2011

PART 02 – BASIC ENGINEERING AND SCIENCES

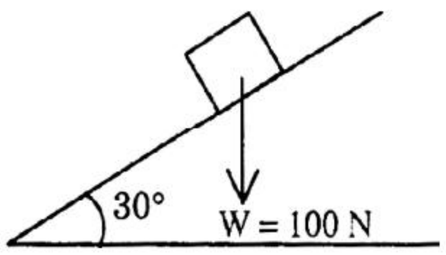
(Common to all candidates)

(Answer ALL questions)

31. Two equal forces are acting at a point with an angle of 60° between them. If the resultant force is $\neq 20\sqrt{3}$ N, the magnitude of each force is equal to

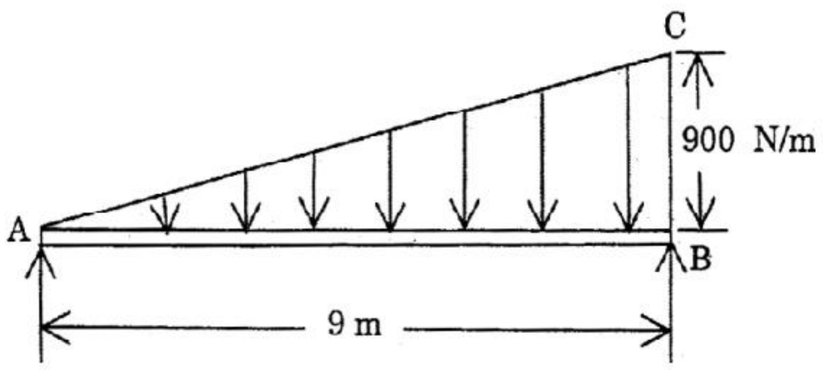
1) 40 N
2) 20 N
3) $10\sqrt{3}$ N
4) $20\sqrt{3}\ \cos 60°$

32. A small block of weight 100N is placed on an inclined plane which makes an angle of 30° with the horizontal. The components of the weight perpendicular and parallel to the plane are respectively



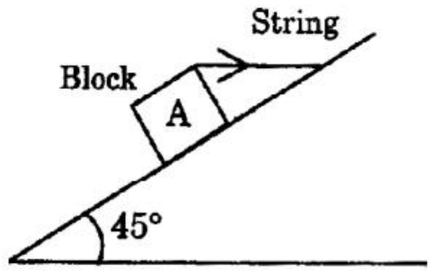
1) 50 N and 8.66 N
2) 100 N and 17.32 N
3) 17.32 N and 100 N
4) 86.6 N and 50 N

33. A simply supported beam of span 9 m carries a uniformly varying load that varies as shown in Fig. from zero at end A to 900 N/m at end B. The reactions R_A and R_B are respectively



1) 1350 N and 2700 N
2) 2700 N and 1350 N
3) 2025 N each
4) 1050 N and 3000 N

34. A block weighing 15 N rests on a rough inclined plane as shown in Fig. The block is held by a taut horizontal string with a tension of 5 N. The frictional force on the block is



1) 10.755 N
2) 15 N
3) 7.07 N
4) 14.14 N

35. A particle moves along a straight line with a velocity given by the equation $v = 2t^3 - t^2 - 2t + 4$ where v is the velocity in m/s and t the time in seconds. When t = 2 seconds, the particle is found to be at a distance of 10m from a station A. The acceleration of the particle after 6 seconds is given by

1) 202 m/s^2
2) 12 m/s^2
3) 564.67 m/s^2
4) 404 m/s^2

36. Zeroth Law of thermodynamics defines

1) internal energy
2) enthalpy
3) temperature
4) pressure

37. A heat engine is supplied with 800 kJ/sec of heat at 600K and heat rejection takes place at 300 K. Which one of the following results report a reversible cycle?

