



# SSC JE 2019 Tier-1 **MECHANICAL ENGINEERING**

27th Oct. Shift-2

**Memory Based Questions with Solutions** 





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#### SSC JE 2019 Mechanical Subject Weightage Analysis

Shift-2 (Memory Based)					
Subject	<b>Difficulty Level</b>	No. of Questions			
Theory of Machines	Easy	2-3			
Machine Design	Easy	2-3			
Engineering Mechanics	Easy	1-2			
Strength of Materials	Easy	4-5			
Thermodynamics, Power Plant, IC Engines	Easy	25-30			
Refrigeration and Air Conditioning	Easy	8-10			
Fluid Mechanics & Machinery	Easy	25-30			
Production Engineering	Easy	7-8			
Reasoning	Moderate	50			
General Awareness	Moderate	50			
OVERALL	Easy	200 Qs			



#### MECHANICAL ENGINEERING

#### **Questions Shift-II (Memory Based)**

- 1. What type of boiler is a Lancashire boiler?
- Sol. Lancashire is a horizontal stationary multitubular fire tube boiler
- 2. What is the Length of Cornish boilers?
- Sol. Length of Cornish boiler is around 5 to 7.5 m
- 3. Babcox and Wilcox boiler: fire tube or water tube?
- Sol. Babcox and Wilcox boiler is Horizontal inclined natural circulation water tube boiler
- What is the Cd value in a venturi meter? 4.
- Sol. Cd value for venturimeter is 0.98
- 5. Heat exchanger cold fluid temp on  $mcp\Delta T$  equation.
- Sol. Equation for heat transfer for cold fluid = mcCc (Tce-Tci) where, mc is mass of cold fluid, Cc is specific heat of cold fluid and Tce and Tci are cold fluid exit and inlet temperature
- 6. What is the composition of 18-4-1 steel?
- For HSS Tungsten Chromium Vanadium Sol.
- 7. For the shaft, steel is mild, medium, high, and low c steel?
- Sol. Generally, it is made up of Mild Steel
- What is the number of buckets formula used in an impulse turbine? 8.
- Sol. No. of buckets = (D/2d)+15
- 9. Centrifugal pump numerical?
- Sol. Insufficient data
- 10. Friction factor numerical: 64/Re based
- Sol. Insufficient data
- Head loss value: hf formula 11.
- hf=flV<sup>2</sup>/2qD Sol.



- 12. Hopper minimum angle in power plant
- Sol. The minimum hopper 30 deg from vertical to reduce the waste of wall materials, or 45 deg to minimize headroom requirements and simplify design calculations.
- 13. Circle name from where involute starts?
- Sol. Base Circle
- 14. Specific speed ratio range for Francis
- Sol. For Francis it ranges from 70-250.
- 15. Thixotropic fluid example?
- Sol. Ice cream, Yoghurt, Paints, Lipstick, Ink.
- 16. Fluid for which absolute viscosity increases with rate of shear strain?
- Sol. Dilatant fluids are the fluid for which there is increase in viscosity with increase of rate of shear strain
- What is the Deflection in simply supported, fixed and cantilever beam 17.
- 18. What is by Bypass factor?
- Sol. Bypass Factor is part of the total air through the coil which fails to come into contact with the surface of the cooling or heating coil
- 19. What is the equation for the number of links in mechanisms?
- Sol. L = 2P - 4

L= no of links

- P = no of pairs in a mechanism
- 20. What is Gibbs phase rule?
- P+F= C+2 (Used in Thermodynamics) Sol. P+F=C+1 (Used in Material Science)
- 21. What is the Reheat of Rankine cycle?
- Sol. Reheating in Rankine cycle is done to increase the dryness fraction at exit of turbine and with that turbine work and net work also increases with increase of efficiency upto 4 to 5%.



