POST GRADUATE COMMON ENTRANCE TEST-2018

DATE and TIME	COURSE	SUBJECT
14-07-2018 2.30 p.m. to 4.30 p.m.	ME/M.Tech/M.Arch/ courses offered by VTU/UVCE/UBDTCE	MECHANICAL SCIENCES (AE/MC/IPE/IEM/MSE)

MAXIMUM MARKS	TOTAL DURATION	MAXIMUM TIME FOR ANSWERING
100	150 Minutes	120 Minutes

MENTION YOUR PGCET NO.					QUESTION BOOKLET DETAILS	
					VERSION CODE	SERIAL NUMBER
					A	118169

DOs :

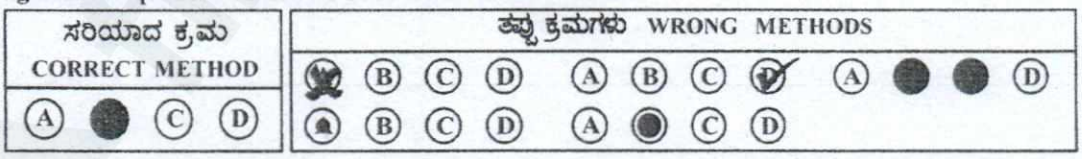
1. Candidate must verify that the PGCET number & Name printed on the OMR Answer Sheet is tallying with the PGCET number and Name printed on the Admission Ticket. Discrepancy if any, report to invigilator.
2. This question booklet is issued to you by the invigilator after the **2nd bell i.e., after 2.25 p.m.**
3. The Version Code of this Question Booklet should be entered on the OMR Answer Sheet and the respective circle should also be shaded completely.
4. The Version Code and Serial Number of this question booklet should be entered on the Nominal Roll without any mistakes.
5. Compulsorily sign at the bottom portion of the OMR answer sheet in the space provided.

DON'Ts :

1. **The timing and marks printed on the OMR answer sheet should not be damaged / mutilated / spoiled.**
2. The **3rd Bell rings at 2.30 p.m., till then;**
   - Do not remove the paper seal / polythene bag present on the right hand side of this question booklet.
   - Do not look inside this question booklet.
   - Do not start answering on the OMR answer sheet.

IMPORTANT INSTRUCTIONS TO CANDIDATES

1. This question booklet contains 75 (items) questions and each question will have one statement and four answers. (Four different options / responses.)
2. After the **3rd Bell is rung at 2.30 p.m.,** remove the paper seal / polythene bag on the right hand side of this question booklet and check that this booklet does not have any unprinted or torn or missing pages or items etc., if so, get it replaced by a complete test booklet. Read each item and start answering on the OMR answer sheet.
3. During the subsequent 120 minutes:
   - Read each question (item) carefully.
   - Choose one correct answer from out of the four available responses (options / choices) given under each question / item. In case you feel that there is more than one correct response, mark the response which you consider the best. In any case, choose **only one response** for each item.
   - **Completely darken / shade the relevant circle with a BLUE OR BLACK INK BALLPOINT PEN against the question number on the OMR answer sheet.**



4. Use the space provided on each page of the question booklet for Rough Work. Do not use the OMR answer sheet for the same.
5. After the **last Bell is rung at 4.30 p.m.,** stop marking on the OMR answer sheet and affix your **left hand thumb impression** on the OMR answer sheet as per the instructions.
6. Handover the **OMR ANSWER SHEET** to the room invigilator as it is.
7. After separating the top sheet (KEA copy), the invigilator will return the bottom sheet replica (Candidate's copy) to you to carry home for self-evaluation.
8. Preserve the replica of the OMR answer sheet for a minimum period of **ONE year.**
9. Only **Non-programmable** calculators are allowed.

Marks Distribution

PART-A : (Section 1) 30 Questions : 30 × 1 = 30 (Section 2) 15 Questions : 15 × 2 = 30
PART-B : (Section 1) 20 Questions : 20 × 1 = 20 (Section 2) 10 Questions : 10 × 2 = 20

ME - A

MECHANICAL SCIENCES
PART – A
(Common to AE / MC / IPE / IEM / MSE)
(SECTION – I)

Each question carries one mark. **(30 × 1 = 30)**

1. The standard deviation of a uniformly distributed random variable between 0 and 1 is

(A) $\frac{1}{\sqrt{12}}$

(B) $\frac{1}{\sqrt{3}}$

(C) $\frac{5}{\sqrt{12}}$

(D) $\frac{7}{\sqrt{12}}$

2. The function $y = x^2 + \frac{250}{x}$ at $x = 5$ attains;

(A) maximum

(B) minimum

(C) neither

(D) 1

3. For the set of equations;

$x_1 + 2x_2 + 3x_3 + 4x_4 = 2$

$3x_1 + 6x_2 + 7x_3 + 12x_4 = 6$

The following is true;

(A) only trivial solution; $x_1 = x_2 = x_3 = x_4 = 0$ exits

(B) there are no solutions

(C) a unique non-trivial solution exists

(D) multiple non-trivial solutions exists

4. Two forces of magnitude 2P and 5P act at an angle of 60° to each other. The resultant is;

(A) $P\sqrt{7}$

(B) 7P

(C) $\frac{P}{\sqrt{7}}$

(D) $\frac{7}{P}$

5. The polar moment of inertia is;

(A) the M.I. of an area about an axis parallel to centroidal axis

(B) equal to M.I. of an area squared

(C) equal to M.I. of an area doubled

(D) the M.I. of an area about a line or axis perpendicular to plane of the area

6. Existence of velocity potential implies that

(A) fluid is in continuum

(B) fluid is irrotational

(C) fluid is ideal

(D) fluid is compressible

Space For Rough Work

7. Navier Stoke's equation represents the;
   (A) conservation of mass
   (B) conservation of energy
   (C) conservation of momentum
   (D) conservation of pressure