1) 200 kJ/sec are rejected
2) 400 kJ/sec are rejected
3) 100 kJ/sec are rejected
4) 500 kJ/sec are rejected

38. If a system neither exchanges mass nor energy with the surroundings, it is known as

1) segregated system
2) semi closed system
3) closed system
4) isolated system

39. The relationship between universal gas constant (Ru) and characteristic gas constant (Rc) is

1) Ru = Rc / Molecular weight
2) Rc = Ru / Molecular weight
3) $\frac{Rc}{Tamb} = Ru$
4) $\frac{Ru}{Tamb} = Rc$

40. During a cycle of processes, the heat transfers are the following +120 kJ, –16 kJ, –48 kJ and +12 kJ. The network for the cycle is

1) 60,000 N-m
2) 68,000 N-m
3) 120,000 N-m
4) 44,000 N-m

41. A point source emits sound waves with an average output of 80W. The intensity at 3m from source will be

1) 0.808 W/m^2
2) 8.080 W/m^2
3) 0.707 W/m^2
4) 7.707 W/m^2

42. If a magnet is broken into two pieces, each piece possesses two poles. The strength of the new poles is ..... as the poles of original magnet

1) same
2) one half
3) double
4) triple

43. When a dielectric is inserted into the gap of a capacitor, the capacitance always

1) decrease
2) remain same
3) increase
4) goes to zero

44. Average energy of electrons in a Fermi gas at T = 0 is (E_F = Fermi energy)

1) zero
2) (2/5) E_F
3) (3/5) E_F
4) (1/2) E_F

45. The electrons in a Cooper pair have

1) Equal and same spins
2) Equal and opposite spins
3) Unequal spins
4) None of the above

46. White light passes through two slits 0.5 mm apart, and an interference pattern is observed on a screen 2.5m away. The first-order fringe resembles a rainbow with violet and red light at opposite ends. The violet light is about 2mm from the centre of the central white fringe. The wavelength for the violet light is

1) 200 nm
2) 350 nm
3) 400 nm
4) 500 nm

47. The shortest wavelength X-ray photon emitted in an X-ray tube subjected to 50 kV will be (Planck's constant = 6.63×10^{-19} J.s, speed of light in vacuum = 3.0×10^8 m/s and charge of electron = 1.6×10^{-19} C)

1) 2.5 nm
2) 0.25 nm
3) 0.0025 nm
4) 0.025 nm

48. A sodium surface is illuminated with light having a wavelength of 300nm. The work function for sodium metal is 2.46 eV. The maximum kinetic energy of the ejected photoelectrons is

1) 1.67 eV
2) 16.7 eV
3) 0.16 eV
4) 167 eV

49. Which one of the following phenomena does not affect the direction of wave light?

1) Dispersion
2) Diffraction
3) Polarisation
4) Refraction

50. A person shines coherent light through an object A, which produces a pattern of concentric rings on a screen B. A is most likely

1) a single-slit
2) a pinhole
3) a multiple-slit diffraction grating
4) a polarisation filter

51. A perfect or an ideal fluid is one that is

1) a real fluid
2) which obeys perfect gas laws
3) compressive and gaseous
4) incompressible and frictionless

52. In a sample of water an increase in pressure by 18 MPa caused 0.5% reduction in the volume. The bulk modulus of elasticity for this sample in MPa is

1) 3.6
2) 360
3) 3600
4) 0.36

53. Streamline, pathline and streakline are identical when the flow is

1) steady
2) uniform
3) unsteady
4) neither steady nor uniform

54. The Bernoulli equation is written with usual notation as $\frac{p}{\gamma} + z + \frac{V^2}{2g} = \text{const}$. In this equation each one of the terms represents

1) energy in kg.m / kg mass of fluid
2) energy in N.m / kg mass of fluid
3) energy in N.m / N weight of fluid
4) power in kW / kg mass of fluid

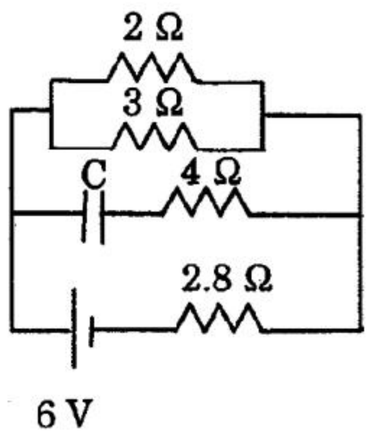
55. If two pumps identical in all respects and each capable of delivering a discharge Q against a head H are connected in series, the resulting discharge is

1) 2Q against a head of 2H
2) 2Q against a head of H
3) Q against a head of 2H
4) $Q^{0.5}$ against a head of $H^{0.5}$

56. The Chemical Oxygen Demand (COD) test is used to measure

1) non-biodegradable organics
2) bio-degradable organics
3) non-biodegradable inorganics
4) bio-degradable inorganics

57. What is the steady state current in the 2Ω resistor as shown in Figure. The internal resistance of the battery is negligible and the value of the capacitor is 0.2 μF.



