

DAY and TIME					COURSE					SUBJECT				
DAY-1 10.30 am to 12.30 pm					ME/M.Tech/M.Arch courses offered by VTU/UVCE/UBDTCE					MECHANICAL SCIENCES AE/MC/IPE/IEM/MSE				
SESSION : FORENOON														
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 - 2					154850				

DOs :

1. Check whether the PGCET No. has been entered and shaded in the respective circles on the OMR answer sheet.
2. Ensure whether the circles corresponding to course and the specific branch have been shaded on the OMR answer sheet and also ensure the circle against the appropriate paper you are answering in Part-B is also shaded.
3. This Question Booklet is issued to you by the invigilator after the 2nd Bell i.e., after 10.25 a.m.
4. The Serial Number of this question booklet should be entered on the OMR answer sheet.
5. The Version Code of this question booklet should be entered on the OMR answer sheet and the respective circles should also be shaded completely.
6. 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 10.30 a.m., till then;
 - Do not remove the paper seal / polythene bag 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 10.30 a.m., remove the paper seal / polythene bag 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 BALL POINT 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 12.30 pm, stop marking on the OMR answer sheet and affix your **left hand thumb impression** on the OMR answer sheet as per the instructions.
6. Hand over the OMR ANSWER SHEET to the room invigilator as it is.
7. After separating the top sheet, 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 I) 30 Questions : $30 \times 1 = 30$	(Section II) 15 Questions : $15 \times 2 = 30$
Part-B : (Section I) 20 Questions : $20 \times 1 = 20$	(Section II) 10 Questions : $10 \times 2 = 20$



MECHANICAL SCIENCES

IMPORTANT INSTRUCTIONS AND BRANCHWISE INDEX FOR THE CANDIDATES

Question Nos. 1 to 45 is compulsory and common to all the branches. Question Nos. 46 to 75 are optional. Sub-branches are there in this Booklet. The candidate has to opt any one branch according to his/her Application Form.

Sub-branch	Subject	Page No.	
		From	To
1.	Automobile Engineering (AE)	9	13
2.	Mechanical Engineering (MC)	14	18
3.	Industrial and Production Engineering (IPE)	19	22
4.	Industrial Engineering and Management (IEM)	23	27
5.	Manufacturing Science and Engineering (MSE)	28	31

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

Each question carries one mark.

30 × 1 = 30

1. Eutectoid reaction occurs at
(A) 600 °C (B) 723 °C
(C) 1147 °C (D) 1493 °C
2. A force 'f' acts for 1 sec on a body of mass 1 kg moving with a initial velocity 'u'. Then which of the following statements is / are not true ?
(A) Body covers a distance $(u + (f/2))$
(B) Final velocity of a body is $(u + f)$
(C) Change in kinetic energy of body is $\frac{1}{2} mf^2$
(D) Momentum of the body increases by f
3. Time dependent permanent deformation is called _____
(A) Plastic deformation (B) Elastic deformation
(C) Creep (D) Fatigue
4. Which of the following is dimensionless parameter ?
(A) Pressure coefficient (B) Froude number
(C) Darcey Weisbach friction factor (D) None of the above
5. In a laminar flow
(A) Experimentation is required for simplest flow cases
(B) Newton's law of viscosity applies
(C) Fluid particles move in a irregular and haphazard path
(D) Viscosity is unimportant
6. Capillarity is due to
(A) Cohesion (B) Adhesion
(C) Adhesion & cohesion (D) Gravity
7. Ratio between inertial forces and square root of pressure forces is known as
(A) Euler number (B) Weber number
(C) Froude number (D) Mach number
8. Internal energy of a perfect gas depends upon
(A) Temperature only
(B) Temperature and pressure
(C) Temperature, pressure and specific heats
(D) None of these

Space For Rough Work

9. In Carnot cycle, the algebraic sum of the entropy changes for the cycle is
(A) Positive (B) Negative
(C) Zero (D) None of the above
10. In IC engine, removing of burnt gases from combustion chamber of engine cylinder is known as
(A) Scavenging (B) Supercharging
(C) Detonation (D) Polymerization
11. A gas turbine cycle with infinitely large number of stages during compression and expansion leads to
(A) Stirling cycle (B) Atkinson cycle
(C) Ericsson cycle (D) Brayton cycle
12. Which of the following is an inversion of a single slider crank chain ?
(A) Pendulum pump
(B) Oscillating cylinder
(C) Rotary internal combustion engine
(D) All of the above
13. In a single degree of freedom vibration system, the undamped natural frequency is _____ the damped natural frequency.
(A) greater than (B) equal to
(C) less than (D) uncertain
14. Balancing of a rigid rotor can be achieved by appropriately placing weights in
(A) A single plane (B) Two planes
(C) Three planes (D) Four planes
15. Shaft is subjected to which of the following stresses ?
(A) Bending (B) Torsional
(C) Both (A) & (B) (D) None of these
16. A Transmission shaft subjected to bending loads must be designed on the basis of
(A) Maximum normal stress theory (B) Maximum shear stress theory
(C) Both (A) & (B) (D) Fatigue strength

Space For Rough Work

17. The most suitable bearing for carrying very heavy loads with slow speed is
(A) Hydrodynamic bearing (B) Ball bearing
(C) Roller bearing (D) Hydrostatic bearing
18. The addition of iron oxide to the foundry sand improves the
(A) Bonding (B) Green strength
(C) Hot strength (D) Permeability
19. When material is ductile and cutting speed is higher then chips formed are
(A) Continuous (B) Continuous chip with built up edge
(C) Discontinuous (D) None of these
20. The process is capable of meeting the specification if 6σ is _____ (USL – LSL).
(A) lesser than (B) greater than
(C) equal to (D) all the three
21. The chart which uses film analysis to record simultaneously on a common time scale, the thirbligs performed by different parts of the body of one or more workers.
(A) Gantt chart (B) Simochart
(C) Travel chart (D) Control chart
22. On a critical path float is
(A) Maximum (B) Minimum
(C) Zero (D) Neglected
23. The coordinating of detailed production plans in multistage production system, with inventory control of planned order release, so that the dependent-demand items are made available in the appropriate time schedule is called as
(A) MRP (Materials Requirements Planning)
(B) BOM (Bill Of Materials)
(C) Time phasing
(D) None of the above

