20=100

1. a) Define shear stress and strain in a body under specified loading. 4
- b) Prove that for uniform average normal stress in an axially loaded member, load must pass through the centroid of the cross section. 4
- c) A rectangular block of a material is subjected to a direct compressive stress of P_1 in the longitudinal direction. The lateral strain in the two directions at right angle to each other is reduced to one half and one third respectively of those which normally would have occurred by the application of external pressure on the lateral sides of intensity P_2 and P_3 respectively. Calculate P_2 and P_3 in terms of P_1 and strain in its own direction. Show that a material with $\nu = 0.5$ is practically incompressible. 12
2. a) Draw stress strain diagram showing salient points on it for a mild steel specimen tested in laboratory. 4
- b) Set up the relationship among elastic constant : Elastic Modulus, Poisson ratio and shear modulus of a given material. 6
- c) A rectangular bar made of steel is 3m long and 12mm thick. The rod is subjected to an axial tensile load of 85kN. the width of the rod varies from 70mm at one end to 28mm at the other. Find the extension of the steel rod. Also derive the necessary formula used. Assume $E = 200\text{GPa}$. 10
3. a) Prove that the state of stress (2D) at a point can be represented by a equation of a circle. What is the name of it ? 5
- b) Establish the equations for principle stress, principal planes and maximum shearing stresses and corresponding planes for 2D state of stress. 5

- c) At a point in a strained material, the principal stress are 120MPa tensile and 45MPa compressive. Determine the resultant stress in magnitude and direction on a plane inclined at 30° to the axis of the major principal stress. What is the maximum intensity of shear stress in the material at the point ? 10
4. a) Derive flexure formula. Use standard symbols in deriving the formula. 5
- b) Mention and explain the important assumptions made in deriving the flexural formula. 5
- c) A cast iron beam 25mm X 25 mm in section and 120cm long is simply supported at the ends. It carries a point load W at the centre. The maximum stress induced is 120MPa. What uniformly distributed load will break a cantilever of the same material 50 mm wide. 100 mm deep and 2m long ? 10
5. a) Define Shearing Force (SF) and Bending Moment (BM). Are they internal forces ? 5
- b) A simply supported over hanged beam of 4m is subjected to udl of intensity 4.5 kN/m over its entire length. The beam has equal overhang of 1m on each side with a concentrated load P at two end points. If the simply supported span is 6m calculate the value of P for which moment over each support equals the moment at midspan. Also draw SFD and BMD for the beam showing important values on it. Does the beam has any point of contra flexure ? If so locate it in the diagram. 15
6. a) Derive the moment curvature relationship used for calculation of slope and deflection in beams by integrating twice. Use standard symbols in deriving the relation. 5
- b) A cantilever beam of span 1.5L is subjected to linearly varying load with intensity zero at free end and maximum w at fixed end. If the beam has uniform flexural rigidity, find maximum deflection and slope of the beam under the load. Also calculate slope and deflection of the beam at mid span. 10
- c) A simply supported beam of span 4.0m is subjected to a uniformly distributed load 10kN/m throughout its span. Design the beam cross section as rectangular when the permissible flexural stress for the beam material is 10.00 Mpa. Assume the width to depth ratio of the beam cross section as 1:3. 5

7. a) Prove that in case of thin cylinder tangential stress is two times of longitudinal stress. 5
- b) A thin cylinder of bronze 200mm internal diameter has a thickness of 2.5 mm. It has its ends closed and is filled with water. On the application of an external pull of 80kN at its ends, it was found that water pressure decreased by 0.15 Mpa. Calculate the value of Poission's ratio. Take $E = 120\text{GPa}$ and $K = 2.2\text{GPa}$. 10
- c) A vessel in the shape of a thin cylinder 40cm radius and 1cm thick is completely filled with a fluid at admospheric pressure. Additional fluid is then pumped till the pressure is increased to 6MPa. Find volume of additional fluid pumped. Take, Poission ratio 0.26 and $E = 100\text{GPa}$. 5

THE INDIAN INSTITUTE OF WELDING

Associate Membership Examination

Summer Session, June 2016

Sub : Electrical Engineering and Electronics
(AME - 08, A-08 (R))

Full Marks : 100

Time : 3 Hours

Pass Marks : 40

PART - A

Parts of a questions should be answered at one place

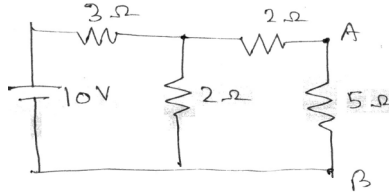
Answer any 10 questions, each carrying 1 mark

1. a. The time constant of an R - L circuit is given by 1x10=10
a) RL b) $\frac{R}{L}$ c) $\frac{L}{R}$ d) $\frac{L^2}{R^2}$
- b. Self inductance of a magnetic coil is proportional
a) N b) $\frac{1}{N}$ c) N^2 d) $\frac{1}{N^2}$
- c. Storage elements of an electrical network are
a) R, L b) L, C c) R, C d) R, L and C
- d. The power factor of a purely capacitive circuit is
a) 0 b) 1 c) ∞ d) 0.5
- e. The energy stored by a capacitor is given by
a) $\frac{1}{2} QV$ b) $\frac{Q^2}{2C}$ c) $\frac{Q^2}{C}$ d) $\frac{1}{2} CV^2$
- f. The basic circuit elements are
a) R, L and C b) V_s, I_s
c) P, Q d) P_1, V
- g. The voltage gain of a source following or common drain JFET amplifier is
a) About 1 b) About 2 c) About 10 d) About 100
- h. Power factor is the angle between
a) V, I b) V, Z c) I, Z d) None of these
- i. Back e.m.f. is related to
a) A.C. generator b) D.C. Generator
c) A.C. Motor d) D.C. Motor
- j. The energy stored in the magnetic field can be given by
a) $\frac{1}{2} LI^2$ b) $\frac{B^2}{2\mu_o\mu_r}$ c) $\frac{1}{2} \mu_o\mu_r H^2$ d) All of these
- l. For tight coupling the coefficient of coupling of two coils is
a) 0 b) 1.0 c) 0.8 d) -1

Part - B

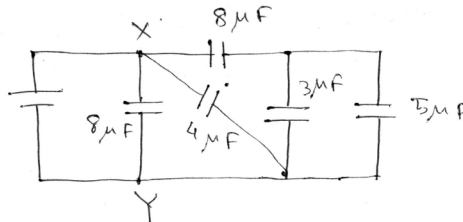
Answer any three questions

2. a. State and explain superposition theorem 3+4
 b. For the electrical circuit shown in Fig. 2(b) find the current through 5Ω resistor using Norton's Theorem



8

3. a. Derive the expression of energy stored in the capacitor and inductor. 4+4
 b. Find the equivalent capacitance across terminals x- y in Fig 3(b). Also find the time to change the capacitance by a direct current of 10A. 4+3



4. a. Explain with diagram. The various parts of a.d.c. generator. 7
 b. Primary winding of a 50 Hz transformer is supplied from 440 V, 50 Hz source and has 200 turns. Find the i) Peak value of flux ii) Voltage induced in the secondary winding if it has 50 turns. 4+4
5. a. Draw the equivalent circuit for different types of D.C. generator and motor. 8
 b. A.D.C. Shunt motor has an armature resistance of 0.3Ω and takes an armature current of 18A from 230V D.C. mains. Calculate the power output and overall efficiency of the motor if the rotational losses are measured to be 112W and the shunt field resistance is 300Ω . 7

PART - C

Answer any three question

6. a. Explain with equivalent circuit and phaser diagram, the starting of capacitor start motors. 8

- | | | |
|-------|--|-----|
| b. | Draw and explain the torque speed characteristic of capacitor start capacitor run motors. | 7 |
| 7. a. | What is resonance ? Derive the expression of resonance frequency of series R-L-C circuit. | 8 |
| b. | A coil resistance 2Ω and inductance 0.01 H is connected in series with a capacitor across 200 V mains. What must be the capacitance for maximum current at 25 Hz ? Find also the voltage in the capacitor. | 7 |
| 8. a. | Draw the Schematic diagram of a permanent magnet moving coil type instrument and explain its principle of operation. | 8 |
| b. | Explain with Schematic diagram of current Shunt feedback amplifier. | 7 |
| 9. | Write short notes on any three | 3x5 |
| a. | Zener Diode | |
| b. | Differentiation | |
| c. | Logic gates | |
| d. | Balanced three phase system | |
| e. | Feedback Amplifier | |

THE INDIAN INSTITUTE OF WELDING

Associate Membership Examination

Summer Session, June 2016

Sub : Material Science (AME - 09, B-09(R))

Full Marks : 100

Time : 3 Hours

Pass Marks : 40

Answer any 5 questions out of the 7 questions given.

