Department of Mechanical Engineering
and Industrial Engineering
GITAM Institute of Technology
GITAM (DEEMED TO BE UNIVERSITY)
(Estd. u/s 3 of the UGC Act, 1956), NAAC Accredited with `A+' Grade
Gandhinagar Campus, Rushikonda, Visakhapatnam-530 045, A.P., India

Ph.D. Entrance Test - 2019-20 (Phase-II)

Part – A: Research Methodology

Syllabus:

What is Research; Objectives, Motivation, Types of Research. Literature Review and Technical Reading, Attributions and Citations, Building Intellectual Property Rights: Codes and Standards, Ethics in Engineering Research, Technical Writing and Publishing, Communicating Research Work: Presentation Skills, Assessing Research Quality.

Reference Books:

1. Dipankar Deb, Rajeeb Dey, Valentina E. Balas, Engineering Research Methodology, A Practical Insight for Researchers, Springer Publications, 2019
2. C. R. Kothari, Research Methodology – Methods and Techniques, New Age International Publishers, 2004.
3. David V. Thiel, Research Methods for Engineers, Cambridge University Press, 2014.

Part – B: Mechanical Engineering and Industrial Engineering

Syllabus:

Fluid Mechanics and Thermal Sciences:

Fluid Mechanics: Fluid properties; fluid statics, manometry, buoyancy, forces on submerged bodies, stability of floating bodies; control-volume analysis of mass, momentum and energy; fluid acceleration; differential equations of continuity and momentum; Bernoulli's equation; dimensional analysis; viscous flow of incompressible fluids, boundary layer, elementary turbulent flow, flow through pipes, head losses in pipes, bends and fittings.

Heat-Transfer: Modes of heat transfer; one dimensional heat conduction, resistance concept and electrical analogy, heat transfer through fins; unsteady heat conduction, lumped parameter system, Heisler's charts; thermal boundary layer, dimensionless parameters in free and forced convective heat transfer, heat transfer correlations for flow over flat plates and through pipes, effect of turbulence; heat exchanger

performance, LMTD and NTU methods; radiative heat transfer, Stefan-Boltzmann law, Wien's displacement law, black and grey surfaces, view factors, radiation network analysis.

Thermodynamics: Thermodynamic systems and processes; properties of pure substances, behaviour of ideal and real gases; zeroth and first laws of thermodynamics, calculation of work and heat in various processes; second law of thermodynamics; thermodynamic property charts and tables, availability and irreversibility; thermodynamic relations.

Applications: *Power Engineering*: Air and gas compressors; vapour and gas power cycles, concepts of regeneration and reheat.

I.C. Engines*:* Air-standard Otto, Diesel and dual cycles.

Refrigeration and air-conditioning*:* Vapour and gas refrigeration and heat pump cycles; properties of moist air, psychrometric chart, basic psychrometric processes.

Turbomachinery: Impulse and reaction principles, velocity diagrams, Pelton-wheel, Francis and Kaplan turbines.

Industrial Engineering:

Production Planning and Control*:* Forecasting models, aggregate production planning, scheduling, materials requirement planning.

Inventory Control*:* Deterministic models; safety stock inventory control systems.

Operations Research*:* Linear programming, simplex method, transportation, assignment, network flow models, simple queuing models, PERT and CPM.

Applied Mechanics and Design:

Engineering Mechanics: Free-body diagrams and equilibrium; trusses and frames; virtual work; kinematics and dynamics of particles and of rigid bodies in plane motion; impulse and momentum (linear and angular) and energy formulations, collisions.

Mechanics of Materials: Stress and strain, elastic constants, Poisson's ratio; Mohr's circle for plane stress and plane strain; thin cylinders; shear force and bending moment diagrams; bending and shear stresses; deflection of beams; torsion of circular shafts; Euler's theory of columns; energy methods; thermal stresses; strain gauges and rosettes; testing of materials with universal testing machine; testing of hardness and impact strength.

Theory of Machines: Displacement, velocity and acceleration analysis of plane mechanisms; dynamic analysis of linkages; cams; gears and gear trains; flywheels and governors; balancing of reciprocating and rotating masses; gyroscope.

Vibrations: Free and forced vibration of single degree of freedom systems, effect of damping; vibration isolation; resonance; critical speeds of shafts.