8. For a completely submerged body with centre of gravity 'G' and centre of buoyancy 'B', the condition of stability will be;
   (A) G is located below B
   (B) G is located above B
   (C) G and B are coincident
   (D) independent of locations of G and B

9. If a closed system is undergoing an irreversible process, the entropy of the system;
   (A) must increase
   (B) always remains constant
   (C) must decrease
   (D) can increase, decrease or remain constant

10. Constant pressure lines in the super-heated region of Mollier diagram will have
   (A) positive slope
   (B) negative slope
   (C) zero slope
   (D) None of the above

11. A cycle consisting of two reversible isothermal and two reversible isobaric process is called;
   (A) Atkinson cycle
   (B) Stirling cycle
   (C) Brayton cycle
   (D) Ericsson cycle

12. For a given set of operating pressure limits of a Rankine cycle, the highest efficiency occurs for
   (A) saturated cycle
   (B) superheated cycle
   (C) reheat cycle
   (D) regenerative cycle

13. A Mohr's circle reduces to a point when the body is subjected to
   (A) pure shear
   (B) uniaxial stress only
   (C) equal and opposite axial stresses on two mutually perpendicular planes, the planes being free of shear
   (D) equal axial stresses on two mutually perpendicular planes, the planes being free of shear

Space For Rough Work

14. When bending moment 'M' and torque 'T' is applied on a shaft, then equivalent torque is
(A) $M + T$
(B) $\sqrt{M^2 + T^2}$
(C) $\frac{1}{2}\sqrt{M^2 + T^2}$
(D) $\frac{1}{2}(M + \sqrt{M^2 + T^2})$

15. The buckling load in a steel column is
(A) related to the length
(B) directly proportional to the slenderness ratio
(C) inversely proportional to the slenderness ratio
(D) non-linearly to the slenderness ratio

16. The longitudinal joint in a boiler shell is usually
(A) butt joint
(B) lap joint
(C) butt joint with two cover plates
(D) butt joint with single cover plate

17. Tooth interference in an external involute spur gear pair can be reduced by
(A) decreasing centre distance between gear pair
(B) decreasing module
(C) decreasing pressure angle
(D) increasing number of gear teeth

18. Starting friction is low in
(A) Hydrostatic lubrication
(B) Hydrodynamic lubrication
(C) Mixed (or semi-fluid) lubrication
(D) Boundary lubrication

19. Which of the following material has maximum ductility ?
(A) Mild steel
(B) Copper
(C) Nickel
(D) Aluminium

20. Connecting rod usually made from
(A) low carbon steel
(B) high carbon steel
(C) medium carbon steel
(D) high speed steel

21. The process in which carbon and nitrogen both are absorbed by the metal surface to get it hardened is known as
(A) carburising
(B) cyaniding
(C) flame hardening
(D) induction hardening

22. Continuous chips with build up edge are formed during machining of
(A) brittle metals
(B) ductile metals
(C) hard metals
(D) soft metals

Space For Rough Work

23. The lip angle of a single point cutting tool is usually

(A) 20° – 40°

(B) 40° – 60°

(C) 60° – 80°

(D) None of these

24. The filler metal used in brazing is called as

(A) lead tin alloy

(B) solder

(C) spelter

(D) brazer

25. String diagram is used

(A) for checking the relative value of various layouts

(B) when a group of workers are working at a place

(C) where process require the operator to be moved from one work place to other

(D) All of the above

26. PERT analysis is based upon

(A) optimistic time

(B) pessimistic time

(C) most likely time

(D) All of these

27. The chart which gives an estimate about the amount of material handling between various work stations is called

(A) flow chart

(B) process chart

(C) travel chart

(D) operation chart

28. The pair is known as higher pair, when the relative motion between the elements of a pair is

(A) turning only

(B) sliding only

(C) rolling only

(D) partly turning and partly sliding

29. Which of the following is an inversion of a single slider crank chain ?

(A) Pendulum pump

(B) Oscillating cylinder engine

(C) Rotating I.C. engine

(D) All of these

30. The gear train usually employed in clock is a

(A) simple gear train

(B) reverted gear train

(C) sun and planet gear train

(D) differential gear train

Space For Rough Work

MECHANICAL SCIENCES
PART – A
(SECTION – II)

Each question carries two marks. **(15 × 2 = 30)**

31. Consider an ODE $\frac{dx}{dt} = 4t + 4$. If $x = 0$ at $t = 0$, the increment in x calculated using Runge-Kutta 4th order method with a step size of $\Delta t = 0.2$ is;

(A) 0.22 (B) 0.44

(C) 0.66 (D) 0.88

32. The two eigen values of the matrix $\begin{bmatrix} 2 & 1 \\ 1 & p \end{bmatrix}$ have a ratio of 3 : 1 for p = 2. What is another value of p for which the eigen values have same ratio of 3 : 1 ?