Space For Rough Work

24. The radius of curvature of the curve $pa^2 = r^3$ is _____.
 (A) $a^2/3r$ (B) a^2b^2/P^3
 (C) $a^3/3$ (D) None of these
25. $\lim_{x \rightarrow 0} \frac{x}{\sqrt{1 - \cos x}} =$ _____.
 (A) $1/2$ (B) 1
 (C) $\sqrt{2}$ (D) None of these
26. Which of the following is an iterative procedure ?
 (A) Gauss-Jordan (B) Gauss Seidal
 (C) Gauss elimination (D) None of these
27. The solution of a differential equation which is not obtained from the general solution is known as _____.
 (A) Particular solution (B) Singular solution
 (C) Complete solution (D) Auxiliary solution
28. Which one of the following theory is related to the theory of the thermocouple ?
 (A) Piezoelectric effect (B) Skin effect
 (C) Seeback effect (D) Faraday's law
29. Amorphous material is
 (A) Glass (B) Silver
 (C) Lead (D) Zinc
30. Ferromagnetic materials when heated to a temperature above Curie temperature are
 (A) behaves as paramagnetic materials.
 (B) become ferrites.
 (C) tend towards superconductivity.
 (D) become insulator for heat and electricity.

Space For Rough Work

SECTION - II

Each question carries Two marks :

15 × 2 = 30

31. The Euler load for a column is 1000 kN and crushing load is 1500 kN. The Rankine load is equal to
(A) 600 kN (B) 1000 kN
(C) 1500 kN (D) 2500 kN
32. The elastic strain energy stored in a rectangular cantilever beam of length L , subjected to bending momentum ' M ' applied at the end of it is
(A) $M^2L / 2EI$ (B) $ML^2 / 2AE$
(C) $ML^2 / 3EI$ (D) $ML^2 / 16EI$
33. When pressure ' P ', flow rate ' Q ', diameter ' D ' and density ' d ', a dimensionless group is represented by
(A) PQ^2/dD^4 (B) P/dQ^2D^4
(C) PD^4d/Q^2 (D) PD^4/dD^2
34. The condition for irreversibility of a cycle is
(A) Cyclic $\oint dQ/T < 0$ (B) Cyclic $\oint dQ/T > 0$
(C) Cyclic $\oint dQ/T = 0$ (D) None of the above
35. Difference between the tight side and slack side tensions of a belt drive is 3000 N. If the belt speed is 15m/s the transmitted power in kW is
(A) 45 (B) 22.5
(C) 90 (D) 100
36. In full depth $14\frac{1}{2}^\circ$ involute system, the smallest number of teeth in a pinion which meshes with rack without interference is
(A) 12 (B) 16
(C) 25 (D) 32
37. Velocity of belt for maximum power transmission is
(A) $V = \sqrt{T/3m}$ (B) $V = \sqrt{3T/m}$
(C) $T = \sqrt{V/3m}$ (D) $T = \sqrt{3V/m}$
38. The lead angle of a worm is 22.5 degree. Its helix angle will be
(A) 22.5° (B) 45°
(C) 67.5° (D) 90°
39. For casting Aluminium cube of sides 15 cm. The volume of shrinkage of aluminium during solidification is 6.5%. If cylindrical top riser is used then, what will be height of cylinder ?
(A) 6 cm (B) 9 cm
(C) 12 cm (D) 16 cm

Space For Rough Work

40. Fifty flat pieces 1mm thick and initial dimensions as shown in fig-(a) are to be milled in a single cut to the final dimension shown in fig-(b) using end milling, if the cutter of diameter 25 mm has 10 teeth and rotates at 100 rpm. Find the maximum cut chip thickness if the horizontal feed of table is 10 mm/min, assuming single tooth in contact.

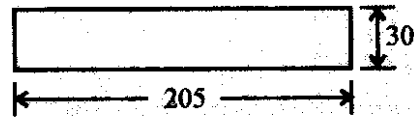


Fig. a

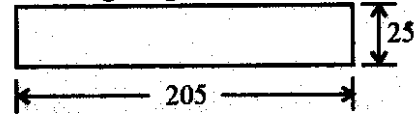


Fig. b

- (A) 8×10^{-3} (B) 9×10^{-3}
 (C) 12×10^{-3} (D) 16×10^{-3}
41. A carbide tool with mild steel work piece was found to give life 2 hours while cutting at 50 m/min. Assume $VT^{0.27} = C$. What will be the cutting speed if tool is required to have 3 hours life ?
 (A) 44.8 m/min (B) 54.8 m/min
 (C) 94.8 m/min (D) None of the above
42. A bullet of mass 0.03 kg moving with a speed of 400 m/s penetrates 12 cm into a fixed block of wood. The average force exerted by the wood on the bullet will be
 (A) 10 kN (B) 20 kN
 (C) 30 kN (D) 40 kN
43. A motorbike starts from rest and accelerates at a rate of 4m/s^2 for 10 seconds and then decelerates at 8m/s^2 until it stops. The total distance covered is
 (A) 100 m (B) 200 m
 (C) 300 m (D) 500 m
44. Bending moment 'M' and torque 'T' is applied on a solid circular shaft. If the maximum bending stress equals to maximum shear stress developed, then M is equal to
 (A) $T/2$ (B) T
 (C) $2T$ (D) $4T$
45. σ_x , σ_y and τ_{xy} are the rectangular stress components at a point. The radius of Mohr's circle is,