Machine Design: Design for static and dynamic loading; failure theories; fatigue strength and the S-N diagram; principles of the design of machine elements such as bolted, riveted and welded joints; shafts, gears, rolling and sliding contact bearings, brakes and clutches, springs.

Materials, Manufacturing and Industrial Engineering:

Engineering Materials*:* Structure and properties of engineering materials, phase diagrams, heat treatment, stress-strain diagrams for engineering materials.

Casting, Forming and Joining Processes: Different types of castings, design of patterns, moulds and cores; solidification and cooling; riser and gating design. Plastic deformation and yield criteria; fundamentals of hot and cold working processes; load estimation for bulk (forging, rolling, extrusion, drawing) and sheet (shearing, deep drawing, bending) metal forming processes; principles of powder metallurgy. Principles of welding, brazing, soldering and adhesive bonding.

Machining and Machine Tool Operations: Mechanics of machining; basic machine tools; single and multi-point cutting tools, tool geometry and materials, tool life and wear; economics of machining; principles of non-traditional machining processes; principles of work holding, design of jigs and fixtures.

Metrology and Inspection: Limits, fits and tolerances; linear and angular measurements; comparators; gauge design; interferometry; form and finish measurement; alignment and testing methods; tolerance analysis in manufacturing and assembly.

Computer Integrated Manufacturing: Basic concepts of CAD/CAM and their integration tools.

Reference Books:

1. Theory of Machines by SS Rattan, McGraw Hill Education; Fourth edition
2. Design of Machine Elements by VB Bhandari, McGraw Hill Education India Private Limited; Fourth edition.
3. Engineering Mechanics by SS Bhavikatti, New Age International Publishers
4. Strength of Materials by SS Rattan, McGraw Hill Education, Third edition
5. Fluid Mechanics by RK Bansal, Laxmi Publications; Tenth edition.
6. Heat & Mass Transfer by PK Nag, McGraw Hill Education, 3rdedition
7. Mechanical Vibration by GK Grover, Nem Chand & Bros.
8. Engineering Thermodynamics by Cengel& Boles, McGraw Hill Education; 8th edition.
9. Internal Combustion Engine by V Ganesan, McGraw Hill Education; 4th edition.
10. Refrigeration & Air Conditioning by CP Arora, McGraw Hill Education; 3rdedition
11. Material Science and Engineering by V Rahavan, Prentice Hall India Learning Private Limited; 6th Revised edition.
12. Manufacturing Technology by PN Rao, I & II Volumes, McGraw Hill Education; Fifth edition
13. Industrial Engineering by OP Khanna, DhanpatRai Publications (2018)
14. Operation Research by SD Sharma, KedarNath Publishers.
15. Computer integrated manufacturing by Mikell P. Groover, Pearson Publishers; 4th edition.
16. Production Planning and Control, M. Mahajan, DhanpatRai& Co.; 2018 edition.

Ph.D. Entrance Test - 2019-20 (Phase-II)

Model-Question paper

Duration: 2hours **Max Marks 70**

Part – A: Research Methodology

Section - A contains : 25 questions × 1 mark = 25 Marks
Section- B contains : 15 questions × 2 marks = 30 Marks
Section-C contains : 5 questions × 3 marks = 15 Marks

Section-A
Answer the following each question carries 1 Mark
25 questions × 1 mark = 25 Marks

1. Essence of both basic and applied research lies in
a)Market orientation b)scientific method
c) Performance monitoring research d) costing methods

2. Which of the following is the first step in starting the research process?
a) Searching sources of information to locate problem. b) Survey of related literature
c) Identification of problem d) Searching for solutions to the problem

3. Research involves all the following except
a)Promotion b)validation c) Control d) Testing

4. Statement of research problem is preceded by
a) Objectives b) Introduction c) Review of literature d) Methodology

5. The following are the features of a good research study except
a)Should be replicable b) Should be systematic and objective
c)Should be completed in 6 months d)Should be ethical and unbiased

6. Applied research is directed towards
a) Problem solving b)Action oriented research
b) Real time problemsd) All of the above

7. The primary objective of ---------- is to provide insights into and an understanding of the problem confronting the researcher
a) Exploratory research b) Conclusive research
c) Casual research d) Descriptive research

8. Qualitative research is
a) is essentially same as the quantitative research
b) Employs rigorous mathematical analysis
c) is subjective in nature d) is objective in nature