Parts of a question should be answered at one place

1. a. In a FCC crystal what is the ratio of the interplanar spacing of the crystallographic plane of (111) to that of (221) ? 6
- b. Explain the following crystal systems in terms of inter relations between unit cell lattice parameters (a, b, c and α, β, γ): Cubic, Tetragonal, Hexagonal and Orthorhombic. 8
- c. In which crystal system there are four Bravais lattices ? 2
- d. Write down the coordination numbers for FCC and simple cubic structure. 2
- e. Identify the corresponding electronic configurations given below for an inert gas and for an alkaline metal : 2
 - i) $1s^2 2s^2 2p^6 3s^1$
 - ii) $1s^2 2s^2 2p^6$
2. a. A cylindrical specimen of steel having an original diameter of 12.8 mm is tensile tested to fracture and found to have an engineering fracture strength σ_f of 460 Mpa. If its cross sectional diameter at fracture is 10.7 mm, determine the ductility in terms of percent reduction in area. 4
- b. A metallic single crystal is oriented for a tensile test such that its slip plane normal makes an angle of 30° with the tensile axis. Three possible slip directions make angles of $60^\circ, 75^\circ,$ and 80° with the same tensile axis. If plastic deformation begins at a tensile stress of 400 Mpa, what would be the critical resolved shear stress for this material ? 10
- c. What is the difference between plastic deformation and elastic deformation ? 2
- d. What is Young's modulus ? What is its unit ? 4
3. a. Explain the following invariant reactions clearly indicating what happens during heating and during cooling 8
 - a) Eutectic
 - b) Eutectoid
 - c) Peritectic
 - d) Peritectoid

- b. If a system shows both peritectic and eutectoid reactions, which of these two reactions will occur at higher temperature? What is the reason behind the same? 2
- c. What is the value of degrees of freedom in the pearlitic phase mixture regime of a binary Fe-C system below the critical temperature A_{e1} at 1 atm. pressure? 2
- d. In plain carbon steel, equilibrium compositions of α ferrite austenite and cementite phases are 0.022, 0.77 and 6.67 wt% C respectively. If for a specific alloy 20% proeutectoid ferrite is observed, what is the alloy composition? 8
4. a. What is the line direction (in terms of Miller index) of a screw dislocation with Burger's vector $\frac{a}{2} [1\bar{1}0]$. 2
- b. What are the number of slip systems in FCC, and HCP (if only the basal plane is operative)? 4
- c. i) What are edge dislocation and screw dislocation? 4
 ii) Which of these (edge and screw) can 4
 1) Cross slip
 2) Climb
- d. At a particular point of a curved dislocation the Burger's Vector is $\frac{a}{2} [1\bar{1}0]$. What will be the Burger's vector at another point of the same dislocation where the line direction is perpendicular to that at the previously mentioned point? Explain. 4
- e. Write down the slip system in BCC. 2
5. a. Two blocks of a metallic alloy with same composition and microstructure are deformed under same conditions, however to different strains, first one to 20% reduction, and the second one to 85% reduction. Annealing treatments were carried out at the same time temperature condition for both the deformed blocks. One of these two blocks shows complete recrystallization, while the other does not show any recrystallization after the annealing treatment. Which one of these does not show any recrystallization? What might be the reason behind it? 2+4
- b. What is the driving forces for 2
 I) Recrystallization? 2
 ii) Grain growth? 2

- | | | |
|-------|---|-----|
| c. | Among the following two conditions which one will have a preferred crystallographic orientation : | 2 |
| | i) Recrystallized | |
| | ii) Rolled | |
| d. | What is work hardening ? Draw schematically in the same graph stress strain plots of two alloys which show same yield strength but different work hardening. Indicate the alloy showing higher work hardening in the graph. | 4+4 |
| 6. a. | Draw a typical tensile stress stain curve and indicate the followings : I) Proportional limit, ii) Elastic limit, iii) Yield Point, iv) Ultimate tensile strength, iv) Fracture strength, v) Uniform elongation and vi) Total elongation. | 8 |
| b. | Draw a typical creep curve and indicate the different stages of creep. | 6 |
| c. | Write down the differences between slip and twin. | 2 |
| d. | Among FCC and HCP which one is more prone to deform by twinning ? Why ? | 4 |
| 7. a. | Give examples for : I)Point defect, ii) Line defect, iii) Surface defect | 6 |
| b. | In each of metals , ceramics and polymers what types of bonds are predominantly found ? | 6 |
| c. | what are the two primary elements in the silicate material ? | 2 |
| d. | what is degree of polymerization ? | 2 |
| f. | What is fracture toughness ? How is it related to the crack length ? | 4 |

THE INDIAN INSTITUTE OF WELDING

Associate Membership Examination

Summer Session, June 2016

Sub : Production Engineering (AME - 10, B-10 (R))

Full Marks : 100

Time : 3 Hours

Pass Marks : 40

Answer any Five questions

Parts of a questions should be answered at one place

1. a) Explain in details how a riser is designed for a casting. 7
- b) Differentiate clearly between hot chamber and cold chamber die casting methods 6
- c) State the defects and their remedies in casting. 4
- d) Explain with suitable sketches : core prints, chills and chaplets. 3
2. a) With neat sketches explain direct and indirect extrusion processes. 5
- b) How does 'coining' differ from 'embossing' ? 5
- c) Make neat sketches and explain different types of rolling mills. 5
- d) Explain the significance of 'spring back' in sheet metal operations. 5
3. a) With the help of Merchant's Circle Diagram, derive the condition for minimum power consumption. 6
- b) Explain the cause and effect of Built up edge formation in machining. 4
- c) Briefly state the detrimental effects of heat produced during machining operation. 5
- (d) Explain how Taylor's Tool life equation is derived. 5
4. a) Draw a single point turning tool and explain it's geometry. 5
- b) How does grinding differ from other conventional machining processes ? 4
- c) Explain with suitable sketches the different types of taper turning methods performed in a lathe. 6
- d) Explain any one method of manufacturing gears 5
5. a) Classify fits giving suitable examples of each type. 5
- b) What do you mean by positive and negative allowance ? 3
- c) Explain how once flatness of a surface plate is measured in a laboratory. 8
- d) Explain the functions of limit gauges. 4

6. a) State the significance of inventory control and the costs associated with inventory. 6
- b) What is 'EOQ' ? 4
- c) Explain the basic concepts of work study, method study and time study. 6
- d) Differentiate between PERT and CPM. 4
7. a) What do you mean by 'cladding' of a surface ? State it's applications. 5
- b) Explain the features and application of case carburizing, nitriding and cyaniding. 9
- c) Differentiate between PVD and CVD processes. 6
8. Write short notes on any four of the following. 4x5=20
- a) Press forging
- b) Investment casting
- c) Internal grinding
- d) Gear forming
- e) Radial drilling machine
- f) Properties of moulding sand

THE INDIAN INSTITUTE OF WELDING

Associate Membership Examination

Summer Session, June 2016

Sub : Engineering Drawing (AME - 11, B-11(R))

Full Marks : 100

Time : 3 Hours

Pass Marks : 40

Answer all questions

Parts of a questions should be answered at one place

1. A circle of 50 mm diameter rolls on a straight line without slipping. Trace the locus of a point 'p' on the circumference of the circle rolling for one revolution. Name the curve 15

OR

Draw the involute of a square of side 25 mm

2. A line CD 80 mm long is inclined at an angle of 30° to H.P. and 45° to V.P. The point C is 20 mm above H.P. and 30 mm in front of V.P. Draw the projections of the straight line. 15
3. Draw the projections of a cone, base 45 mm diameter and axis 50 mm long. When it is resting on the ground on a point on its base circle with the axis making an angle 30° with the H.P. 15
4. A right circular cylinder 20 mm dia. And 45 mm long is resting on its base in H.P. It is cut by a section plane perpendicular to V.P. and 45° with H.P. and passes the axis at point 6 mm from the top. 15

OR

A triangular prism, side of base 30 mm and height 65 mm lies with one of its longer edges on H.P. such that its axis is parallel to both H.P. and V.P. Draw its projections

5. Draw the following types of welded joints with a neat sketch. 5x2=10
- (i) Corner-joint (ii) Tee joint (iii) Fillet joint (iv) Spot joint
(v) Single-V Butt joint.