(A) $\sqrt{\sigma_x^2 - \sigma_y^2 + \tau_{xy}^2}$

(B) $\sqrt{\frac{(\sigma_x + \sigma_y)^2}{4} + \tau_{xy}^2}$

(C) $\sqrt{\sigma_y^2 - \sigma_x^2 + \tau_{xy}^2}$

(D) $\sqrt{\frac{(\sigma_x^2 + \sigma_y^2)}{4} + \tau_{xy}^2}$

Space For Rough Work

PART - B
(AE : AUTOMOBILE ENGINEERING)
SECTION - I

Each question carries one mark :

20 × 1 = 20

46. _____ batteries are generally used in automobiles.
(A) 6V (B) 12V
(C) 24V (D) 48V
47. Critical damping is a function of
(A) Stiffness and damping co-efficient
(B) Stiffness and natural frequency
(C) Mass and damping co-efficient
(D) Mass and Stiffness
48. Regarding forced vibration, which of the following statement is correct ?
(A) These vibration are independent of natural frequency.
(B) These vibration take place at a frequency more than natural frequency.
(C) These vibration are presided by free vibration.
(D) These vibration are followed by free vibration.
49. The ratio of the maximum dynamic displacement due to dynamic force to the Deflection due to the static force of the same magnitude is called
(A) Displacement Ratio (B) Deflection ratio
(C) Forced factor (D) Magnification factor
50. At node of the shaft, the amplitude of vibration is
(A) Minimum (B) Maximum
(C) Average (D) Zero
51. Thickness of the cylinder wall is determined on the basis
(A) Longitudinal Stresses (B) Circumferential Stresses
(C) Thermal Stresses (D) All the above

Space For Rough Work

52. The Piston rings located at the top of the piston are known as
(A) Compression rings (B) Oil Scroppers rings
(C) Both the above (D) None of the above
53. The twisting moment on the crankshaft of a diesel engine is maximum when the crank is at an angle from top dead centre
(A) 25 to 30° (B) 30 to 40°
(C) 40 to 60° (D) 90°
54. In measuring instrument _____ damping is used.
(A) Frictional (B) Viscous
(C) Coloumb (D) Any of the above
55. Which of the following statements about LVDT is correct ?
(A) It converts strain in to electrical output
(B) It converts linear displacement in to electrical signal
(C) It converts pressure in to electrical output
(D) None of the above
56. An auto collimator is used to measure
(A) Angles (B) Linear movement
(C) Straightness (D) Parallelism
57. For strain gauge, the gauge factor is generally in the range
(A) 0.2 to 0.8 (B) 0.8 to 1.5
(C) 1.5 to 2.0 (D) 2.0 to 4.0
58. Robots consist of basic components: power supply, control censual and
(A) Micro computer (B) Co-axial cable
(C) Mechanical unit (D) Software

Space For Rough Work

59. Which of the following has the lowest production rate ?
(A) Job shop production (B) Batch production
(C) Mass production (D) None of the above
60. In a four stroke cycle S.I. engine the cam shaft runs
(A) At the same speed as crank shaft
(B) At the half the speed of crank shaft
(C) At twice the speed of crank shaft
(D) At any speed irrespective of crankshaft speed
61. The Knocking in SI engine increases with
(A) increase in inlet air temperature
(B) increase in compression ratio
(C) increase in cooling water temperature
(D) all of the above
62. Detonation can be controlled by
(A) Reducing the rpm
(B) Retarding the spark time
(C) Varying compression ratio
(D) Any of the above
63. _____ is the method of governing used in diesel engine.
(A) Quality governing (B) Hit and miss governing
(C) Quantity governing (D) Any of the above
64. The ignition quality of fuels for SI engines is determined by
(A) Cetane number rating (B) Octane number rating
(C) Calorific value rating (D) Volatility of the fuel
65. The ignition temperature of diesel fuel is about
(A) 200 °C (B) 400 °C
(C) 600 °C (D) 800 °C

Space For Rough Work

SECTION - II

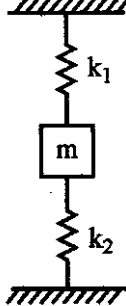
Each question carries 2 marks :

10 × 2 = 20

66. For critical damping, which of the following condition will be satisfied ?

(A) $(C/2m)^2 > K/M$ (B) $(C/2m)^2 = K/M$
 (C) $(C/2m)^2 < K/M$ (D) None of the above

67. The Natural frequency of the spring shown in the figure will be

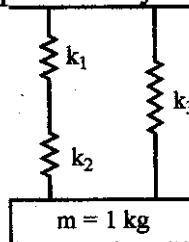


(A) $f_n = 1/2\pi \sqrt{k_1 k_2 / m(k_1 + k_2)}$ (B) $f_n = 1/2\pi \sqrt{k_1 + k_2 / m(k_1 k_2)}$
 (C) $f_n = 1/2\pi \sqrt{k_1 + k_2 / m}$ (D) None of the above

68. A fit is specified as 2.5h8/e8. The tolerance value for a nominal diameter of 25 mm in IT 8 is 33 microns and fundamental deviation for the shaft is -40 micron. The maximum clearance of the fit in microns is

(A) -7 (B) 7
 (C) 73 (D) 106

69. A mass of 1kg is suspended by means of 3 springs as shown in the figure below. The spring constants k_1 , k_2 and k_3 are respectively 1 kN/m, 3kN/m and 2kN/m. The natural frequency of a system is approximately

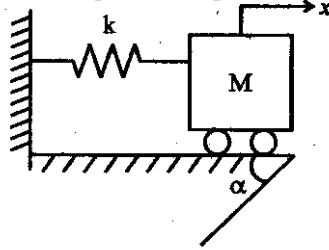


(A) 46.90 Hz (B) 52.44 Hz
 (C) 60.55 Hz (D) 77.46 Hz

70. A diesel engine is generally more efficient than a petrol engine because of
 (A) proper air fuel mixing and combustion.
 (B) high calorific value of diesel fuel.
 (C) knock free operation.
 (D) high compression ratio.