9. In compare to the primary data, secondary data can be collected
a) Rapidly and easily b) At a relatively low cost
c) In a short time with less effort d) All of the above

10.Which of the following gives the measure of the consistency of data?
a) Mean b) Standard deviation c) Mode d) Median

11.Descriptive research is conducted for all the following reasons except
a)To describe the characteristics of the relevant groups , such as consumers, company personnel, organizations or territories
b)To determine the occurrence of study variables
c) To understand which variables are the cause and which variables are the effect of a phenomenon
d)To determine the perceptions of construction and their features

12. The practice of someone's work/idea/paper as one's without proper acknowledgement is termed as
a) Citation b) plagiarism c) Referencing d) none of the above

13. In the process of conducting research 'Formulation of Hypothesis" is followed by
a) Statement of Objectives b) Analysis of Data
c) Selection of Research Tools d) Collection of Data

14. A research paper is a brief report of research work based on
a) Primary Data only b) Secondary Data only
c) Both Primary and Secondary Data d) None of the above

15. Conference proceedings are considered as.....documents.
a) Conventional b) Primary c) Secondary d) Tertiary

16. Which of the following is not a "Graphic representation" ?
a) Pie Chart b) Bar Chart c) Table d) Histogram

17. One of the following search engine is exclusively meant for scientific information :
a) Google b) Yahoo c) SCIRUS d) Altavista

18. What is full form of IPR
a) Intellectual property rights b) Intelligent property right
c) Intellectual property right d) Intelligent property rotation

19. Protocol means..... .
a) Interchange of data between two devices b) Interchange of data between two computers
c) Linkage between two computers d) Linkage between two devices

20. Questionnaire is
a) Research method b) Measurement technique
c) Tool for data collection d) Data analysis technique

21. A Research Report is a formal statement of
a) Research process c) Data collection b) Research Problem d) Data Editing

22. A short summary of technical report is called
a) Article b) Research Abstract c) Publication d) Guide

23. Ethical Neutrality is a feature of
a) Deduction b) Scientific method c) Observation d) experience

24. Scientific method is committed to …….
a) Objectivity b) Ethics c) Proposition d) Neutrality

25. Research method is a part of ……..
a) Problem b) Experiment c) Research Techniques d) Research Methodology

Section-B
Answer the following each question carries 2 Marks
15 questions × 2 marks= 30 Marks

26. Before searching you should define the timeframe of your search. Why?
a) So you don't find the library busy b) So you find the most articles
c) So you work when you are most efficient d) So you do not incur unnecessary costs

27.Why is it important for a researcher to review the literature?
a) Because it is traditional b) Because it will find if anyone has done the work before
c) Because it identifies like-minded researchers d) Because it shows time has been spent on the subject

28. The literature review will examine:
a) all aspects of a topic b) only facts
c) only one side of the main argument d) only opinions

29. Writing your research objectives clearly helps to
a) Define the focus of your study b)Clearly identify variables to be measured
c) Indicate the various steps to be involved d)Establish the limits of the study
e) All of the above

30. The starting point for a literature search is
a) tertiary data b) secondary data c) primary data d) some other data

31. Researchers need to be cautious of some material, particularly material found online. Why?
a) It has been used before b) The quality is unknown
c) The authors name often does not appear d) It is too recent

32.What do you mean by citation
a) A citation allows authors to provide the source of any quotations, ideas, and information on the copyrighted works of other authors
b) A citation allows authors to provide the source of any quotations, ideas, and information on the copyrighted works of own work
c) Citation is not typically related to copy right works
d) none of the above

33. When you discover that an author has, (1) cited another author (2) it is good practice to:
a) not to use the work b) use the work and attribute it to author 1
c) use the work and attribute it to author 2 d) locate and read the original, then attribute it to author 2

34.What are the important things when giving a presentation
a) Introduce yourself by name b) Slow down when you are speaking
c) Make eye contact with the audience d)Ask for questions from the audience at the conclusion of presentation e) All of the above

35. The objective of the communication is
a) Specific b) Measurable c) Attainable
d) Results – oriented and Time-limited e) All of the above

36. A side bar is used to
a) Useful way of physically framing the text and giving shape to the document.
b) Highly necessary c) Used to provide extra information such as organization, or publication; copyright, contact information d) both a& b is correct e) both a&c is correct