6. Draw the orthographic projections of the solid in Fig.01

30

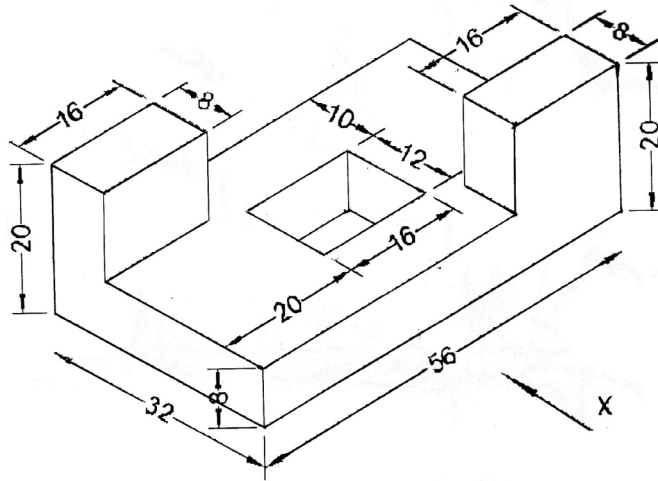


Fig.1

THE INDIAN INSTITUTE OF WELDING

Associate Membership Examination

Summer Session, June 2016

Sub : Engineering Mathematics (AME-12,B-12(R))

Full Marks : 100

Time : 3 Hours

Pass Marks : 40

Answer any five questions

Parts of a questions should be answered at one place

1. a. Prove that a real square matrix can be expressed as the sum of a symmetric and a skew symmetric matrix

Hence express $A = \begin{pmatrix} 4 & 5 & 1 \\ 1 & 6 & 8 \\ 3 & 7 & 2 \end{pmatrix}$ as the sum of a symmetric and skew symmetric matrix 10

- b. Solve the following system of equations by matrix methods :

$$\begin{aligned}x+z &= 2 \\3x+4y+5z &= 4 \\2x+3y+4z &= 3\end{aligned}$$

2. a. Consider the following function :

$$f(x, y) = \begin{cases} xy \frac{x^2 - y^2}{x^2 + y^2}, & \text{when } x^2 + y^2 \neq 0 \\ 0, & \text{when } x^2 + y^2 = 0 \text{ (i.e. } x=y=0) \end{cases} \quad 10$$

Show that $f_{xy}(0,0) \neq f_{yx}(0,0)$

- b. If $2x + 3y + 4z = 9$, then find the maximum value of $x^2y^3z^4$. 10

3. a. For $m > -1, n > -1$, show that

$$\int_a^b (x-a)^m (b-x)^n dx = \frac{m+n+1}{(b-a)} \frac{\Gamma(m+1)\Gamma(n+1)}{\Gamma(m+n+1)} \quad 10$$

- b. Evaluate $\iiint_V \frac{dx dy dz}{(x+y+z+1)^3}$ 10

where V is the volume of the cube $x = 0, x = 1;$
 $y = 0, y = 1; z = 0, z = 1$

4. a. Test the convergence of the following series :

i) $\sum_{n=1}^{\infty} \frac{1}{\sqrt{n(2n+1)}}$ 5+5

ii) $\frac{1}{3} + \left(\frac{2}{5}\right)^2 + \left(\frac{3}{7}\right)^3 + \dots + \left(\frac{n}{2n+1}\right)^n + \dots$

- b. Show that the series $\sum_{n=1}^{\infty} \frac{n}{(n^2+1)}$ diverges but the alternating series $\sum_{n=1}^{\infty} (-n)^{n+1} \frac{1}{n}$ converges 10

5. a. Find the radius of convergence of the following power series :

$$\frac{1}{2} x + \frac{1.3}{2.5} x^2 + \frac{1.3.5}{2.5.8} x^3 + \frac{1.3.5.7}{2.5.8.11} x^4 + \dots \dots \dots \infty$$
 10

- b. Express f(x) in Fourier series on the interval - 2<x<2 if

$$f(x) = 0, -2 < x < 0$$

$$= 1, 0 \leq x < 2$$
 10

6. a. Find an integrating factor of the differential equation

$$x \cos x \frac{dy}{dx} + y(x \sin x + \cos x) = 1$$
 10
 and hence solve it.

- b. Solve the following differential equation

$$\frac{d^2y}{dx^2} - y = 8e^{3x}, \text{ given } y(0) = 2, y'(0) = 6$$
 10

7. a. Test the convergence of the following series

$$\sum_{n=1}^{\infty} \left\{ \frac{2.4.6.8 \dots \dots \dots 2n}{3.5.7.9 \dots \dots \dots (2n+1)} \right\}^2$$
 10

- b. By separation of variables find the general solution of the Laplace's equation

$$\frac{d^2\gamma}{dx^2} + \frac{d^2\gamma}{dy^2} = 0, \text{ given that } \gamma \rightarrow 0 \text{ as } y \rightarrow \infty$$
 10

8. a. Evaluate $\iint_R \sin(x+y) dx dy$ where R is the region bounded by $0 \leq x \leq \frac{\pi}{2}, 0 \leq y \leq \frac{\pi}{2}$ 10

- b. Solve the following heat equation by the method of separation of variables.

$$\frac{\partial^2 \theta}{\partial x^2} = \frac{1}{k} \frac{\partial \theta}{\partial t}, \text{ for } 0 \leq x \leq L, t \geq 0, k > 0$$
 10

given that $\theta(0, t) = 0, \theta(L, t) = 0$ for all t and

$$\theta(x, 0) = \sin \frac{2\pi x}{L}$$

THE INDIAN INSTITUTE OF WELDING

Associate Membership Examination

Summer Session, June 2016

Sub : Welding Metallurgy - I (AME - 13, B-16 (R))

Full Marks : 100

Time : 3 Hours

Pass Marks : 40

Attempt any Five Questions

Parts of a questions should be answered at one place

1. a) Draw the structure of the unit cell of a F.C.C. crystal. 4+3
Calculate the number of atoms per unit cell. 6+7
= 20
- b) Name the defects usually present in metallic crystals.
- c) Name the allotropic forms of iron. Mention the temperatures at which such allotropic transformations occur on heating. What are the crystal structures of different allotropic forms ?
- d) Draw the macrostructure of a steel ingot and label the zones.
2. a) Draw the stress strain diagram of a mild steel and mark the elastic zone, upper yield point and lower yield point. 5+5+
5+5
=20
- b) What is the difference between cold and hot working ? Draw the microstructure of the cold worked copper.
- c) Explain the phenomenon of recrystallisation. Draw the microstructure of cold worked and annealed copper.
- d) What do you mean by work hardening ? What is the difference between slipping and twinning ?
3. a) What are the major steel making processes in India ? What is the energy source in each such process ? 5+5+
5+5
=20
- b) What do you mean by deoxidation of liquid steel ? Why is it necessary ? How is it carried out ?
- c) How do you carry out dephosphorisation during steel making? Explain your point with reference to oxygen potential and basicity of the slag.
- d) Why is it necessary to carry out argon purging of the liquid steel ? Suggest a simple industrial procedure for argon purging.
4. a) Draw the cooling curves of a pure metal and an alloy solidifying over a range of temperatures. What do you mean by critical nucleus size and what is its importance in the solidification of metals and alloys ? 8+6+6
= 20