(A) –2 (B) 1

(C) $\frac{14}{3}$ (D) $\frac{7}{3}$

33. The pressure drop for laminar flow of a liquid in a smooth pipe at normal temperature and pressure is;

(A) directly proportional to density

(B) inversely proportional to density

(C) independent of density

(D) proportional to (density) 0.75

34. A diesel engine has a compression ratio of 17 and cut-off takes place at 10% of stroke. Assuming ratio of specific heats as (1.4), the air-standard efficiency in % is;

(A) 57.6 (B) 59.6

(C) 61.6 (D) 65

35. For two cycles coupled in series, the tapping cycle has an efficiency of 30% and the bottoming cycle has an efficiency of 10%. The overall combined cycle efficiency is

(A) 50% (B) 37%

(C) 41% (D) 53%

36. A steel bar of 40 mm × 40 mm square cross-section is subjected to an axial compressive load of 200 kN. If the length of the bar is 2 m and E = 200 GPa, then the elongation of the bar will be

(A) 1.25 mm (B) 2.70 mm

(C) 4.05 mm (D) 5.40 mm

37. The outside diameter of a hollow shaft is twice its inside diameter. The ratio of its torque carrying capacity of that of a solid shaft of the same material and the same outside diameter is

(A) $\frac{15}{16}$ (B) $\frac{3}{4}$

(C) $\frac{1}{2}$ (D) $\frac{1}{16}$

Space For Rough Work

38. Two shafts A and B are made of the same material. The diameter of the shaft B is twice that of shaft A. The ratio of power which can be transmitted by shaft A to that of shaft B, is

(A) $\frac{1}{2}$ (B) $\frac{1}{4}$

(C) $\frac{1}{8}$ (D) $\frac{1}{16}$

39. If the ratio of the diameter of rivet hole to the pitch of the rivet is 0.25, the tearing efficiency of the joint is

(A) 0.5 (B) 0.75

(C) 0.25 (D) 0.87

40. The life of a ball bearing at a load of 10 kN is 8000 hours. Its life in hours, if the load is increased to 20 kN, keeping all other conditions the same, is

(A) 4000 (B) 2000

(C) 1000 (D) 500

41. The difference between the tight side and slack side tensions of a belt drive is 3000 N. If the belt speed is 15 m/s, the transmitted power in kW is

(A) 45 (B) 22.5

(C) 90 (D) 100

42. The secondary unbalanced force is _____ the primary unbalanced force.

(A) one-half (B) two-third

(C) 'n' times (D) $\frac{1}{n}$ times

43. The natural frequency of free longitudinal vibrations is equal to

(A) $\frac{1}{2\pi}\sqrt{\frac{s}{m}}$ (B) $\frac{1}{2\pi}\sqrt{\frac{g}{\delta}}$

(C) $\frac{0.4985}{\sqrt{\delta}}$ (D) Any of these

where, m – mass of body

s – stiffness of body

δ – static deflection of the body

44. The tool life of a single point cutting tool has been found to be 1000 s at a cutting speed of 0.5 m/s. How many pieces can be produced within one tool life, if each piece is 50 mm diameter and requires to be turned over a length of 80 mm using a feed of 0.1 mm/rev and a cutting speed of 0.5 m/s ?

(A) 2 (B) 3

(C) 4 (D) 6

45. In orthogonal turning of medium carbon steel, the specific machining energy is 2 J/mm^3. The cutting velocity, feed and depth of cut are 120 m/min, 0.2 mm/rev and 2 mm respectively. The main cutting force in N is

(A) 40 (B) 80

(C) 400 (D) 800

Space For Rough Work

PART – B
AE : Automobile Engineering
SECTION-I

'(Each question carries one mark) **(20 × 1 = 20)**

46. The theoretically correct mixture of air & petrol is

(A) 10 : 1

(B) 15 : 1

(C) 20 : 1

(D) 25 : 1

47. In a four stroke cycle, the minimum temperature inside the engine cylinder occurs at the

(A) beginning of suction stroke

(B) end of suction stroke

(C) beginning of exhaust stroke

(D) end of exhaust stroke

48. The volumetric efficiency of a well designed engine may be

(A) 30 to 40%

(B) 40 to 60%

(C) 60 to 70%

(D) 75-90%

49. The air standard efficiency of an I.C. Engine is given by

(A) $1 - r^{\sqrt{-1}}$

(B) $1 + r^{\sqrt{-1}}$

(C) $1 - \frac{1}{r^{\sqrt{-1}}}$

(D) None of these

50. If the damping factor for a vibrating system is unity, then the system will be

(A) over damped

(B) under damped

(C) critically damped

(D) without vibration

51. A reed type tachometer use the principle of

(A) longitudinal vibration

(B) torsional vibration

(C) transverse vibration

(D) damped free vibration

Space For Rough Work

52. The critical speed of a shaft depends upon its

(A) mass

(B) stiffness

(C) mass & stiffness

(D) stiffness & eccentricity

53. Precisions polygons are calibrated from first principles using

(A) one auto collimator

(B) two auto collimator

(C) three auto collimator

(D) two precision spirit levels

54. For grade IT7, value of tolerance is equal to

(A) 8i

(B) 10i

(C) 16i

(D) 24i

55. Expressing a dimension as $18.3^{+\ 0.00}_{-\ 0.02}$ mm is the case of

(A) unilateral tolerance

(B) bilateral tolerance

(C) limiting dimensions

(D) None of these

56. Which of the following is the position feedback device on NC machine ?

(A) Liner scale

(B) Shaft encoder

(C) Inductosync

(D) All of these

57. The speed at which the monitor accepts data is called

(A) bandwidth

(B) interlacing

(C) response time

(D) scanning

Space For Rough Work

58. Robots are specified by
(A) control system
(B) axis of movement
(C) pay load
(D) All of the above

59. The APT (Automatically Programmed Tools) language is used with
(A) drafting system
(B) programmable controller
(C) NC Machine
(D) large automation system

60. The cetane ($C_{16}H_{34}$) which is a straight chain paraffin is assigned a cetane number of
(A) 0
(B) 50
(C) 100
(D) 120