Space For Rough Work

71. For a single degree of freedom system shown in the figure below, the mass M rolls along an incline of α . The natural frequency of the system will be



- (A) Increase as α increases
 (B) Decrease as α increases
 (C) Be independent of α
 (D) Increase initially as α increases and then decreases with further increase in α

72. Match List I with List II and select the correct answer from the codes given below :

List-I

- P. _____ is a device which measures the total intensity of radiation emitted from a body.
 Q. _____ is an instrument which measures humidity directly.
 R. _____ is a device which converts the energy from one form to another.
 S. Transducer which make use of air gap change are referred as _____

List-II

1. Transducer
 2. Reluctance
 3. Hygrometer
 4. Radiation Pyrometer

Codes :

	P	Q	R	S
(A)	4	3	1	2
(B)	1	2	3	4
(C)	2	3	4	1
(D)	3	4	1	2

73. An Otto cycle operates with volumes of 40 cm^3 and 400 cm^3 at top dead centre (TDC) and bottom dead centre (BDC) respectively. If the power output is 100 kW, what is the heat input, in kJ/s ? Assume $\gamma = 1.4$
- (A) 166 (B) 145
 (C) 110 (D) 93
74. If the approximate average mean pressure during induction, compression, power and exhaust strokes of an internal combustion engine are respectively 15 kN/m^2 below atmosphere, 200 kN/m^2 above atmosphere, 1000 kN/m^2 above atmosphere and 20 kN/m^2 above atmosphere, then the resultant mean effective pressure in kN/m^2 is
- (A) 765 (B) 795
 (C) 800 (D) 805
75. When 1 kg of pure carbon is burnt in air, the percentage of carbon is burnt in air, the percentage of carbon dioxide cannot exceed
- (A) 10% (B) 14.5%
 (C) 21.75% (D) 29%

Space For Rough Work

PART – B
MC : MECHANICAL ENGINEERING
SECTION – I

Each question carries one mark.

20 × 1 = 20

46. In perpetual inventory control, the material is checked as it reaches its
(A) Minimum value (B) Maximum value
(C) Average value (D) Alarming value
47. The disadvantage of product layout is
(A) High initial investment for the specialized facilities
(B) Skilled labour to operate machines
(C) Production time is longer, requiring more goods in inventory
(D) High cost of inspection
48. In a PERT chart
(A) All activities should be numbered
(B) Only important activities should be numbered
(C) Only critical activities are numbered
(D) Only selected activities are numbered
49. Capital expenditure means
(A) Expenses incurred in acquiring capital
(B) Main expenditure
(C) Recurring expenditure
(D) Expenditure on procurement of fixed assets
50. The property of a fluid which determines, its resistance to shearing stresses is called
(A) Viscosity (B) Surface tension
(C) Compressibility (D) None of the above
51. The tendency for an immersed body to be lifted upon the fluid due to an upward force opposite to the action of gravity is known as
(A) Buoyancy (B) Centre of buoyancy
(C) Buoyancy force (D) None of the above

Space For Rough Work

52. Which of the following is an example of free vertex flow ?
(A) A whirlpool in a river
(B) Flow of liquid in centrifugal pump
(C) Flow of liquid through a hole provided at the bottom of a container
(D) All of the above
53. Which of the following factors determine the friction factor for turbulent flow in a rough pipe ?
(A) Mach number & relative roughness
(B) Froude number & Mach number
(C) Reynolds number & relative roughness
(D) Froude number & relative roughness
54. Which of the following materials are used in the manufacture of thermistors ?
(A) Carbides of silicon & germanium (B) Oxides of manganese & cobalt
(C) Oxides of iron & zinc (D) All of the above
55. The working of _____ is not affected by the fluid density.
(A) Pitot static tube traverse (B) Rotameter
(C) Orifice plate (D) Electro magnetic flow meter
56. In which of the following units is high vacuum pressure most commonly expressed ?
(A) Micron (B) Torr
(C) Pascal (D) Cm of water
57. On which of the following factors does the sensitivity accuracy of an instrument depend ?
(A) Hysteresis (B) Amplitude distortion
(C) Temperature variations (D) Frequency response
58. Flexible manufacturing allows for
(A) Automated design (B) Factory management
(C) Tool design & tool production (D) Quick & inexpensive product changes

Space For Rough Work

59. Robots are specified by
(A) Control system (B) Axis of movement
(C) Pay load (D) All of the above
60. Thermal conductivity of solid metals with rise in temperature normally
(A) Increases
(B) Decreases
(C) Remains constant
(D) May increase or decrease depending on temperature
61. Heat is transferred by all three modes of transfer, viz, conduction, convection and radiation in
(A) Electric heater (B) Steam condenser
(C) Refrigerator condenser coils (D) Boiler
62. A non-dimensional number generally associated with natural convection heat transfer is
(A) Grasshoff number (B) Nusselt number
(C) Weber number (D) Prandtl number
63. Stefan Boltzmann law is applicable for heat transfer by
(A) Conduction (B) Convection
(C) Radiation (D) Convection & radiation combined
64. Micro motion study is
(A) Enlarged view of motion study
(B) Analysis of one stage of motion study
(C) Minute and detailed motion study
(D) Subdivision of an operation into therbligs and their analysis
65. CPM is the
(A) Time oriented technique (B) Event oriented technique
(C) Activity oriented technique (D) Work oriented technique

Space For Rough Work

SECTION - II

Each question carries two marks.