- b) Define the following reactions with reference to the Fe-C system :
- i) Peritectic reaction
 - ii) Eutectic reaction
 - iii) Eutectoid reaction
- c) Explain the phenomenon of coring
5. a) Draw the T-T-T diagram of an eutectoid steel and label the phase fields. How do you explain the characteristic configuration of the T-T-T diagram. 10+10
=20
- b) What is the difference between ferrite and martensite ? How will you harden a 0.4% C steel ? What happens when a hardened plain carbon steel is tempered at 400°C ?
6. a) Discuss the effects of 0.5 - 1.0% addition of Ni, Cr, and Mo on the mechanical properties of a 0.3% C steel. Which alloying element would you prefer for cryogenic applications of a steel and why ? 10+10
=20
- b) Suggest suitable heat treatments for the following :
- i) Improving the machinability of a steel bar.
 - ii) Hardening an Al - 4% Cu alloy.
 - iii) Relieving the stress in a massive casting
7. a) What is the usual micro-structure of a steel weld deposit in manual metal arc welding ? How is the structure refined in multi pass welding ? 10+10
=20
- b) What do you mean by a heat affected zone (HAZ) ? Discuss the microstructures in different sub zones in the HAZ of a 0.4% C steel welded joint.
8. Write short notes on any four of the following : 5X4
=20
- a) Preheating and post weld heat treatment
 - b) Dilution of the weld deposit
 - c) Slag and gas entrapment in the weld deposit
 - d) CCT diagram
 - e) Micro alloyed steels
 - f) Hardness and hardenability of steels

THE INDIAN INSTITUTE OF WELDING

Associate Membership Examination

Summer Session, June 2016

Sub : Heat and Mass Transfer (AME-14, B-14 (R))

Full Marks : 100

Time : 3 Hours

Pass Marks : 40

**Answer Questions no. 1 and any Five from the rest
Parts of a questions should be answered at one place**

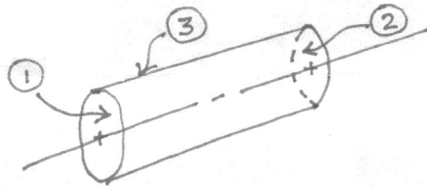
1. a) With rise in temperature thermal conductivity of solid metals $1 \times 10 = 10$
- i) Increases ii) Decreases
 - iii) Remains same iv) Unpredictable
- b) Fins are provided on heat transferring surface
- i) To increase temperature gradient
 - ii) To increase heat transfer coefficient
 - iii) To increase heat transfer area
 - iv) All of the above
- c) The temperature variation with time, in the lumped parameter model, is
- i) Linear ii) Cubic
 - iii) Sinusoidal iv) Exponential
- d) In M-L-T- θ system, the dimensions of thermal diffusivity are
- i) L^2T^{-1} ii) MLT^{-1} iii) MT^{-2} iv) $L^2T^{-1}\theta^{-1}$
- e) Which dimension less number has a significant role in forced convection ?
- i) Prandtl number ii) Reynolds number
 - iii) Peclet number iv) Mach number
- f) In case of heat exchanger, the value of logarithmic mean temperature difference should be
- i) as large as possible ii) as small as possible
 - iii) Constant iv) None of the above
- g) The fouling factor
- i) Increases the overall heat transfer coefficient
 - ii) Decreases the overall heat transfer coefficient
 - iii) Causes no change to the overall heat transfer coefficient
 - iv) None of the above
- h) In case of a black body
- i) Reflectivity is one ii) Absorptivity is zero
 - iii) Transitivity is one iv) None of the above

- i) In metals heat transfer by conduction happens by
- Movement of atoms
 - Movement of free electrons
 - Bombardment of atoms with each other
 - None of the above
- j) A good absorber of thermal radiation is also a good emitter. It is called
- Wien's Law
 - Kirchhoff's Law
 - Planck's Law
 - Stefan's Law
2. a. Derive the three dimensional transient heat conduction equation in Cartesian co-ordinates. Hence write down the one dimensional steady state heat conduction equation with heat generation. 10+2
- b. Consider a slab of thickness $L = 25$ cm. One surface is kept at 100°C and the other surface at 0°C . determine the net flux across the wall if the slab is made from pure copper. Thermal conductivity of copper may be considered to be 387.6 $\text{w/m}^{\circ}\text{C}$. 6
3. a. Derive an expression of the rate of heat conduction through a composite wall having three layers A, B and C. Assume that there is no heat generation within the wall. 8
- b. The maximum operating temperature of a kitchen oven is set at 310°C . Due to seasonal variation, the kitchen temperature may vary from 12°C to 32°C . If the average heat transfer coefficient between the outside oven surface and kitchen air is 12 $\text{w/m}^2\text{C}$, determine the necessary thickness of fibre glass ($k = 0.036$ $\text{w/m}^{\circ}\text{C}$) insulation to ensure that the outside surface temperature of oven does not exceed 45°C . Assume that the steady state conditions prevail and the thermal resistance of metal wall is negligible. 8
- c. Define effectiveness of a fin. 2
4. a. derive an expression of the critical radius of insulation for a sphere. 6
- b. Which of the following arrangements of pin fins will give higher heat transfer rate from a hot surface ? 6
- 6 fins of 10 cm length;
 - 12 fins of 5 cm length.
- The base temperature of the fins is maintained at 200°C and the fins are exposed to convection environment at 15°C with convective coefficient 25 $\text{w/m}^2\text{C}$. Each fin has a cross

sectional area 2.5 cm^2 and perimeter 5 cm , being made of a material having thermal conductivity $250 \text{ w/m}^\circ\text{C}$. Neglect heat loss from the tip of a fin.

- c) A solid copper sphere of 10 cm diameter ($\rho = 8954 \text{ kg/m}^3$, $C_p = 383 \text{ J/kgk}$, $k = 386 \text{ w/mk}$), initially at a uniform temperature 250°C , is suddenly immersed in a well stirred fluid which is maintained at a uniform temperature of 50°C . The heat transfer coefficient between the sphere and the fluid is $h = 200 \text{ w/m}^2\text{C}$. Find the temperature of the sphere 5 minutes after immersion. 6
5. a. What do you understand by the hydrodynamic and thermal boundary layers ? Illustrate with reference to flow over a flat heated plate. 7
- b. A straight tube having a diameter of 40 mm carries water with a velocity of 10 m/s . The temperature of the tube surface is 50°C and the flowing water is heated from the inlet temperature of 15°C to an outlet temperature of 25°C . Determine the coefficient of heat transfer from the tube surface to water and the length of the tube. Take the physical properties of water at 20°C as 8
- $\nu = 1.006 \times 10^{-6} \text{ m}^2/\text{s}$, $k = 59.86 \times 10^{-2} \text{ w/mk}$
 $c_p = 4138 \text{ J/kgk}$ and $Pr = 0.702$
 Use the following relation
 $Nu = 0.023 (Re)^{0.8} (Pr)^{0.33}$
 Where Nu is Nusselt number, Re is Reynolds number and Pr is Prandtl number
- c. Write down the physical significance of Prandtl number. 3
6. a. The velocity distribution in the boundary layer is given by $u/U = y/\delta$, where u is the velocity at a distance y from the plate and $u = U$ at $y = \delta$, δ being boundary layer thickness. Find 8
- i) The displacement thickness δ^*
 ii) The momentum thickness, θ
 iii) The energy thickness, δ_e
 iv) the value of δ^*/θ .
- b. With the help of dimensional analysis show that in case of free convection the Nusselt number is a function of the Grashof number and the Prandtl number. 10

7. a. Define total and monochromatic emissive power. Hence state and explain Wien's displacement law. 2+2
- b. The effective temperature of a body having an area of 0.12 m^2 is 527°C . Calculate the following : 6
- i) Total rate of energy emission
 - ii) Intensity of normal radiation, and
 - iii) Wavelength corresponding to the maximum monochromatic emissive power
- c. The radiation shape factor of the circular surface of a thin hollow cylinder of 10 cm diameter and 10 cm length is 0.172. What is the shape factor of the curved surface of the cylinder with respect to itself? 8



8. a. Briefly explain the working principle of a regenerative heat exchanger. 3
- b. Derive an expression of Logarithmic Mean Temperature Difference (LMTD) for a parallel flow heat exchanger. 8
- c. An oil cooler has to cool 1000 kg/h of oil ($C_p = 2.09 \text{ KJ/KgK}$) from 80°C to 40°C by a cooling water flow of 1000 kg/h at 30°C . Give your choice for a parallel flow or counter flow heat exchanger, with reasons. Calculate the surface area of the heat exchanger, if the overall heat transfer coefficient is $24 \text{ W/m}^2\text{k}$. Take C_p of water = 4.18 KJ/KgK . 7
9. Write short notes on (any four) 4 $\frac{1}{2}$ x4
- a. Area weighted fin efficiency
 - b. Biot number and Lumped Parameter Analysis
 - c. Fully developed flow through a pipe.
 - d. Buckingham π - theorem
 - e. Correction factor for multi pass heat exchangers.