61. Which one of the following does not relate to a spark ignition engine ?
(A) Ignition coil
(B) Spark plug
(C) Carburettor
(D) Fuel injector

62. In helical gear, the distance parallel to the axis, b/w similar faces of adjacent teeth is called
(A) normal pitch
(B) axial pitch
(C) diametral pitch
(D) module

63. In order to withstand resistance to wear, the best profile of gear is
(A) 14½° full depth involute tooth
(B) 20° full depth involute tooth
(C) 20° involute stub tooth
(D) 14½° stub tooth

64. Teflon is used for bearing because of
(A) low co-efficient of friction
(B) better heat dissipation
(C) smaller space consideration
(D) All of these

65. The period during which the cam follower remains at rest, when cam moves, is known as
(A) constant period
(B) fixed period
(C) dwell period
(D) idle period

Space For Rough Work

SECTION-II

(Each question carries two marks.) **(10 × 2 = 20)**

66. Determine the minimum value of the basic dynamic load rating for selecting ball bearing to 5000 hrs. of operations with not more than 10% failures. The radial load is 1800 N during 90% of the time & 7200 N during the remaining 10%, the sheet is rotated at 150 rev/min.

(A) 12.45 kN (B) 25 kN

(C) 13.45 kN (D) 14.25 kN

67. A circular shaft can transmit a torque of 5 kN-m. If the torque is reduced to 4 kN-m, then the maximum value of bending moment that can be applied to the shaft is

(A) 1 kN-m (B) 2 kN-m

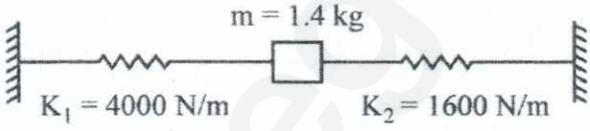
(C) 3 kN-m (D) 4 kN-m

68. A radial ball bearing has a basic load rating of 50 kN. If the desired rating life of the bearing is 6000 hours, what equivalent radial load can be bearing carry at 500 rev/min ?

(A) 18.85 kN (B) 8.85 kN

(C) 12.5 kN (D) 14.25 kN

69. The Natural frequency of the spring mass system shown in the figure is closest to



(A) 8 Hz

(B) 10 Hz

(C) 12 Hz

(D) 14 Hz

70. An automotive engine weighing 240 kg is supported on four springs with linear characteristics. Each of the front two springs have a stiffness of 16 MN/m while the stiffness of each rear spring is 32 MN/m. The engine speed (rpm) at which resonance is likely to occur, is

(A) 6040

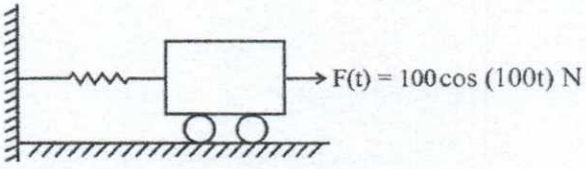
(B) 3020

(C) 1424

(D) 955

Space For Rough Work

71. A mass m attached to a spring is subjected to a harmonic force as shown in figure. The amplitude of the forced motion is observed to be 50 mm, the value of m (in kg) is



(A) 0.1 (B) 1.0

(C) 0.3 (D) 0.5

72. The profile of a cam in a particular zone is given by $x = \sqrt{3} \cos \theta$ & $y = \sin \theta$. The normal to the cam profile at $\theta = \pi/4$ is at an angle (with respect to x axis)

(A) $\pi/4$ (B) $\pi/2$

(C) $\pi/3$ (D) 0

73. An Otto cycle operates with volumes of 40 cm^3 & 400 cm^3 at Top Dead Centre (TDC) & Bottom Dead Centre (BDC) respectively. If the power o/p is 100 kW, what is heat input, in kJ/s ? $\Upsilon = 1.4$

(A) 166 (B) 145

(C) 110 (D) 93

74. A large diesel engine runs on a stroke cycle at 2000 rpm. The engine has a displacement of 25 litre and a brake mean effective pressure of 0.6 MN/m^2. It consumes 0.018 kg/s of fuel (calorific value = 42000 kJ/kg). The brake power will be

(A) 150 kW

(B) 200 kW

(C) 250 kW

(D) 300 kW

75. A diesel engine developes a brake power of 4.5 kW. Its indicated thermal efficiency is 30% and the mechanical efficiency is 85%. Calorific value of the fuel as 40000 kJ/kg.

The indicated specific fuel consumption will be

(A) 0.3 kg/kWh

(B) 0.4 kg/kWh

(C) 0.5 kg/kWh

(D) 0.6 kg/kWh

Space For Rough Work

PART – B
MC : Mechanical Engineering
SECTION-I
(Each question carries one mark) **(20 × 1 = 20)**

46. Heat transfer takes place according to

(A) Zeroth law of thermodynamics

(B) First law of thermodynamics

(C) Second law of thermodynamics

(D) None of the above

47. In radiative heat transfer, a grey surface is one

(A) which appears gray to the eye

(B) whose emissivity is independent to wavelength

(C) which has reflectivity equal to zero

(D) None of the above

48. Automobile radiator is a heat exchanger of

(A) counter flow type

(B) parallel flow type

(C) cross flow type

(D) regenerator type

49. Specific speed of a Kaplan turbine ranges between

(A) 30 and 60

(B) 60 and 300

(C) 300 and 1000

(D) 1500 – 3000

50. Cavitation in a hydraulic turbine is most likely to occur at the turbine

(A) entry

(B) exit

(C) stator exit

(D) rotor exit

51. Operating head of a Pelton wheel is

(A) 50 to 200 m

(B) 2.5 to 50 m

(C) 200 to 1700 m

(D) None of the above

Space For Rough Work

52. Which of the following cannot be considered as data in Data Acquisition System (DAq) ?

(A) Temperature

(B) Mechanical displacement

(C) Flow rate

(D) None of the above

53. When _____ contacts are actuated, they disrupt the power supply through them.

(A) Normally open type

(B) Normally closed type

(C) Both (A) and (B)