$10 \times 2 = 20$

66. If the cost of production of N units is given as $(N + \frac{10000}{N})$, the value of N should be as follows for the total cost to be minimum

(A) 100 (B) 1000
(C) 10000 (D) 100000

67. The standard time for a job is

(A) Total work content
(B) Basic time + relaxation time
(C) Total work content + basic time
(D) Total work content + delay contingency allowance

68. Match list-I with list-II and select the correct answer using the codes given below the lists :

List-I

P. Propeller turbine
Q. Tangential turbine
R. Reaction is zero
S. Reaction turbine

List-II

1. Impulse turbine
2. Kaplan turbine
3. Gas turbine
4. Pelton wheel

Codes : P Q R S

(A) 3 2 1 4
(B) 2 1 4 3
(C) 2 4 1 3
(D) 3 4 2 1

69. Balls of diameter 30 mm and 15 mm were used to measure the taper of a ring gauge. During inspection, the ball of 30 mm diameter was protruding by 2.5 mm above the top surface of the ring. This surface was located at a height of 50 mm from the top of the 15 mm diameter ball. Calculate the taper angle.

(A) 12° (B) 14°
(C) 18° (D) 20°

Space For Rough Work

70. A 750 hours life test is performed on ten components. If one component fails after 350 hours of operation and all others survive the test, then the failure per hour is
 (A) 0.000141 (B) 0.000133
 (C) 0.00141 (D) 0.00133
71. The monthly demand is ₹ 2000 of sales. Annual carrying cost is ₹ 2400. 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
72. A turbine works at 20 m head and 500 rpm speed. Its 1:2 scale model to be tested at a head of 20 m should have a rotational speed of nearly
 (A) 1000 rpm (B) 700 rpm
 (C) 500 rpm (D) 250 rpm
73. Thermal conductivity of water at 20 °C is of the order of
 (A) 0.1 (B) 0.23
 (C) 0.42 (D) 0.51
74. The ratio of heat flow $\frac{Q_1}{Q_2}$ from two walls of same thickness having their thermal conductivity as $K_1 = 2 K_2$ will be
 (A) 1 (B) 0.5
 (C) 2 (D) 0.25
75. Two plane slabs of equal areas and conductivities in the ratio 1 : 2 are held together and temperature in between surface ends are t_1 and t_2 is desired to be $\frac{t_1 + t_2}{2}$, then their thickness should be in the ratio of
 (A) 1 : 2 (B) 2 : 1
 (C) 1 : 1 (D) 3 : 1

Space For Rough Work

PART - B
IPE: INDUSTRIAL AND PRODUCTION ENGINEERING
SECTION - I

Each question carries one mark.

20 × 1 = 20

46. Extrusion is a
(A) Metal cutting process (B) Metal forming process
(C) Method of heat treatment (D) Casting process
47. The saddle point in theory of games is the point where
(A) Maximin for A = Minimax for B
(B) Maximin for A > Minimax for B
(C) Maximin for A < Minimax for B
(D) None of these
48. Linear programming can be applied to
(A) Steel industry (B) Oil industry
(C) Chemical industry (D) All of the above
49. CAD/CAM is the inter-relationship between
(A) Marketing and Design (B) Manufacturing
(C) Engineering and Marketing (D) Engineering and Manufacturing
50. Example of Non-Destructive testing is
(A) X- ray test (B) Compression test
(C) Tension test (D) Bending test
51. The cutting speed of a job of 20 mm diameter, rotating at 1000 rpm in m/min is
(A) 62.8 (B) 31.4
(C) 100 (D) 50
52. Curved surface can be machined in numerical control by
(A) Bend axis method (B) Contour method
(C) Point to point method (D) Straight line method
53. Magnetic particle test
(A) is employed for non-ferrous materials
(B) is adapted for ferromagnetic materials
(C) is used to identify defects deep inside the material
(D) needs a die to be employed
54. Which of the following chart is used as a control chart for variables ?
(A) C - chart (B) $\bar{x}$ - chart
(C) P - chart (D) None of these
55. When the process capability is less than the specified tolerance, the rejection are
(A) Less (B) Very high
(C) Nil (D) High

Space For Rough Work

56. Gilbreth developed a spring driven fast moving clock called micro chronometer which is capable of indicating a minimum time value of _____ of a minute.
 (A) 1/7000 (B) 1/8000
 (C) 1/2000 (D) 1/6000
57. Therblig is a set consisting which of the following numbers of elementary motions ?
 (A) 15 (B) 19
 (C) 17 (D) 16
58. In a 2-D CAD package, clock wise circular arc of radius 5, specified from p_1 (15, 10) to p_2 (10, 15) will have its center at
 (A) (10, 10) (B) (15, 10)
 (C) (15, 15) (D) (10, 15)
59. The process involving the heating of steel above upper critical temperature and then cooling it in a furnace is known as
 (A) Tempering (B) Normalizing
 (C) Hardening (D) Annealing
60. The chart that gives an overall picture by recording in sequence only the main operations and inspections.
 (A) Flow process chart (B) Multiple activity chart
 (C) Outline process chart (D) Gantt chart
61. Ship building is an example for _____ Type of layout.
 (A) Process (B) Product
 (C) Group (D) Fixed position
62. Feeler gauge is used to check
 (A) Radius (B) Screw pitch
 (C) Surface roughness (D) Thickness of clearance
63. An auto-collimator is used to measure small angular inclinations and also to check
 (A) Straightness (B) Flatness
 (C) Alignment (D) All the above three
64. Systematic errors are
 (A) Randomly distributed
 (B) Unpredictable
 (C) Regularly repetitive in nature
 (D) Distributed on both +ve and -ve sides of mean value
65. The spot grinding process is used only for finishing operation and can produce accuracy of _____ for both flatness and parallelism.
 (A) 0.01 mm (B) 0.002 mm
 (C) 0.02 mm (D) 0.05 mm

Space For Rough Work

SECTION - II

Each question carries 2 marks.