THE INDIAN INSTITUTE OF WELDING

Associate Membership Examination

Summer Session, June 2016

Sub : Welding & Allied Processes-I (AME - 15, B-15(R))

Full Marks : 100

Time : 3 Hours

Pass Marks : 40

Question No.1 is compulsory. Answer any Four from the rest of the questions (Q.2 - Q.8) All the question carry equal marks Parts of a particular question should be answered at one place

1. Write the full expansion of each of the following terms with a short explanatory note : 2x10
a) MMAW b) GMAW c) GTAW d) FCAW e) SAW
f) EBW g) OFW h) OCV i) SCR j) RSW
2. State in details the hazards and corresponding safety precautions to be adapted in each of the following processes : 10x2
a. Gas Cutting and Welding
b. SMAW, GMAW, GTAW
3. Draw sketches and explain how the following processes work : 2 ½ x 4
a. Shielded metal arc welding
b. Transfer of Metal in GMAW
c. Resistance welding
d. Friction stir welding
4. Explain the functions and utility of each of the following : 2x10
a. Coating on a Stick Electrode
b. CO₂ heater
c. Flow Meter
d. Gas Torch in Oxy-Fuel Cutting
e. Tungsten Electrode
f. Wire Feeder
g. Flux Cored Wire
h. Peening Hammer
i. Tinted Glass in Hand Shield
j. Plain Glass in Hand Shield
5. a. Explain how heat is generated in a Welding Arc and the principle of transferring molten metal from an electrode to the parent metal. Which types of electrode coating enable an arc to run at a lower voltage ? State the formula of heat input by an arc and the unit by which it is expressed. 5

- b. What is a Power Source in an Arc Welding system ? Explain the principles on which a Power Source operates. Draw diagrams to explain the characteristics (CC & CV) of Power Sources. Why is it essential to control the Dynamic Characteristics of Power Sources ? 5
- c. State the selection criteria for i) SMAW and ii) MIG/MAG welding 5
- d. What is an Inverter ? State and explain the basic principles on which an inverter works. 5
6. a. How is an arc ignited in GTAW, to weld two pieces of 10 mm thick IS 2062 plates; state your selection and reason of selection of : 2x5
- a) Electrode b) Shielding Gas c) Current
d) Polarity f) Joint preparation
- b. In MIG/MAG welding explain : 5x2
- i) The difference between the uses of Solid wire and Flux cored wire regarding welding quality, Productivity, Cost of Welding and Relative ease of operation.
- ii) The different types of Gases and Gas Mixtures used and their specific applications on different metals, effects on penetration and heat inputs.
7. a) Explain with a neat Diagram the Classification of all Welding Processes Flame, Arc, Resistance. Solid State etc. 5
- b) Make a list showing the Chronological Development of all welding processes. 5
- c) List all the different types of electrode coatings used in SMAW and their uses. 5
- d) List all the types of Power sources used in SMAW <GMAW and GTAW. 5
8. In Oxy Fuel Gas Cutting
- a) State different fuel gases with respective chemical formula. Which fuel gas is mostly used in Gas Cutting MS and why ? 5
- b) State the Oxygen - Fuel gas ratio, flame temperature in degrees centigrade and heat of combustion for at least three types of fuel gases commonly used. 5
- c) What is DA ? How is it formed ? What should be the working Pressure ? How can we distinguish between an Oxygen Cylinder and a DA cylinder for their connections and colours ? 5
- d) State the combustion chemistry of oxygen and acetylene, The oxygen acetylene ratio used and the maximum flame temperature obtained. 5

THE INDIAN INSTITUTE OF WELDING

Associate Membership Examination

Summer Session, June 2016

Sub : Engineering Economics (AME -16,C-17(R))

Full Marks : 100

Time : 3 Hours

Pass Marks : 40

**Answer question No.1 (Compulsory) and any
Four question from the rest
Parts of a questions should be answered at one place**

1. Point out the correct alternative answer : (answer any ten) 2x10
- a) _____ Management is concern with the management of current assets & current liabilities
- i) Dividend Policy ii) Capital budgeting
- iii) Working capital iv) net profit
- b) _____ are converted into cash within a year
- i) Fixed assets ii) Current assets
- iii) Fictitious assets iv) Floating assets
- c) In _____ market goods are sold at uniform price
- i) Imperfect competition ii) Monopoly
- iii) Oligopoly iv) Duopoly
- d) Fresh vegetable market is _____ market
- i) Very short period ii) Short period
- iii) Long period iv) Very long period
- e) The demand curve monopoly is _____
- i) Inelastic ii) Elastic
- iii) Perfectly elastic iv) Imperfect elastic
- f) _____ can't be charged in the short period
- i) Fixed cost ii) Marginal cost
- ii) Total Cost iv) Variable cost
- g) Cost of material is _____ cost of production
- i) Fixed cost ii) Opportunity cost
- iii) Marginal cost iv) Variable cost

- h) If selling price per unit decreases, the BEP _____
 i) Decreases ii) Increases
 iii) Neither i or ii iv) Constant
- i) When variable cost decreases the BEP _____
 i) Remain same ii) Decreases
 iii) Increases iv) Neither of the i, ii, iii
- j) Production can be measured in terms of _____
 i) Total Productivity ii) Marginal Productivity
 iii) Average productivity iv) Monthly Productivity
- k) Law of increasing return applies because of _____
 i) Indivisibility of factors ii) Specialization
 iii) Economics iv) None of them
- l) Cash credit is a popular form of _____
 i) Secure loan ii) Unsecure loan
 iii) Rural bank financing iv) Farmer loan
2. a) Discuss the scope of Managerial Economics for under taking 10
 Management decision
- b) Describe the various utility concepts in relation to 10
 consumer's equilibrium
3. a) Explain the importance of Law of Demands. Is there any 10
 exception to the Law of Demands ? Explain briefly
- b) Distinguish between extension of Demand & increase in 10
 Demand
4. a) Discuss in details the different methods of production 10
 function
- b) Explain & illustrate the law of variable proportion 10
5. a) Describe the importance of demand forecasting. How many 10
 types of demand forecasting are there based on time period
 and level of forecast ?
- b) What is price discrimination ? What are the essential 10
 conditions for price discrimination ?

6. Discuss in details of the followings : 5x4
- a. The concept of marginal opportunity cost & increasing marginal opportunity cost
 - b) Past & future cost and avoidable & unavoidable cost
 - c) Replacement cost & Historical cost
 - d) Accounting cost & Economic cost
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 five) 4x5
- a) Black marketing
 - b) Free entry & exit
 - c) Bilateral monopoly
 - d) Margin of safety
 - e) Private cost & social cost
 - f) Isoquant
 - g) Marginal physical product

THE INDIAN INSTITUTE OF WELDING

Associate Membership Examination

Summer Session, June 2016

Sub : Computational Methods &
Computer Programming (AME - 17, C-18(R))

Full Marks : 100

Time : 3 Hours

Pass Marks : 40

**Answer question 1 (compulsory) and any Five from the rest
Parts of a questions should be answered at one place**

1. Answer all questions 6x5
 - a) How a computer is different from calculator ?
 - b) Explain the Input-Output devices of a Laptop.
 - c) What is ASCII ? How it is useful ?
 - d) What is a multi dimensional array ? How is it used in a C program ?
 - e) Give the explanation of input - output using file in C program with example.
 - f) Differentiate between windows and DOS OS.
2.
 - a) Calculate the octal equivalent of $(100\ 100)_B$. 5
 - b) Calculate the decimal equivalent of $(5A3)_H$. 5
 - c) What is BCD ? How it is Extended ? 4
3.
 - a) Write a C program to Calculate GCD and LCM of given numbers. 10
 - b) Write a C program using recursion. 4
4.
 - a) Write a C program to arrange a set of integers in ascending order using array. 7
 - b) Write a C program to demonstrate the use of structure and union. 7
5.
 - a) Write a C program to find the number of characters on given string. 8
 - b) Give an example of using # define in a C program 6
6.
 - a) Write a C program to add two matrices. 8
 - b) Write a C program to print on upper diagonal matrix 6
7.
 - a) Write a C program to point Fibonacci series. 7
 - b) Write a C program to demonstrate the use of CASE in a program 7