(D) None of the above

54. Digital to analog conversion is _____ analog to digital conversion.

(A) less complex than

(B) more complex than

(C) as complex as

(D) unpredictable

55. Forecasting which assumes a static environment in the future is

(A) passive forecasting

(B) active forecasting

(C) long-term forecasting

(D) short-term forecasting

56. In the production model for determining the economic batch size, the production rate is considered as

(A) equal to demand rate

(B) less than demand rate

(C) greater than demand rate

(D) independent of demand rate

57. The method of classification of items to be adopted for spare parts inventory is

(A) ABC analysis

(B) XYZ analysis

(C) VED analysis

(D) SDE analysis

Space For Rough Work

58. Graphical method, Simplex method are concerned with
(A) Value Analysis
(B) Linear Programming
(C) Break-even Analysis
(D) Queuing Theory

59. In the PERT network, the project completion time is considered to follow
(A) Normal distribution
(B) Beta distribution
(C) Linear distribution
(D) None of these

60. In a CPM network, the critical path is
(A) Shortest path
(B) Longest path
(C) Moderate path
(D) None of these

61. Item, which best describes a CAM, technology is
(A) Numerical control
(B) Documentation
(C) Drafting
(D) Geometric modelling

62. CAD/CAM is hardware oriented but _____ gives it life.
(A) Numerical control
(B) Documentation
(C) Software
(D) Communications

63. Robot motion
(A) imitates human motion
(B) is same for all robots
(C) is not dependent on robot structure
(D) None of these

64. Surface roughness on a drawing is represented by
(A) Triangles
(B) Circles
(C) Squares
(D) Rectangles

65. Gauges having gauging sections combined on one end is
(A) Combination gauge
(B) Limit gauge
(C) Fixed gauge
(D) Progressive gauge

Space For Rough Work

PART – B
MC : Mechanical Engineering
SECTION-II
(Each question carries two marks) **(10 × 2 = 20)**

66. For a current carrying wire of 20 mm diameter and (K = 0.5 W/m K) exposed to air (h = 20 W/m^2 K), maximum heat dissipation occurs when thickness of insulation is

(A) 30 mm

(B) 25 mm

(C) 20 mm

(D) 15 mm

67. The radiative heat transfer rate per unit area (W/m^2) between two plane gray surfaces (emissivity = 0.9) maintained at 400 K and 300 K is _____. Take Stephen Boltzmann constant = 5.67 × 10^{-8} W/m^2 K^4. Assume two surfaces are parallel.

(A) 992

(B) 812

(C) 464

(D) 567

68. What is the value of the view factor for two inclined flat plates having common edge of equal width, and with an angle of 20 degrees ?

(A) 0.83

(B) 1.17

(C) 0.66

(D) 1.34

69. Air enters a counter flow heat exchanger at 70 °C and leaves at 40 °C. Water enters at 30 °C and leaves at 50 °C. The LMTD in deg. C is

(A) 5.65

(B) 14.43

(C) 19.52

(D) 20.17

70. The quantity of water available for a hydro-electric station is 260 m^3/s, under a head of 1.73 m. Assuming the speed of the turbine to be 50 rpm, & their efficiency to be 82.5%. The number of turbines required is

(A) 4 turbines

(B) 2 turbines

(C) 3 turbines

(D) 1 turbine

Space For Rough Work

71. Identify the type of turbo machinery for the following case :

Power developed = 430 kW; Operating head = 300 m; Speed = 600 rpm.

(A) Pelton wheel

(B) Francis turbine

(C) Kaplan turbine

(D) None of the above

72. A hydraulic turbine develops 1000 kW power for a head of 40 m. If the head is reduced to 20 m, the power developed (in kW) is

(A) 177

(B) 354

(C) 500

(D) 707

73. If the demand for an item is doubled and the ordering cost halved, the economic order quantity

(A) remains unchanged

(B) increases by a factor of $\sqrt{2}$

(C) is doubled

(D) is halved

74. In a $n \times n$ matrix of an assignment problem, the optimality is reached when the minimum number of straight line scoring all the zeros is

(A) n^2

(B) $\frac{1}{n}$

(C) n

(D) None of these

75. Fulkerson's rule is connected with

(A) Numbering of event in PERT/CPM

(B) The Simulation model

(C) Queuing theory

(D) None of these

Space For Rough Work

PART – B

IPE : Industrial and Production Engineering

SECTION-I

(Each question carries one mark) **(20 × 1 = 20)**

46. In DC welding, the straight polarity (electrode negative) results in

(A) lower penetration

(B) lower deposition rate

(C) less heating of work

(D) smaller weld pool

47. Tool steels are quenched and tempered to impart

(A) High hardness

(B) High toughness

(C) Combined hardness and toughness

(D) High strength

48. If there are m sources and n destinations in a transportation matrix, the total number of basic variables in a basic feasible solution is