$10 \times 2 = 20$

66. Match list-I with list-II and select the correct answer using the codes given below the lists :

List-I

- a. Sine bar
- b. Auto collimator
- c. Clinometer
- d. Micrometer

List-II

- 1. Optical principles
- 2. Slip gauge
- 3. Small linear measurement
- 4. Included angle
- 5. Compares linear measurements

Codes :

	a	b	c	d
(A)	4	3	5	1
(B)	4	2	3	1
(C)	2	1	4	3
(D)	2	1	5	3

67. In transportation problem there are four supply centres and five demand centres. The total quantity of supply available is greater than the total demand. The number of allocations, without degeneracy during iteration is

- (A) 3
- (B) 6
- (C) 9
- (D) 0

68. If D is the duration, ES and EF are the Earliest start and Latest finish times, then the relation holds good is

- (A) $LS = LF - D$
- (B) $LF = LS + D$
- (C) $D = EF - ES$
- (D) All of the above

69. A company is engaged in the manufacturing of chairs. The cost of land, building and machinery is ₹ 1,00,000/-, the cost of wood and labour for each chair is ₹ 40/- and selling price is ₹ 60/-, the minimum number of chairs to be manufactured so that neither profit nor loss is incurred is

- (A) 15,000
- (B) 10,000
- (C) 5,000
- (D) 20,000

Space For Rough Work

70. In point-to-point control NC Machine, the slide is positioned by an integrally mounted stepper motor drive. If the motor specification is 1° per pulse and the pitch of the lead screw is 3.6 mm, the expected positioning accuracy is
 (A) $1\ \mu\text{m}$ (B) $10\ \mu\text{m}$
 (C) $50\ \mu\text{m}$ (D) $100\ \mu\text{m}$
71. The variance of the population is 36 and the sample size is 4. The standard error of the sample is
 (A) 3 (B) 4
 (C) 5 (D) 6
72. A project requires an initial investment of ₹ 5,00,000 and returns are of ₹ 2,00,000 at the end of each year for 5 years with no terminal salvage. The undiscounted payback period for the project is
 (A) $2\frac{1}{2}$ years (B) 3 years
 (C) 2 years (D) None of these
73. The work materials experiences strain during its entry and exit through rolls. If t_o represents original work thickness and t_f be its final thickness, then true strain is expressed as to
 (A) $\log_n \frac{t_o - t_f}{t_o}$ (B) $\log_n \frac{t_o}{t_o - t_f}$
 (C) $\log_n \frac{t_o}{t_f}$ (D) $\log_n \frac{t_f}{t_o}$
74. In the Taylor's tool life equation $VT^n = C$ the value of $n = 0.5$. The tool has a life of 180 minutes, a cutting speed of 18 m/minute. If the tool life is reduced to 45 minutes, then the cutting speed will be
 (A) 9 m/minute (B) 18 m/minute
 (C) 36 m/minute (D) 72 m/minute
75. Interference fit results when there is a
 (A) negative allowance between the larger hole and smallest shaft, the shaft being larger than the hole.
 (B) positive allowance between largest - possible shaft and the smallest possible hole, hole being larger than the shaft.
 (C) zero allowance between the shaft and the hole.
 (D) none of these.

Space For Rough Work

PART - B
ITEM : INDUSTRIAL ENGINEERING & MANAGEMENT
SECTION - I

Each question carries one mark

20 × 1 = 20

46. The fact that how closely the instrument reading follows the measured variables is termed as
(A) Fidelity (B) Accuracy
(C) Threshold sensitivity (D) Precision
47. CAD/CAM is hardware oriented, but _____ gives it life.
(A) Numerical control (B) Documentation
(C) Software (D) Communications.
48. The ultimate solution to the CAD/CAM problem will be
(A) LANs
(B) The Microprocessor
(C) Turnkey systems
(D) Development of more efficient display controller
49. If the number of defective parts in a sample lot is more than the acceptance number, then the whole lot will be rejected in
(A) Sampling inspection (B) Sequential sampling
(C) Acceptance sampling (D) Lot-by-lot inspection.
50. Which of the following charts is used as a control chart for variables ?
(A) C-chart (B) $\bar{X}$ -chart
(C) P-chart (D) None of these
51. Maslow's hierarchy of Human needs are
(A) Physiological, Safety, Ego, Social, Self realization
(B) Physiological, Safety, Social, Self realization
(C) Safety, Physiological, Ego, Social, Self realization
(D) Physiological, Safety, Social, Ego, Self-realization.