8. a) Write whatever you know about the evaluation of computer programming languages 12
- b) What is XDR gate ? 2
9. Write Short Notes on any four from the following 3.5x4
- a) Application software
 - b) Mobile applications
 - c) Internet
 - d) Compiler
 - e) Flash memory
 - f) Operators in C

THE INDIAN INSTITUTE OF WELDING

Associate Membership Examination

Summer Session, June 2016

Sub : Weldment Design and Weld Procedure
(AME - 18, C-23 (R))

Full Marks : 100

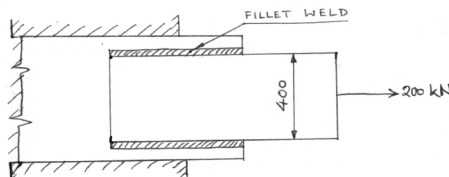
Time : 3 Hours

Pass Marks : 40

(Answer any five questions)

Parts of a questions should be answered at one place

1. Neatly draw butt joint, lap joint T-joint and corner joint that are fillet welded. Also show standard symbols for the above weld joints. 4x2½
+4x1 ½
+2x2=20
Sketch double V and single U joint symbolically.
2. a) Briefly discuss about the importance of cleaning and de-greasing the faying surface before welding. 4
b) State the reason for giving v on double v on x type edge preparation 6
c) Define Weldability. Compare weldability of a low carbon steel with a stainless steel. 2+4=6
d) What is reversible loading ? What are the means of limiting stresses that needs be considered for designing a component subject to reversible loading ? 2+2=4
3. a) For the structure shown in Fig.1, determine the total lengths of the fillets. Assume safe working stress in shear in the fillet weld as 100 Mpa, and size of fillet in given as 22 mm. 8



- b) Why is pipe welding difficult ? 4
- c) Briefly discuss about different welding positions 6
- d) What is factor of safety ? 2
4. a) For welding of a cylindrical pressure vessel, describe different design considerations to be taken while designing for weld fabrication of it. 8
b) What is distortion ? Why is a single v butt joint prone to large distortion than a double V joint ? 2+4=6

- c) Discuss how residual stress can be removed from a welded joint, and distorted welded structure can be made distortion free. 3+3=6
5. a) Compare WPS with WPQ 6
 b) Outline the WPS for undertaking welding of a stainless steel structures 8
 c) What is meant by 100% radiography ? How can it be done ? Why is it needed ? 6
6. a) What are step to take to achieve sound welding of aluminium components ? 7
 b) Discuss about the problems faced while welding C.I. parts. 4
 c) For qualifying a typical welded structure, discuss the NDT techniques to employ 5
 d) Outline any two destructive testing techniques related to welded parts. 4
7. a) Discuss the importance of ASME section IX standard 7
 b) Write a note on 'F' number and 'P' number as per ASME section IX. 6
 c) State the procedure of certifying a welder as per ASME section IX. 7
8. a) What is hardfacing ? Why is it needed 4
 b) Discuss any two weld cladding processes 10
 c) To impart corrosion resistance of an M.S. structure, what types of cladding material may be employed ? Why 4
 d) What is a wear plate ? 2
9. Write short notes on Any Five 5x4=20
 a) Reinforcement and penetration of a weld bead
 b) HAZ
 c) Repair of cast iron gear
 d) Essential variables in connection with WPS
 e) Creep property of a welded structure
 f) Choice of AC/DC for non ferrous welding
 g) Basicity of flux of an electrode
 i) Need of welding automation
 j) Applications of brazing and soldering.

THE INDIAN INSTITUTE OF WELDING
Associate Membership Examination
Summer Session, June 2016
Sub : Testing and Quality Assurance (AME - 19, C-19(R))

Full Marks : 100

Time : 3 Hours

Pass Marks : 40

Answer any Five questions. All questions carry equal marks
Parts of a questions should be answered at one place

- | | | |
|-------|--|----|
| 1. a) | Explain the principle of Brinell hardness test | 10 |
| b) | What is the difference between Brinell and Rockwell hardness tests ? | 5 |
| c) | What is meant by % elongation in case of tensile test ? Why is it necessary to specify gauge length along with % elongation data ? | 5 |
| 2. a) | What is significance of fatigue loading ? | 5 |
| b) | How is fatigue test carried out ? | 5 |
| c) | What is S-N curve ? Show a typical plot of this curve | 5 |
| d) | Explain what is meant by endurance limit ? | 5 |
| 3. a) | Give source, appearance and remedy of following d effects observed in case of arc welding | 10 |
| | i) Burn through ii) Under bead cracks | |
| | iii) Porosity iv) Slag inclusion | |
| b) | Give source, appearance and remedy of following, defects observed in case of resistance spot welding | 10 |
| | i) Indentation ii) Metal expulsion | |
| | iii) Porosity, void | |
| 4. a) | Explain the principle of X-Ray radiography | 10 |
| b) | What is meant by real time radiography ? Explain | 10 |
| 5. a) | Explain the working and use of following probes in ultrasonic testing. | 10 |
| | i) Normal probe ii) Angle probe iii) Surface probe | |
| b) | What is meant by A, B and C-scan in the context of ultrasonic testing ? | 10 |
| 6. | Explain the principle and use of following | |
| a) | Liquid penetrant testing | 10 |
| b) | Magnetic particle testing | 10 |
| 7. a) | Explain the concept and use of X-Bar and R charts | 12 |
| b) | Show how these charts can be used for quality control in welding. | 8 |

THE INDIAN INSTITUTE OF WELDING

Associate Membership Examination

Summer Session, June 2016

Sub : Welding Metallurgy - II (AME - 20, C-20(R))

Full Marks : 100

Time : 3 Hours

Pass Marks : 40

Five questions to be answered. Question no.1 is compulsory.

Answer any four question from question number 2 to 8.

Parts of a question should be answered at one place

- 1.1 State True or False. Answer any Five questions. 5x1=5
- Brass is an alloy of Copper and Tin.
 - Stainless steels contain 10.5% Cr. min.
 - Monels are alloys of Copper and Zinc.
 - Bronze is an alloy of Copper and Zinc
 - Aluminium bronze is not an alloy of Copper
 - Density of Titanium is more than that of Iron & Steel.
 - Aluminium alloys never contain Mg as an alloying element.
- 1.2 Choose the correct answer (any five) : 5x1=5
- Cryogenic steels are used for i) low temperature application, OR ii) high temperature
 - 2.25 Cr 1 Mo steels are used for i) low temperature application, OR ii) high temperature
 - Aluminium alloy welds can suffer from i) cold cracking OR ii) hot cracking.
 - At elevated temperatures titanium is embrittled by i) O₂, N₂, H₂ gases, OR ii) no effect.
 - Austenitic stainless steels can suffer from i) cold cracking OR ii) hot cracking ?
 - Carbon equivalent is used to evaluate susceptibility of steel to i) hot cracking, OR ii) cold cracking ?
 - Carbon Equivalent (C.E) is calculated taking into consideration i) only carbon content, OR ii) alloy content also.
- 1.3 Answer the following questions in brief (any five) ; 5x2=10
- What actions are taken to reduce diffusible hydrogen in MMAW welds in steels ?