(A) $m + n$

(B) $m + n + 1$

(C) $m + n - 1$

(D) m

49. In PERT analysis a critical activity has

(A) Maximum float

(B) Zero float

(C) Maximum cost

(D) Minimum cost

50. Ductility of a material with work hardening,

(A) Increases

(B) Decreases

(C) Remains same

(D) Unpredictable

51. Anisotropy in rolled components is caused by

(A) change in dimensions

(B) scale formation

(C) closure of defects

(D) grain orientation

52. Built-up edge formation decreases under following conditions, except

(A) at low cutting speeds

(B) using large positive rake angle

(C) using sharper tool

(D) using cutting fluid

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53. In HSS tool materials the element tungsten can be completely replaced, without changing material property by

(A) Molybdenum

(B) Carbon

(C) Cobalt

(D) Vanadium

54. In ultrasonic machining, the material removed rate is higher for a material with

(A) High toughness

(B) High ductility

(C) Low toughness

(D) High fracture strain

55. In EDM, the tool is made of

(A) Copper

(B) HSS

(C) Cast iron

(D) Plain carbon steel

56. Ring gauge is used to measure

(A) outside diameter but not roundness

(B) roundness but not outside diameter

(C) both outside diameter and roundness

(D) only external threads

57. Calibration of outside micrometer is done using

(A) Inside micrometer

(B) Depth micrometer

(C) Ring gauges

(D) Slip gauges

58. In engineering drawing, the position of tolerance of hole in the designation 20 G7 f8 is

(A) Number 7

(B) Number 8

(C) Letter f

(D) Letter G

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59. Aluminium is difficult to weld due to its
(A) high tendency of oxidation
(B) high thermal conductivity
(C) low melting point
(D) low density

60. The main objective of work measurement is to
(A) plan and schedule of production
(B) formulate a proper incentive scheme
(C) estimate the selling prices and delivery dates
(D) All of above

61. The time taken by a trained worker to perform an operation, while working at a steady pace is
(A) Representative time
(B) Normal time
(C) Standard time
(D) None

62. Time study is carried out to determine time required to complete job by
(A) slow worker
(B) a fast worker
(C) an average worker
(D) an apprentice

63. Break even analysis consists of
(A) fixed expenses
(B) variable cost
(C) sales revenue
(D) All of these

64. At break even point
(A) total cost is more than sales revenue
(B) total cost is less than sales revenue
(C) total cost is equal to sales revenue
(D) fixed cost is equal to variable cost

65. Production Flow Analysis (PFA) is a method of identifying part families that uses data from
(A) Engineering drawings
(B) Production schedule
(C) Bill of materials and route sheets
(D) Route sheets

Space For Rough Work

SECTION-II

(Each question carries two marks) **(10 × 2 = 20)**

66. In a typical metal cutting operation using a cutting tool of positive rake $\gamma = 10$ deg., it was observed that the shear angle was 20 deg. The friction angle is

(A) 45 deg.

(B) 30 deg.

(C) 60 deg.

(D) 40 deg.

67. A milling cutter having 10 teeth is rotating at 100 rpm. The table feed is set at 50 mm per minute. The feed per tooth in mm is

(A) 5

(B) 0.5

(C) 0.2

(D) 0.05

68. Cylindrical pins of $25^{+0.020}_{+0.010}$ mm dia. are electroplated in a shop. Thickness of the plating is 30 ± 0.2 micron. Neglecting gauge tolerance, the size of G0 gauge in 'mm' to inspect the components is

(A) 25.042

(B) 25.052

(C) 25.084

(D) 25.074

69. A resistance capacitance relaxation circuit is used for EDM process. The discharge voltage is 100 V, at a spark cycle time of 25 μs the average power input is 1 kW. The capacitance (in μF) in the circuit is

(A) 2.5

(B) 5.0

(C) 7.5

(D) 10.0

70. When the annual demand of a product is 12000 units; the EOQ (Economic Order Quantity) is 2000 units. If the annual demand is 24000 units, the most appropriate EOQ will be

(A) 1000 units

(B) 2000 units

(C) 2800 units

(D) 4000 units

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71. A manufacturer has following data regarding a product :

Fixed cost per month = ₹ 1,00,000, Variable cost per unit = ₹ 500, Selling price per unit = ₹ 1,000, Production capacity = 2000 units per month. If production is carried at 80% of rated capacity, monthly profit (in ₹) is

(A) 7,00,000

(B) 8,00,000

(C) 9,00,000

(D) 10,00,000

72. A shaft has a dimension $\phi\ 35^{-0.009}_{-0.025}$. The respective values of fundamental deviation and tolerance are

(A) $-0.025, \pm 0.008$

(B) $-0.025, -0.008$

(C) $-0.009, \pm 0.008$

(D) $-0.009, 0.016$

73. The thickness of the blank needed to produce, by power spinning a cone of thickness 1.5 mm and half cone angle of 30° is

(A) 2.5 mm

(B) 3.0 mm

(C) 2.0 mm

(D) 1.5 mm

74. The indirect cost of a plant is ₹ 4,00,000 per year and direct cost is ₹ 20 per product. If the average revenue per product is ₹ 60, the break-even point is

(A) 10,000 products

(B) 20,000 products

(C) 40,000 products

(D) 60,000 products

75. A machine with a 5 year life has a first cost of ₹ 20,000 and ₹ 2,000 salvage value. Its annual operating cost is ₹ 8,000 per year. According to straight line method, the depreciation change in year 2 is nearest to

(A) ₹ 3,600

(B) ₹ 4,000

(C) ₹ 11,600

(D) ₹ 12,000

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PART – B
IEM : Industrial Engineering and Management
SECTION-I

(Each question carries one mark) **(20 × 1 = 20)**

46. Work study consists of
(A) effective use of plant and equipment
(B) effective use of human effort
(C) evaluation of human work
(D) All of the above