37. Which is the major disadvantage of using peer-reviewed journals in literature reviews?
a) The information is too recent b) Humans control the quality
c) Subscription fees are high d) Information could be as old as four years

38 Which of these will NOT help you to decide whether a publication is reputable?
a) Advertising inside b) Citation rate
c) Audience d) Importance to peers

39. When you cite Internet resources, you do not need to find
a) date created b) date of birth of the author
c) date last updated d) date of access

40. Which of these is the most efficient way to locate relevant journals?
a) Searching using tertiary sources b) Browsing the shelves in the library
c) Browsing in a newsagents d) Following up references in articles

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Section- C
Answer the following each question carries 3 Marks
5 questions × 3 marks= 15 Marks

41. What do you think might happen if you started a research project, but hadn't written any clear research objectives?
a) Confusion about the limits of study b) Collection of data is unlimited c) identify barriers and concerns d) only a is correct e) both a &b is correct

42. Surveying the literature involves
a) Narrow the problem itself b) identify the gaps c) limited information about the existing theories d) b is correct e) both a& b is correct

43.The purpose of attribution is
a) similar to citation b) not similar to citation c) Used to quote (or paraphrase **all or a portion** of an openly licensed work d) both a &c e) none of the above

44. Who is responsible for plagiarism?
a) Lecturers and supervisors b)The participant c) Institution
d) The researcher e) All of the above

45. How do you prepare for presentation?
a) Writing main argument or conclusion b) Writing the main points as headings
c) Timing the presentation & discuss the main issue by clear opening and closing line remarks
d) all of the above e) only a& b

Part – B Mechanical Engineering and Industrial Engineering

Section - A contains : 25 questions × 1 mark = 25 Marks
Section- B contains : 15 questions × 2 marks = 30 Marks
Section-C contains : 5 questions × 3 marks = 15 Marks

Section-A
Answer the following each question carries 1 Mark
25 questions × 1 mark = 25 Marks

1. The total number of instantaneous centres for a mechanism consisting of *n* links are
a) *n/2* b) *n* c) (*n-1)/2* c) *n*(*n-1)/2*

2. In a mechanism, the fixed instantaneous centres are those centres which
a) remain in the same place for all configurations of the mechanism
b) vary with the configuration of the mechanism
c) moves as the mechanism moves, but joints are of permanent nature
d) none of the above

3. The direction of linear velocity of any point on a link with respect to another point on the same link is
a) parallel to the link joining the points *b*) perpendicular to the link joining the points
c) at 45° to the link joining the points *d*) none of these

4. When there is a reduction in amplitude over every cycle of vibration, then the body is said to have
a) free vibration *b*) forced vibration *c*) damped vibration d) none

5. In cyclic loading, stress concentration is more serious in
a) brittle materials *b*) ductile materials
c) brittle as well as ductile materials *d*) elastic materials

6. In the Taylor's tool life equation, $VT^n = C$, the value of n = 0.5. The tool has a life of 180 minutes at a cutting speed of 18m/min. If the tool life is reduced to 45 min., then the cutting speed will be

a) 9 m/min b) 18 m/min c) 36 m/min d) 72 m/min

7. A wire rope is designated as 6 x 19 standard hoisting. The numbers 6 x 9 represent

a) diameter in millimeter x length in meter b) diameter in centimeter x length in meter c) number of strands x number of wires in each strand

d) number of wires in each strand x number of strands

8. The ratio of highest to lowest absolute temperature is 1.5, then the COP of a heat pump working on reversed Carnot cycle will be

a) 2 b) 3 c) 4 d) 6

9. Hardness of green sand mould increases with

a) increase in moisture content beyond 6 percent b) increase in permeability

c) decrease in permeability d) increase in both moisture content and permeability

10. During heat treatment of steel, the hardness of various structures in increasing order is

a) martensite, fine pearlite, coarse pearlite, spherodite

b) fine pearlite, coarse pearlite, spherodite, martensite

c) martensite, coarse pearlite, fine pearlite, spherodite

d) spherodite, coarse pearlite, fine pearlite, martensite

11. For laminar forced convection over a flat plate, if the free stream velocity increases by a factor of 2, the average heat transfer coefficient

a) remains same b) decreases by a factor of $\sqrt{2}$

c) rises by a factor of $\sqrt{2}$ d) rises by a factor of 4

12. The following four unconventional machining processes are available in a shop floor. The most appropriate one to drill a hole of square cross section of 6 mm × 6 mm and 25 mm deep.