- b) Why hard facing is done on steel plates ? Answer briefly.
- c) A 0.15% C mild steel, a 0.30% C medium carbon steel and a 0.15% C 2.25 Cr - Mo low alloy steel are hardened. Which steel will develop highest and lowest hardness ? Justify your answer briefly.
- d) Between grey cast iron and spherical graphite cast iron - which material will have higher toughness and ductility ?
- e) Define weldability briefly
- f) The fusion welds show a cast dendritic structure. Do you expect similar structure in case of friction and friction stir welds.
- g) What information do you get from the transverse bend test of a welded test plate ?
2. a) Write the expansion of HAZ. What is HAZ ? Explain. Why is it important ? Draw the sketch of a cross section of a welded plate showing the locations of the weld, HAZ and unaffected base metal. "Higher the heat input, greater will be the width of the HAZ" - is the statement true or false. The peak temperature in the HAZ will be high near the fusion line or away from it ? 14
- b) What is pre-heating ? When it is required ? What is the effect of pre-heating on HAZ ? 6
3. a) What are stainless steels ? Name the types of stainless steels when they are classified based on the microstructure. What are the alloying elements that are commonly added to improve mechanical properties and corrosion resistance ? 10
- b) Why is it necessary to have low carbon content in the austenitic stainless steels ? Explain "Weld Decay" and the means to prevent it. 10
4. a) Pre-heating is not required to weld a 5mm thick mild steel plate; but why a pre-heat of 200 deg C is needed to weld 5mm thick plate of copper ? Mention two other important physical properties of copper. Name some of the important copper alloys. What type of filler alloys are generally used to weld brass ? Why ? 12
- b) Why aluminium is welded by AC TIG instead of the usual DCEN TIG ? Which shielding gases and gas mixtures are used in AC TIG welding of aluminium ? Can you use CO₂ as shielding as for aluminium ? 8

- | | | |
|-------|--|--------|
| 5. a) | What is residual stress ? How is it different from applied stress ? What are its effects ? | 8 |
| b) | Can residual stress exist in welded structures ? How residual stresses can be relieved from welded parts ? | 12 |
| 6. a) | What are the different types of cast irons ? Explain the welding procedure for grey cast iron with special reference to problems and precautions to be taken. | 10 |
| b) | Mention some of the important properties and uses of titanium and its alloys. Is it considered as a reactive metal ? Mention the special precautions needed to weld titanium. | 10 |
| 7. a) | Explain the phenomenon of cold cracking in steels with particular reference to contributing factors. What is carbon equivalent (C.E.) ? Write one formula for estimating C.E. How cold cracking can be avoided in arc welding of steels ? Does the problem of cold cracking exist in austenitic stainless steels ? | 15 |
| b) | The age hardened aluminium alloys suffer from softening in the HAZ upon welding. True OR false ? Justify your answer. | 5 |
| 8. | Write short notes (any four) : | 4x5=20 |
| a) | Re-heat cracking in steels. | |
| b) | Schaffer diagram | |
| c) | Types of coatings on MMAW electrodes | |
| d) | Lamellar tearing | |
| e) | Crevice corrosion | |
| f) | Welding of Cr-Mo heat resisting steels | |
| g) | Defects in MMAW welds. | |

THE INDIAN INSTITUTE OF WELDING

Associate Membership Examination

Summer Session, June 2016

Sub : Welding Applications (AME-21, C-21 (R))

Full Marks : 100

Time : 3 Hours

Pass Marks : 40

Answer any Five questions

Parts of question should be answered at one place.

1. a) In welding, differentiate between a code, a standard and a specification. 8
b) What is workmanship standard? 6
c) When does a fresh welder certification become necessary. 6
2. a) In multi pass welding, describe the precautions to be taken in root pass, filler pass and cover pass. 6
b) With neat sketches, explain i) over welding and ii) poor fit-up in groove welding. 8
c) In groove or fillet welding, differentiate between theoretical weight of metal deposited per metre of welding and actual weight of metal deposited per meter of welding. 6
3. a) What is operator factor? On what does it depend? How can the operator factor be increased? 10
b) Compute the cross sectional area of a V-groove weld that is 6 mm wide, 8 mm deep on a 10 mm thick plate having a 2 mm root opening. 10
4. Explain any three of the following pipe line welding techniques and point out typical application area of each : 20
a) uphill welding b) down hill welding, c) dolly mesh technique, d) roll welding and, e) store pipe welding
5. Estimate the time required to marking an open tank of size 80 x 80 x 80 cm of mild steel plates of sizes 80 x 80 x 0.5 cm by considering the following data : 20
a) Welding is to be done on inner sides only
b) Preparation and setting up time 35 minutes
c) Welding time/meter of weld 25 minutes
d) Rest allowance 12%
If labour is paid at Rs.125 per hour. Find the labour cost

6. a) What are the various elements which constitute the welding cost of a product ? 5
- b) Determine the cost per metre of a 6 mm fillet weld made by the semi automatic CO₂ welding process using an electrode wire diameter of 1.2 mm. The operator duty cycle is 60% and the filler metal yield is 96%. 15
- The weight of the weld metal deposited is 0.180 kg/m. The electrode wire price is Rs.400/kg, CO₂ gas cost is Rs.224/m³, welder pay rate is Rs.192/hr, overhead costs as Rs.180/hr, travel speed is 50 cm/min, and the gas flow rate is 20 lit/min.
7. a) What are the various methods that have been used for welding under water ? Briefly explain any one of them in detail. 4+6
- b) Distinguish between hardening and hard facing. If the surface of a steel can be hardened by heat treatment, how would you decide the choice between hardening and hard facing ? 2+8
8. What short notes on only fore of the following : 4+5=20
- Hot spot stress
 - Cladding of pressure vessels
 - Welding repair procedure qualification
 - Fitness for purpose
 - Radiation and protection of human body during Radioactive Testing.
 - Engineering critical assessment of a welded structure.

THE INDIAN INSTITUTE OF WELDING
Associate Membership Examination
Summer Session, June 2016
Sub : Welding Equipment and Consumables (AME - 23)

Full Marks : 100

Time : 3 Hours

Pass Marks : 40

**Answer any Five questions choosing at least two (02)
questions each from Group A and B.**

**Parts of a questions should be answered at one place
Group A : Welding Equipment**

1. Write short notes to explain any two of following Welding processes essentially covering : >2
(2+2=4)
 - a) What is the unique feature of the process ?
 - b) Sketches / Block diagram of the essential parts of the set up required for welding > 5 marks 5+5=10
 - c) Brief Cost - Benefit analysis & Field of Applications > 3 marks 3+3=6
 - i) Gas Tungsten Arc Welding
 - ii) Plasma Arc Welding
 - iii) Resistance welding
 - iv) Submerged Arc Welding
2. Explain with sketches (Where required)
 - a) Principles of MMAW process
 - b) Equipment and accessories required for MMAW process. 5
 - c) Name the variants of Resistance Welding process. What are the applications of spot welding in industries. 5
10
3.
 - a) Name the features of Inverter Power Sources. Why Inverter arc widely used in modern days against the traditional power sources. Give reasons 8
 - b) Explain Plasma Spray process. 6
 - c) Describe the Activated Flux (A-Tig) process 6
4. Write short notes with sketches where required on any four. 4x5=20
 - a) Drooping Characteristic of Power source.
 - b) Intergranular corrosion that occur during welding of Austenitic Stainless Steel.
 - c) Name different surfacing processes ? How surfacing is done by Submerged Arc Welding and Flux Cored Arc Welding.
 - d) Name the safety precautions needed during soldering and plasma cutting.

- e) What is cladding ? Why clad ?
- f) Where and when preheating is needed during welding ? what is interpass temperature ?

Group B : Welding Consumables

1. Write short notes on **(Any four)** :
 - a) Name the functions of the Flux coating in MMAW electrodes. Name the coating constituents.
 - b) Shielding gases and gas mixtures used in MIG welding for different materials.
 - c) Name the types of SAW fluxes. Explain their characteristics.
 - d) Name the modes of Metal Transfer in MIG welding name the application of each metal transfer.
 - e) Name the general purpose brazing flux in paste form for brazing of steels.
 - f) What is the AWS classification of Flux cored wires for Flux Cored Arc Welding (FCAW)

2.
 - a) Describe in detail the Constituents of coating in Basic Coated MMAW process. 6
 - b) Why Basic Coated electrodes arc baked before use and at what temperature ? 4
 - c) Mention the merits of using 'Basic Coated electrodes' 4
 - d) Name the welding positions where these electrodes arc used. 3
 - e) What should be the diffusible Hydrogen levels for these electrodes ? During Welding, where these electrodes need to be kept ? 3

3.
 - a) During MIG Welding of Aluminium and Aluminium alloys what type of metal transfer is needed ? Describe and explain with a sketch. 5
 - b) What are welding process options for above MIG welding ? Mention the shielding gases used in this process. 5
 - c) Why using A.C. power source for welding of Aluminium we get better results. Explain. 5
 - d) During laying root pass in carbon steel pipe welding by MMAW process which type of M.S. electrode is used and why ? 5