Space For Rough Work

52. Provides the management with a means of measuring the time taken in the performance of an operation(s) is _____.
(A) Method study (B) Work measurement
(C) Time study (D) Motion study
53. Vendor Managed Inventory (VMI) decision is taken by
(A) Manufacturers and retailers (B) Manufacturers and suppliers
(C) Manufacturers (D) Suppliers
54. The system of codification which consists of 10 digits of numerical code is called
(A) Brich system (B) Periphery system
(C) Kodak system (D) Centralization system
55. In an MRP system, component demand is
(A) Forecasted
(B) Established by the master production schedule
(C) Calculated by the MRP system from the master production schedule
(D) Ignored
56. An information system that responds immediately to the needs of the physical system is called
(A) Inline system (B) Online system
(C) Offline system (D) Real time system
57. A language for simulating models of business activity is
(A) SPSS (B) PL/I
(C) GPSS (D) COBOL
58. A database models data, so that it is
(A) Appropriate for application
(B) Independent of application program
(C) Optimized for most frequent applications
(D) Optimized for all applications

Space For Rough Work

59. Information is
- | | |
|-----------------------|---------------------|
| (A) Data | (B) Processed data |
| (C) Manipulated input | (D) Computer output |
60. In a M/M/1 queue model, the mean arrival rate is λ , and the lengthen of the queue is Q, the expected waiting time is
- | | |
|-----------------|------------------|
| (A) Q | (B) Q/λ |
| (C) λQ | (D) $1/Q\lambda$ |
61. According to Henry Fayol, one of the functions of Management is
- | | |
|---------------|--------------------|
| (A) Authority | (B) Discipline |
| (C) Planning | (D) Responsibility |
62. The expected time (t_e) of PERT activity in terms of optimistic time (t_o) pessimistic time (t_p) and most likely time(t_m) is given by
- | | |
|----------------------------------|----------------------------------|
| (A) $t_e = (t_o + 4t_m + t_p)/6$ | (B) $t_e = (t_o + 4t_p + t_m)/6$ |
| (C) $t_e = (t_o + 4t_m + t_p)/3$ | (D) $t_e = (t_o + 4t_p + t_m)/3$ |
63. The penalty cost is four times that of carrying cost for an item, and the demand rate is constant. If shortages are permitted, the service level that could be maintained at EOQ ordering is
- | | |
|----------|----------|
| (A) 0.75 | (B) 0.80 |
| (C) 1.25 | (D) 1.33 |
64. In ABC analysis, the C items are those which represents
- | |
|---|
| (A) small percentage of the total annual consumption value. |
| (B) high percentage of the total annual consumption value. |
| (C) small percentage of the closing inventory value. |
| (D) high percentage of the closing inventory value. |
65. Tolerances are specified
- | |
|--|
| (A) to obtain desired fits. |
| (B) because it is not possible to manufacture in size exactly. |
| (C) to obtain high accuracy. |
| (D) to have proper allowance. |

Space For Rough Work

SECTION - II

Each question carries 2 marks :

10 × 2 = 20

66. A small bore is designated as 25H7. The lower (minimum) and upper (maximum) limits of the bore are 25.000 mm and 25.02 mm respectively. When the bore is designated as 25H8, then the upper (maximum) limit is 25.033 mm. Then the bore is designated as 25H6, then the upper (maximum) limit of the bore (in mm) is
- (A) 25.001 (B) 25.005
(C) 25.009 (D) 25.013
67. An operator manufactures 75 jobs in 8 hrs. If this time includes the time for setting his machine, calculate the operation's efficiency, standard setting time is 49 minutes, and production time per piece is 10 minutes.
- (A) 115.5% (B) 164.6%
(C) 184.7% (D) 224.8%
68. Cars arrive at a service station according to Poisson's distribution with a mean rate of 5 per hour. The service time per car is exponential with mean of 10 minutes. At steady state, the average waiting time in the queue is
- (A) 10 minutes (B) 20 minutes
(C) 25 minutes (D) 50 minutes
69. In a point-to-point control NC machine, the slide is positioned by an integrally mounted stepper motor drive. If the motor specification is 1°/pulse and the pitch of the lead screw is 3.6 mm, the expected positioning accuracy is
- (A) 1 μm (B) 10 μm
(C) 50 μm (D) 100 μm
70. A process is to be controlled with standard values of mean = 18 and the standard deviation is equal to 4. The sample size is 9. The control limits for $\bar{x}$ - chart are
- (A) 18 ± 9 (B) 18 ± 6
(C) 18 ± 4 (D) 18 ± 3

Space For Rough Work

71. The monthly sale is ₹ 2000. Annual carrying cost is ₹ 2400. The re-ordering cost per order is ₹ 600. The EOQ is
- (A) One month sales (B) Two month sales
(C) Three month sales (D) Four month sales
72. A PERT activity has an optimistic time of 3 days, pessimistic time of 15 days and the expected time is 7 days. The most likely time of the activity is
- (A) 5 days (B) 6 days
(C) 7 days (D) 9 days
73. If the average outgoing quality is 1.5%, the incoming quality at the point of difference will be
- (A) 1.5% (B) 3%
(C) 6% (D) None of these
74. The constraints in a given situation are found to be as follows :
- $$0 \leq x \leq 12 \quad 0 \leq y \leq 9 \quad 3x + 6y \leq 66$$
- The objective function, which is to be maximized is as follows :
- $$P = 5x + 4y$$
- the values of x and y are
- (A) (11, 6) (B) (6, 11)
(C) (6, 6) (D) (11, 11)
75. A company produces a component for which the annual demand is 72000. The shop capacity is 400 per day. Setup cost is ₹ 75 and holding cost is ₹ 15 per unit per year. The most economical production run will be.
- (A) 800 units/run (B) 1000 units/run
(C) 1200 units/run (D) 1600 units/run

Space For Rough Work

PART - B
MSE : MANUFACTURING SCIENCE AND ENGINEERING
SECTION - I

Each Question carries one mark :