47. Work study is also recognised as
(A) Time study
(B) Motion study
(C) Both (A) & (B)
(D) None of the above

48. In process charts, the symbol used for storage is
(A) Circle
(B) Square
(C) Arrow
(D) Triangle

49. In outline process chart, the horizontal lines represents
(A) general flow of process
(B) materials being introduced
(C) both (A) & (B)
(D) None of the above

50. The following chart(s) record the movements
(A) operation process chart
(B) flow process chart
(C) both (A) and (B)
(D) None of the above

51. Maslow's hierarchy of human needs are
(A) Physiological, Safety, Ego, Social, Self-realisation
(B) Physiological, Safety, Social, Ego, Self-realisation
(C) Safety, Physiological, Social, Ego
(D) None of the above

52. Organisational behaviour tries to synthesize knowledge drawn from
(A) Psychology, Sociology, Physics
(B) Psychology, Sociology, Anthropology
(C) Psychology, Physics, Anthropology
(D) Sociology, Physics, Anthropology

53. The information of MIS comes from the
(A) Internal source
(B) External source
(C) Both internal & external source
(D) None of the above

54. Internal information for MIS may come from any one of the following department :
(A) Customers Care Department
(B) HR Department
(C) Marketing Department
(D) Production Department

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55. AL is the short form of
(A) Artificial Information
(B) Artificial Intelligence
(C) Artificial Integration
(D) None of the above

56. DBMS helps to achieve
(A) Data independence
(B) Centralized control of data
(C) Neither (A) nor (B)
(D) Both (A) & (B)

57. A relational database developer refers to a record as
(A) a criteria
(B) a relation
(C) a tuple
(D) an attribute

58. In P-system of inventory control
(A) The order quantity remains constant
(B) The time between ordering remains constant
(C) The recorder plant remains constant
(D) The production rate remains constant

59. While crashing an activity in the CPM the project direct cost would
(A) increase and the indirect cost would decrease.
(B) decrease and the indirect cost would increase.
(C) increase and the indirect cost would increase.
(D) None of the above

60. If the demand for an item is doubled and the ordering cost is halved, the economic order quantity
(A) remains unchanged
(B) increases by a factor of $\sqrt{2}$
(C) is doubled
(D) is halved

61. A dummy activity is used in PERT Network to describe
(A) Precedence relationship
(B) Necessary time delay
(C) Resource restriction
(D) Resource idling

62. The quality model of forecasting based on the consensus opinion of a panel of experts is called
(A) Delphi Method
(B) Vogel's Method
(C) Regression Method
(D) Exponential Method

63. The ultimate solution to the CAD/CAM problem will be
(A) LAN (Local Area Network)
(B) The Microprocessor
(C) Turnkey Systems
(D) Development of a more efficient display controller

64. The M-system and E-system in Metrology are related with the measurement of
(A) Screw threads (B) Surface finish
(C) Flatness (D) Screws

65. Auto collimator is used to check
(A) Roughness
(B) Flatness error
(C) Pitch
(D) Thread angle

Space For Rough Work

SECTION-II

(Each question carries two marks) **(10 × 2 = 20)**

66. In a point-to-point control NC machine, the slides are positioned by an integrally mounted stepper motor drive. If the specification of the motor is 1°/pulse and the pitch of the lead screw is 3.6 mm, what is the expected positioning accuracy ?

(A) 1 μm

(B) 10 μm

(C) 50 μm

(D) 100 μm

67. A company uses 400 litres of a chemical per week which is ordered in EOQ of 5000 Lts. The safety stock of 200 Lts. is maintained. The procurement lead time is 2 weeks. What is the order point in Lts. ?

(A) 1000

(B) 600

(C) 800

(D) 5000

68. A target date of completion of a project is the length of the critical path. The earliest occurrence of the events of tail node i and head node j of an activity i – j, in the critical path are 10 days and 15 days respectively. The free float of this activity

(A) 5 days

(B) 0 (zero) day

(C) 3 days

(D) None

69. A purchasing assistant has calculated the carrying cost ₹ per unit annum, and the EOQ = 500 units for an item. He must have taken that the annual ordering cost for this item :

(A) ₹ 500

(B) ₹ 100

(C) ₹ 31.62

(D) ₹ 22.36

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70. The monthly demand is ₹ 2,000 of sales. Annual carrying cost is ₹ 2,400. The ordering cost per order is ₹ 600. The EOQ is

(A) one month of sales

(B) two months of sales

(C) three months of sales

(D) four months of sales

71. When the ordering cost is increased to 4 times, the EOQ will be increased to

(A) 2 times

(B) 3 times

(C) 8 times

(D) 1 time

72. A company uses 2555 units of an item annually. Delivery lead time is 8 days. The re-order point (in number of units) to achieve optimum inventory is

(A) 7

(B) 8

(C) 56

(D) 60

73. The value of base variable in the assignment model is

(A) 2 or 4

(B) 1 or 0

(C) 1 or 2

(D) 0 or 4

74. A PERT network has three activities on critical path with mean time 3, 8 and 6 and standard deviations 1, 2 and 2 respectively. The probability that the project will be completed in 20 days is

(A) 0.84

(B) 0.05

(C) 0.66

(D) 0.95

75. A shaft of diameter $20^{+0.05}_{-0.15}$ mm is assembled in a hole of diameter $20^{+0.2}_{+0.1}$ would yield

(A) Transition fit

(B) Interference fit

(C) Clearance fit

(D) Shrink fit

Space For Rough Work

PART – B
MSE : Manufacturing Science and Engineering
SECTION-I

(Each question carries one mark) **(20 × 1 = 20)**

46. Fulkerson's rule is connected with
(A) numbering of event in PERT/CPM
(B) the simulation model
(C) queuing theory
(D) None of these