1) 0.6 A
2) 0.9 A
3) 1.2 A
4) 1.5 A

58. A DC series motor should not be run at no load, because it will

1) draw a dangerously large current
2) stall
3) run at a dangerously high speed
4) draw a dangerously high current and run at a dangerously high speed

59. Power input to a transformer on no load at rated voltage comprises predominantly

1) Copper loss
2) Hysteresis loss
3) Core loss
4) Eddy current loss

60. In a generating synchronous machine, the rotor field

1) lags the stator field and electromagnetic torque is developed in a direction opposite to the direction of rotation of rotor
2) lags the stator field and electromagnetic torque is developed in the direction of rotation of the rotor
3) leads the stator field and electromagnetic torque is developed in the direction opposite to that of rotation of the rotor
4) leads the stator field and electromagnetic torque is developed in the direction of rotation of the rotor

61. Absolute instrument are those which

1) gives the magnitude of the quantity under measurement in terms of the physical constants of the instruments
2) directly indicate the measured quantity on a display unit
3) are calibrated by comparison with a secondary instrument
4) are very popularly used

62. Moving coil instrument can be used for measurements at

1) high frequencies
2) low frequencies
3) only DC
4) both AC and DC

63. Storage class static can be used to

1) restrict the scope of an external identifier
2) preserve the exit value of variables
3) provide privacy to a set of functions
4) all of the above

64. In a C expression involving ||operator, evaluation

1) will be stopped if one of its components evaluates to false
2) will be stopped in one of its components evaluates to true
3) takes place from right to left
4) takes place from left to right

65. Analog systems are different from digital systems because they

1) use transistors
2) handle information in analog form
3) handle information in digital form
4) are slow

66. Which one of the following is not a form of memory?

1) Instruction cache
2) Instruction register
3) Instruction opcode
4) Translation lookaside buffer

67. In which one of the following gates the output is 1, if and only if at least one input is 1?

1) NOR 2) AND
3) OR 4) NAND

68. The variables which can be accessed by all modules in a program are called

1) local variables 2) internal variables
3) external variables 4) global variables

69. Which one of the following is useful in traversing a given graph by breadth first search?

1) Stack 2) Set
3) List 4) Queue

70. Carbonisation involves

1) destructive distillation of coal in the absence of air
2) heating coal to obtain coke by roasting
3) heating coal to remove moisture by distillation
4) destructive distillation of coal in air to form coke

71. Reforming is carried out in refinery to

1) produce straight run gasoline
2) remove sulphur
3) increase the boiling range of the product
4) rearrange the molecular structure of the feel hydrocarbons

72. If the order of a reaction with respect to $[OH^-] = -1$, the hydroxide ion acts as

1) a promoter 2) an inhibitor
3) a catalyst 4) a moderator

73. Which one of the following combinations of carrier gas and detector is not used in gas chromatograph?

1) H_2 and TCD 2) He and FID
3) N_2 and ECD 4) H_2 and FID

74. The location reagent used for the detection of amino acid spots in TLC is

1) Phosphoric acid 2) Dinitrosalicylic acid
3) Ninhydrin 4) Glacial acetic acid

75. Which one of the following chemicals is used for sample preparation for recording IR spectra?

1) Calcium chloride 2) Liquid paraffin
3) Ethanol 4) Sodium iodide

DETAILED ANSWER

37. (2) $\frac{Q_1}{T_1} = \frac{Q_2}{T_2}$

$Q_2 = \frac{800 \times 300}{600} = 400$ KJ

41. (3) Intensity $= \frac{80}{4\pi \times (3m)^2}$

$= 0.707\ W/m^2$

47. (4) Wave length $= \frac{3 \times 10^8}{1.2 \times 10^{19}}$

$= 0.025$ nm.

48. (1) Maximum kinetic energy, K_{max}

$= \frac{hC}{\lambda} = \frac{1240\ evnm}{300\ nm} - 2.46$

$= 1.67\ eV.$

BASIC ENGINEERING AND SCIENCES - 2011 ANSWERS

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41 3	42 1	43 3	44 4	45 2	46 2	47 4	48 1	49 4	50 3
51 4	52 4	53 1	54 2	55 3	56 2	57 1	58 4	59 3	60 3
61 1	62 3	63 4	64 4	65 2	66 3	67 3	68 4	69 4	70 1
71 2	72 2	73 4	74 1	75 4					

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