4. Decode in details as per AWS code of following classifications indicating type of consumables (e.g., MMAW electrode wire/wire flux combination etc) and intended application areas (Any Four) : 4x5=20
 - i. E 6010 ii. E 316-L iii. E 71T-1 iv) ER70S-6
 - v. F7A6-EM12K vi. ER CuSn-A vii. ER 70S-2

THE INDIAN INSTITUTE OF WELDING
Associate Membership Examination
Summer Session, June 2016
Sub : Advanced Welding Technology (AME-24, C(24R))

Full Marks : 100

Time : 3 Hours

Pass Marks : 40

Important Instructions - Read carefully before answering

There are 7 descriptive questions, each for 20 marks

Answer any Five question (5) for 100 marks

Parts of a questions should be answered at one place

Answers should be brief, to the point and relevant to the question.
Long, illogical, unconnected and pointless unnecessary information
will invite lower overall marks

- | | | |
|-------|---|---|
| 1. a) | Explain what you understand by “Zero Defects Welds” | 3 |
| b) | Why HAZ is most susceptible for segregation of weakness in welds ? | 3 |
| c) | Which factors governs HAZ in a given assembly for welding ? | 3 |
| d) | To control the extent of HAZ, one way is to retard & reduce heat flow by pre-heating, which is the other alternative way ? | 6 |
| e) | Explain in general. Why ‘Advanced Welding Processes’ give superior weld quality both in Fusion as well as Solid Phase weld joint they generate. | 5 |
| 2. a) | Name at least 5 different reasons for changing properties of substrate by surface treatments and the process used | 5 |
| b) | What is dilution in cladding processes ? Is it a useful feature ? Why ? | 2 |
| c) | Which cladding process gives “Zero Dilution”? Why ? | 2 |
| d) | What needs to be done to substrate irrespective of the process of surfacing ? | 2 |
| e) | Explain the differences between Coating, Lining, Cladding and Spraying | 4 |
| f) | Describe with sketch any one surfacing process and its special / unique features. | 5 |
| 3. a) | Describe the mechanism of Bonding in Solid Phase Welding. | 3 |
| b) | The process may involve melting but the weld joint is in Solid Phase explain why it so. | 3 |
| c) | Explain why a variety of dissimilar metals can be welded in Solid Phase. | 3 |

- | | | |
|-------|--|------------------------------|
| d) | A Friction Welded joint will show a clear cut line of demarcation indicating a solid phase bond, but not so in Friction Stir Weld, then what type of bond it is ? | 3 |
| e) | With sketch explain the Friction Welding Process and name three most commonly used welded parts for which it has become very reliable and economical. | 8 |
| 4. a) | Write notes focussing on What, Why, How. Where aspects, preferably with sketches on ANY TWO and name the area of application giving specific advantages the process gives compared to other processes. | 2x10=
marks
each
20 |
| | 1) Ultrasonic Welding 2) Electron Beam Welding | |
| | 3) Friction Stir Welding 4) Stud Welding | |
| 5. a) | It is said that 'Penetration is directly proportional to Weld Current', then why do we get 3 times deeper penetration in Plasma compared to TIG, for same value current ? | 5 |
| b) | With sketches explain the comparative features of Plasma Welding, Plasma Spraying and Plasma cutting torches. | 9 |
| c) | What is Water injection plasma technique ? Explain its specific advantage over the standard Plasma Gun and its area of applications with unique operational feature. | 6 |
| 6. a) | Which are the areas where Submerged Arc Welding process is advantages and why ? | 3 |
| b) | What is the highest deposition rate of surfacing possible in Submerged Arc process using modern Technology, Adoption and Techniques | 2 |
| c) | Explain with sketches the mechanism of electroslog Strip Cladding process and set up which looks identical to Submerged Arc Welding | 10 |
| d) | What are the techniques used in Sub-Arc process to get higher deposition rates | 5 |
| 7. | Write explanatory short notes giving what, why where aspects preferably with sketches on ANY FOUR and name the area of application : | 4x5=
marks
each
20 |
| | 1) Mechatronics in Welding 2) Robotic Welding | |
| | 3) Ceramics Welding 4) Thermoplastic Welding Process | |
| | 5) PTFE Welding 6) Explosive Welding | |

THE INDIAN INSTITUTE OF WELDING

Associate Membership Examination

Summer Session, June 2016

Sub : Fluid Mechanics (B -13 (R))

Full Marks : 100

Time : 3 Hours

Pass Marks : 40

Parts of a question should be answered at one place

Group - A

Answer all questions

Choose the correct one

1. a) SI Unit of dynamic viscosity 10x1=10
i) NS/m², ii) m²/s iii) N/m², iv) N/m³
- b) Viscosity of liquid, if temperature increases -
i) increases ii) decreases
iii) remains same iv) Can't say
- c) 1 atm Pressure =
i) 1.01325 bar ii) 10.1325 bar
iii) 1013.25 bar iv) 1 bar
- d) Bourdon gauge measures
i) Temperature ii) Density
iii) Volume iv) Pressure
- e) Path lines follow
i) Lagrangian method ii) Eulerian method
iii) Both of them iv) None of them
- f) Maximum value of Reynold's no. in a laminar flow over a flat plate is
i) 5×10^5 ii) 5×10^4 iii) 50×10^5 iv) 60×10^5
- g) Kinematic viscosity is associated with
i) Only fluid force ii) Only fluid motion
iii) Both fluid force and motion iv) None of the above
- h) Pitot tube measures
i) Pressure ii) Velocity iii) Temperature iv) Discharge
- i) Dynamic Viscosity has the dimensions as -
i) MLT^{-2} , ii) $ML^{-1}T^{-2}$ iii) $M^{-1}L^{-1}T$ iv) $ML^{-1}T$
- j) Bernoulli's theorem deals with law of conservation of
i) Mass ii) Momentum
iii) Kinetic energy iv) Energy

Group B
Answer any five questions

2. a. Explain Vapour pressure and capillarity 5+5+8=
 b. Explain non-newtonian fluid by giving examples 18
 c. A cylinder of 0.12 m radius rotates concentrically inside a fixed hollow cylinder of 0.13m radius. Both the cylinders are 0.3m long. Determine the dynamic viscosity of the liquid which fills the space between the cylinders if a torque of 0.88 Nm is required to maintain an angular velocity of 2π rad/s
3. a. Explain working principle of micro manometer by giving neat sketch. 10+8=
 b. Explain stability conditions of submerged bodies by giving neat sketch. 18
4. a. A cube of side a floats with one of its axes vertical in a liquid of specific gravity S_L . If the specific gravity of the cube material is S_c , find the values of S_L/S_c for the metacentric height to be zero. 9+9=
 b. A ship weighing 25 MN floats in sea water with its axis vertical. A pendulum 2m long is observed to have a horizontal displacement of 20 mm when a weight of 40 kN is moved 5m across the deck. Find the metacentric height of the ship. 18
5. a. Explain with neat sketch how discharge can be measured with the help of orifice meter 9+9=
 b. Explain losses in pipe bends and pipe fittings. 18
6. a. Explain
 i) Eulerian method of fluid motion ii) Stream line
 iii) Path line iv) Rotational flow 8+10=
 b. A three dimensional velocity field is given by 18
 $u(x, y, z) = cx + 2W_0y + u_0$
 $v(x, y, z) = cy + v_0$
 $w(x, y, z) = -2cZ + W_0$ where c, w_0, u_0, V_0 are constants. Find the components of
 i) Rotational velocity ii) Vorticity and iii) The strain rates for the above flow field
7. a. Explain boundary layer phenomenon over a flat plate with neat sketch. 8+10=
 b. Show that the vertical distribution of velocity is parabolic for a uniform laminar flow in a wide open channel with constant slope and depth of flow. 18

8. a. Explain i) Froude No. ii) Reynold's no.
- b. Two identical orifices are mounted on one side of a vertical tank. the height of water above the upper orifice is 3m. If the jets of water from the two orifices intersect at a horizontal distance of 8m from the tank, estimate the vertical distance between the two orifices. Calculate the vertical distance of the point of intersection of the jets from the water level in the tank. Assume $C_v = 1$ for the orifices.

6+12=
18