20 × 1 = 20

46. In forging operation work piece is usually subjected to
(A) Compressive stress (B) Tensile stress
(C) Shear stress (D) Bending stress
47. A Thermit mixture consists of
(A) Iron powder and Aluminum oxide
(B) Aluminum powder and Iron oxide
(C) Copper powder and Aluminum oxide
(D) Aluminum powder and Copper oxide
48. Oxy-acetylene combination is widely used in gas welding because
(A) Gives the cleanest process
(B) Complete combustion is possible
(C) Gives the highest temperature as compared to other combinations
(D) It is more economical
49. A dummy activity is used in PERT network to describe
(A) Precedence relationship (B) Necessary time delay
(C) Resource restriction (D) Resource idling
50. Use of optical micrometer is
(A) To set very small displacement through relatively large angles
(B) To measure surface profiles
(C) To measure surface roughness
(D) To measure small linear displacements
51. In a sine bar, a length is measured
(A) From edge to edge
(B) Between outer circumferences of two rollers
(C) Between inner circumferences of two rollers
(D) Between centres of two rollers
52. The integration of CAD and CAM is called
(A) CAE / CAM (B) CIM
(C) CAE (D) CAD / CAM
53. A robotic instrument is prevented from running into other objects by
(A) Sensory devices (B) Negative image
(C) Bubble memory (D) Pixel
54. A device attached to the end of robots wrist is called
(A) Sensor (B) End effectors
(C) Manipulator (D) Encoder
55. The tolerance zone of shaft and holes overlap in
(A) Clearance fit (B) Interference fit
(C) Transition fit (D) None of the above

Space For Rough Work

56. The CLA value is used for the measurement of
 (A) Sharpness of tool edge (B) Surface roughness
 (C) Surface dimension (D) Metal hardness
57. Seam, Spot and Projection welding processes belong to
 (A) Electric resistance welding (B) Thermit welding
 (C) Forge welding (D) Arc welding
58. Consider a Linear Programming model having n variables and m constraints. The condition of degeneracy is that during an iteration the total number of allocated base calls should be
 (A) Equal to $(m + n - 1)$ (B) More than $(m + n - 1)$
 (C) Less than $(m + n - 1)$ (D) None of these
59. Flow control is adopted for control of
 (A) Production of large volume of single or few types of products
 (B) Intermittent production of small quantities of many items
 (C) Ordering of raw materials
 (D) Consumption of new materials
60. The electrode used in an arc welding is coated. This coating is not expected to
 (A) provide protective atmosphere to weld.
 (B) stabilize the arc.
 (C) add alloying elements.
 (D) prevents electrode from contamination.
61. Quenching involves
 (A) very slow cooling (B) slow cooling
 (C) rapid cooling (D) no cooling
62. Cutting conditions for machining process includes the following parameters :
 (A) Cutting speed (B) Feed
 (C) Depth of cut (D) All of the above
63. Feed drives in CNC milling machines are provided by
 (A) Synchronous motors (B) Induction motors
 (C) Stepper motors (D) Servo motors
64. A 'Block' of information in NC machine programming means :
 (A) One row on tape
 (B) A word comprising several rows on tape
 (C) One complete instruction
 (D) One complete program for a job
65. Which of the following combination of properties are favourable for forming operation ?
 (A) High yield strength
 (B) Low yield strength and high ductility
 (C) High ductility and high ultimate strength
 (D) High ductility and low ultimate strength

Space For Rough Work

SECTION – II

Each Question carries 2 marks :

$10 \times 2 = 20$

66. In an arc welding process, the voltage and current are 25 V and 300 A respectively. The arc heat transfer efficiency is 0.85 and welding speed is 8 mm/sec. The net heat input (in J/mm) is
- (A) 64 (B) 797
(C) 1103 (D) 79700
67. A shaft of diameter $20_{-0.15}^{+0.05}$ mm is assembled in a hole of diameter $20_{+0.1}^{+0.2}$ mm would yield
- (A) Transition fit (B) Interference fit
(C) Clearance fit (D) Shrink fit
68. The hole is specified as $40_{0.000}^{0.050}$ mm. The mating shaft has a clearance fit with minimum clearance of 0.01 mm. The tolerance on the shaft is 0.04 mm. The maximum clearance in mm between the hole and the shaft is
- (A) 0.04 (B) 0.05
(C) 0.10 (D) 0.11
69. For obtaining a cup of diameter 25 mm and height 15 mm by drawing, the size of normal blank should be approximately
- (A) 42 mm (B) 44 mm
(C) 46 mm (D) 48 mm
70. A PERT activity has an optimistic time of 3 days, pessimistic time of 15 days and expected time of 7 days. The most likely time of the activity is
- (A) 15 days (B) 7 days
(C) 6 days (D) 5 days

Space For Rough Work

71. In a point control NC machine, the slides are positioned by an integrally mounted stepper motor drive. If the specification of the motor is $1^\circ/\text{pulse}$, and the pitch of the lead screw is 3.6 mm, what is the expected positioning accuracy?
- (A) $1\ \mu\text{m}$ (B) $10\ \mu\text{m}$
(C) $50\ \mu\text{m}$ (D) None of the above
72. In a 2-D CAD package, clockwise circular arc of radius 5, specified from $P_1 (15,10)$ to $P_2 (10, 15)$ will have its centre at
- (A) (10, 10) (B) (15, 10)
(C) (15, 15) (D) (10, 15)
73. In an orthogonal cutting process, rake angle of the tool is 20° and friction angle is 25.5° . Using Merchant's shear angle relationship, the value of shear angle will be
- (A) 39.5° (B) 42.25°
(C) 47.75° (D) 50.5°
74. A steel bar of $40\ \text{mm} \times 40\ \text{mm}$ square cross-section is subjected to an axial compressive load of 20 kN. If the length of the bar is 2m and $E = 200\ \text{Gpa}$, the elongation of the bar will be
- (A) 1.25 mm (B) 2.70 mm
(C) 4.05 mm (D) 5.40 mm
75. A 4 mm thick sheet is rolled with 300 mm diameter rolls to reduce thickness without any change in its width. The friction co-efficient at the work – roll interface is 0.1. The minimum possible thickness of the sheet that can be produced in a single pass is
- (A) 1.0 mm (B) 1.5 mm
(C) 2.5 mm (D) 3.7 mm

Space For Rough Work

A-2