a) is abrasive Jet Machining b) is Plasma Arc Machining

c) is Laser Beam Machining d) is Electro Discharge Machining

13. The crank radius of a single–cylinder I. C. engine is 60 mm and the diameter of the cylinder is 80mm. The swept volume of the cylinder in 3 cm is

a) 48 b) 96 c) 102 d) 603

14. A pump handling a liquid raises its pressure from 1 bar to 30 bar. Take the density of the liquid as 990 kg/m^3. The isentropic specific work done by the pump in kJ/kg is

a) 0.10 b) 0.30 c) 2.50 d) 2.93

15. A compressor undergoes a reversible, steady flow process. The gas at inlet and outlet of the compressor is designated as state 1 and state 2 respectively. Potential and kinetic energy changes are to be ignored. The following notations are used: v= specific volume and P=pressure of the gas. The specific work required to be supplied to the compressor for this gas compression process is

a) $\int_1^2 P\,dv$ b) $\int_1^2 v\,dP$ c) $v_1(p_2 - p_1)$ d) $-p_1(v_1 - v_2)$

16. The increase in variability as we go up in supply chain

a) Risk pooling b) Bull whip effect c) Aggregation d) Inventory pooling

17. A line balancing problem is solved in the context of

a) Process Layout b) Fixed position Layout c) Product Layout d) Production schedule

18. Which one of the following is not a method of calculating depreciation

a) Straight Line method c) Sum of years Digits Method

b) Declining balance method d)NPV method

19. When the tool of centre lathe moves perpendicular to the axis of rotation,

a) it produces a cylindrical surface b) it produces a flat surface

c) it produces a tapered surface d) none of the above

20. The concept of overall coefficient of heat transfer is used in heat transfer problems of

a) Conduction b) Convection c) Radiation d) Conduction and convection

21. Which theory of failure will you use for aluminum components under stead Loading

a) Principal stress theory b) Principal strain theory

c) Strain energy theory d) Maximum shear stress theory

22. When a body is subjected to transverse vibrations, the stress induced in a body will be

a) shear stress b) tensile stress c) compressive stress d) None

23. Which of the following governor is used to drive a gramophone?

a) Watt governor b) Porter governor c) Pickering governor d) Hartnell governor

24. The number of defectives produced by a six sigma process in Parts per Million is

a) 5.2 b)4.2 c)3.4 d)2.2

25. Parson's turbine is

a) Pressure compounded steam turbine b) Simple single wheel, impulse steam turbine

c) Simple single wheel reaction steam turbine d) Multi wheel reaction steam turbine

Section-B
Answer the following each question carries 2 Marks
15 questions × 2 marks= 30 Marks

1. The swaying couple is maximum or minimum when the angle of inclination of the crank to the line of stroke is equal to

a) 45° and 135° *b*) 90° and 135° *c*) 135° and 225° *d*) 45° and 225°

2. A venturimeter of 20 mm throat diameter is used to measure the velocity of water in a horizontal pipe of 40 mm diameter. lf the pressure difference between the pipe and throat sections is found to be 30 KPa then, neglecting frictional losses, the flow velocity is

a) 0.2 m/s b) 1.0 m/s c) 1.4 m/s d) 2.0 m/s

3. The sale of cycles in a shop in four consecutive months are given as 70, 68, 82, 95. Exponentially smoothing average method with a smoothing factor of 0.4 is used in forecasting. The expected number of sales in the next month is

a) 59 b) 72 c) 86 d) 136

4. In arc welding of a butt joint, the welding speed is to be selected such that highest cooling rate is achieved. Melting efficiency and heat transfer efficiency are 0.5 and 0.2, respectively. The area of the weld cross section is 5 mm2 and the unit energy required to melt the metal the is 10 J/mm^3. If the welding power is 2 KW, the welding speed in mm/s is closest to

a) 4 b) 14 c) 24 d) 34

5. The coefficient of friction at the tool chip interface is

a) 0.23 b) 0.46 c) 0.85 d) 0.95

6. In open-die forging, a disc of diameter 200 mm and height 60 mm is compressed without any barreling effect. The final diameter of the disc is 400 mm. The true strain is

a) 1.986 b) 1.686 c) 1.386 d) 0.602

7. How long will take a 12.7 mm drill to drill a hole 50 mm deep in brass with cutting speed 75m/min and feed 0.175 mm/rev.