47. The optimality of a transportation problem is determined by the application of
(A) North-West corner method
(B) Modi method
(C) Vogel's approximation method (VAM)
(D) Least count method

48. Process producing grain structure with grains aligned along geometrical shape of crank shaft is
(A) casting
(B) rolling
(C) welding
(D) bending

49. Material good for extrusion is
(A) stainless steel
(B) low carbon annealed steel
(C) brass casting
(D) low carbon work hardened steel

50. Cold working of metal increases
(A) tensile strength
(B) hardness
(C) yield strength
(D) All of these

51. Forging of steel is done at temperature of
(A) 400 °C
(B) 800 °C
(C) 1000 °C
(D) 1300 °C

52. Process used for making nuts & bolts is
(A) extrusion
(B) cold peening
(C) hot peening
(D) up setting

53. Welding process using non-consumable electrodes is
(A) Laser welding
(B) MIG welding
(C) TIG welding
(D) Ion beam welding

54. Gases used in tungsten inert gas welding are
(A) hydrogen & oxygen
(B) CO_2 & H_2
(C) argon & neon
(D) argon & helium

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55. In NC, the motion control system is
(A) point-to-point
(B) straight cut type
(C) contouring type
(D) All of these

56. The test that determines whether a m/c can think is the
(A) McCarthy test
(B) Gaussian test
(C) Turing test
(D) Boolean test

57. What ties a CAD/CAM together ?
(A) Keyboard
(B) Digitizer
(C) Plotter
(D) Graphic work station

58. CIM software consist of
(A) MIS program
(B) Sales program
(C) Marketing program
(D) All of these

59. Integration of CAD/CAM is called
(A) CIM
(B) CAE
(C) CAM alone
(D) CAD alone

60. Programmable automation is an example of
(A) small production
(B) medium production
(C) high volume production
(D) None of the above

61. In four high rolling mill the bigger rollers are called
(A) guide rolls
(B) back up rolls
(C) main rolls
(D) support rolls

62. Which machine part is not cold formed ?
(A) Food container
(B) Stainless steel vessel
(C) Crank shaft
(D) Heating duct

63. A bore of 14.67 mm in a work-piece can be measured by
(A) Steel rule
(B) Vernier calliper
(C) Pneumatic gauge
(D) Micrometer

64. Surface roughness on a drawing is represented by
(A) Triangles
(B) Circles
(C) Squares
(D) Rectangular

65. Circular scale of the micrometer is marked on
(A) anvil
(B) barrel
(C) ratchet
(D) thimble

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SECTION-II

(Each question carries two marks) **(10 × 2 = 20)**

66. For turning alloy steel at cutting speeds of 64 $\frac{m}{min}$ and 100 $\frac{m}{min}$, the respective tool lives are 20 min and 12 min. The tool life for cutting speed of 144 $\frac{m}{min}$ is;

(A) 7.9 min
(B) 8.9 min
(C) 9.9 min
(D) 10.9 min

67. Arc welding is performed with welding current of 400 A, voltage of 20 V and weld speed of 10 $\frac{mm}{min}$. If heat transfer efficiency from the arc to weld pool is 90%, heat input per unit length (kJ/mm) is ;

(A) 23.2
(B) 33.2
(C) 43.2
(D) 53.2

68. The percentage change in cutting speed required to reduce tool life by 50% when value of tool life exponent n = 0.125 is;

(A) 8
(B) 9
(C) 10
(D) 12

69. A round billet made of brass is to be extruded (extrusion constant = 250 MPa) at 800 °C. The billet diameter is 100 mm and the diameter of the extrusion is 20 mm. The extrusion force required (in MN) is;

(A) 6.32
(B) 7.12
(C) 6.92
(D) 7.92

70. A cylindrical billet of 100 mm dia. is forged from 50 mm height to 40 mm at 1000 °C. The material has a constant flow stress of 80 MPa. If the reduction is accomplished by a 10 kN drop hammer in one blow; the height of fall should be;

(A) 0.500 m
(B) 0.400 m
(C) 0.453 m
(D) 0.353 m

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71. Consider the following data for a product;

Demand = 1000 units / year

Order cost = ₹ 40 / order

Holding cost = 10% unit cost / unit-yr

Unit cost = ₹ 500

The number of economic orders per year to meet annual demand is;

(A) 20

(B) 25

(C) 30

(D) 35

72. The geometric transformation specified by $[x^1\ y^1\ 1] = [x\ y\ 1]\begin{bmatrix} 0.5 & 0 & 0 \\ 0 & 0.25 & 0 \\ 1 & 2 & 1 \end{bmatrix}$ in a 2D CAD system represents ;

(A) Scaling and translation

(B) Scaling and rotation

(C) Rotation and translation

(D) Rotation

73. A cylindrical pin of diameter $1.996^{+0.0015}_{-0.0015}$ mm is assembled into a hole of diameter $2.000^{+0.0015}_{-0.0015}$ mm. The allowance (in mm) provided for this assembly is ;

(A) 0.001

(B) 0.015

(C) 0.025

(D) 0.035

74. _____ joint type provides rotational relative motion, with the axis of rotation perpendicular to axis of input and output links.

(A) Linear

(B) Orthogonal

(C) Twisting

(D) Revolving

75. The manufacturing area of a plant is divided into four quadrants. Four machines have to be located such that one machine is situated in each quadrant. The total number of possible layouts is

(A) 4

(B) 8

(C) 16

(D) 24

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