a) 0.174 min b) 0.285 min c) 0.396 min d) $^{1.396}$n

8. The ratio of highest to lowest absolute temperature is 1.5, then the COP of a heat pump working on reversed Carnot cycle will be

a) 2 b) 3 c) 4 d) 6

9. In a condenser, water enters at 30^0 C and flows at the rate 1500 kg/hr. The condensing steam is at a temperature of 120^0 C and cooling water leaves the

condenser at 80"C. Specific heat of water is 4.187 kJ/kg K. lf the overall heat transfer coefficient is 2000 Wm^2K, the heat transfer area in m^2 is

a) 0.707 b) 7.07 c) 70.7 d) 141.4

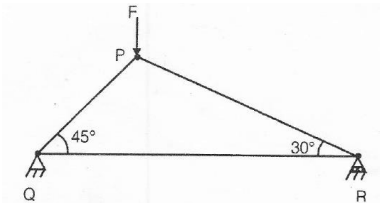
10. A centrifugal pump running at 500 rpm and at its maximum efficiency is delivering a head of 30 m at a flow rate of 60 iitres per minute. If the rpm is changed to 1000, then the head H in metres and f low rate Q in litres per minute at maximum efficiency are estimated to be

a) H=60, Q=120 b) H=120,Q=120 c) H=60, Q=480 d) H=120, Q=30

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

a) 177 b) 707 c) 500 d) 354

12. Consider a truss PQR loaded at P with a force F as shown in the fig.



a) 0.5 b) 0.63 c) 0.73 d) 0.87

13. A simple pendulum of length of 5m, with a bob of mass 1 kg, is in simple harmonic motion. As it passes through its mean position, the bob has a speed of 5 m/s. The net force on the bob at the mean position is

a) 0 b) 2.5 c) 5 d) 25

14. If annual demand, ordering cost and carrying cost become four times of their original values, Economic order quantity (EOQ)

a) Remains the same b) gets halved c) gets doubled d) becomes four times

15. Which one of the following is not a method of calculating depreciation

a) Straight Line method c) Sum of years Digits Method
b) Declining balance method d) NPV method

Section- C
Answer the following each question carries 3 Marks
5 questions × 3 marks= 15 Marks

1. In a Davis steering gear, the distance between the pivots of the front axle is 1.2 metres and the wheel base is 2.7 metres. The inclination of the track arm to the longitudinal axis of the car, when it is moving along a straight path is

a) 12.5° b) *0* c) 156° d) *30°*

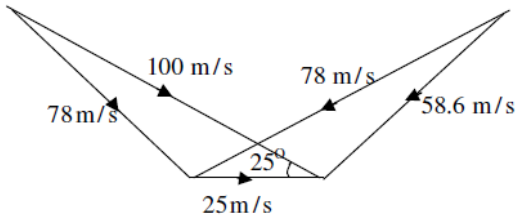
2. A concentrated load P acts on a simply supported beam of span L at a distance L/3 from the left support. The bending moment at the point of application of the load is given by

a) L/3 b) 2PL/3 c) PL/9 d) 2PL/9

3. The useful tool life of a HSS tool machining mild steel at 18 m/min. is 3 hours. Calculate the tool life when the tool operates at 24 m/min

a) 10 b) 18 c) 20 d) 28

4. At the inlet of an axial impulse turbine rotor, the blade linear speed is 25 m/s, the magnitude of absolute velocity is 100 m/s and the angle between them is 25°. The relative velocity and the axial component of velocity remain the same between the inlet and outlet of the blades. The blade inlet and outlet velocity triangles are shown in the figure. Assuming no losses, the specific work (in J/kg) is



a) 3000 b) 3200 c) 3250 d) 3100

5. The partial pressure of water vapour in a moist air sample of relative humidity 70% is 1.6 kPa, the total pressure being 101.325 kPa. Moist air may be treated as an ideal gas mixture of water vapour and dry air. The relation between saturation temperature (Ts in K) and saturation pressure (ps in kPa) for water is given by ln (ps/p0)= 14.317 - 5304/T_s where p0 =101.325 p kPa. The dry bulb temperature of the moist air sample (in ℃) is

a) 18.05 b) 19.89 c) 20.10 d) 21.52