- 22. What are the processes involved in Otto cycle, Carnot cycle, Stirling cycle, joule cycle?
- Sol. Otto cycle: two constant volume and two isentropic

Stirling cycle: two constant volume and two isothermal

Joule cycle: two isentropic and two constant pressure

Carnot cycle: two isothermal and two isentropic

- 23. What is Turbulent flow condition?
- Sol. Turbulent flow occurs due to rapid mixing of fluids where velocity becomes very high while viscosity is low. It is determined by high Reynold's Number

For pipe flow Reynolds number= 4000

For flow over flat plate(Re)=  $10^7$ 

- 24. Back work ratio and work ratio relation?
- Sol. work ratio = 1-Back work ratio
- 25. Pressure ratio for maximum work in a steam turbine?
- Sol. The Optimum pressure ratio for maximum work output in steam turbine is 3 to 4.6
- 26. Heat engine efficiency 0.80. asked cop for reversed cycle?
- Sol. For COP of reversed carnot cycle= 1/Efficiency of heat pump

COP of heat pump=1/0.8=1.25

But if they have asked COP of reversed carnot cycle based on

refrigerator = COP of Heat Pump-1 = 0.25

- 27. Full load power: 200 kW and friction power: 25kW. Then half load mechanical efficiency?
- Sol. Brake is proportional to load, as load reduced to half Brake power becomes 100 kW

Friction power= 25KW

So, indicated power = BP+FP = 125kW

Mechanical efficiency at half load =100/125 =80%

- 28. Pump overall efficiency formula?
- Sol. Pump overall efficiency = Water power/Shaft power
- 29. Vacuum pressure = atmospheric pressure-absolute pre-relation
- Sol. Vacuum pressure=Atmospheric pressure -Absolute pressure
- 30. Cop of vapour compression cycle: enthalpies given
- Sol. Cop of Vapour compression cycle= Refrigeration effect/Work input= h1-h4/h2-h1



- 31. Why is the capillary tube near to the evaporator?
- Sol. Capillary is used to reduce the pressure and simultaneously temperature of the saturated liquid coming out from the condenser and then provide low temperature and pressure liquid to the evaporator to provide refrigeration effect.
- 32. BPF= 0.30 then efficiency?
- BPF+ Efficiency = 1 Sol. So Efficiency = 1-0.30 = 0.7 or 70%
- One coil BPF = 0.80, Then BPF for three coils in series? 33.
- BPF for n coils =  $X^n = 0.80^3 = 0.512$ Sol.
- 34. Composition of heat exchanger material for superheater?
- Sol. Material for superheaters is generally alloy steel or austenitic stainless steel.
- 35. Effect of chromium addition?
- Sol. Chromium increases the corrosion resistance.
- 36. Volumetric efficiency numerical : c=0.012,  $v_1=0.003$ ,  $v_f=0.001$
- i=Incorrect or insufficient data question Sol.
- 37. No of buckets formula in pelton turbine?
- Sol. By Taygun Formula no. of buckets = 15+(D/2d)
- 38. D/d = 12, asked number of buckets?
- Sol. By Taygun Formula no. of buckets = 15+(D/2d)So putting values, no. of buckets = 15+6=21
- 39. What is the Efficiency relationship between Otto diesel and dual for the same compression ratio?
- Sol. For Same compression Ratio, Efficiency otto> Efficiency Dual> Efficiency Diesel
- 40. What are Extensive properties?
- Sol. Extensive properties are mass dependent properties like volume, energy, entropy, enthalpy, heat capacity
- 41. What is Back work ratio?
- Sol. Back work ratio = Negative work/positive work Like for steam turbine it is Wpump/Wturbine For gas turbine= Wcompressor/Work Turbine



- 42. What is the composition for 18-4-1 high speed steel?
- Sol. For HSS Tungsten Chromium Vanadium
- 43. For,  $TL = 2^{\circ}7C$  and  $TH = 227^{\circ}C$  and Qh = 450, find Qr
- Values in absolute kelvin Th= 500k Sol.

TI= 300K

So, 
$$Qh/Ql = Th/Tl$$

QI = 270

- 44. What kind of fluid flow is it if the density is constant?
- If the density of the fluid is constant it is considered to be incompressible fluid. Sol.
- 45. For poisson ratio 0.4 find G/E?
- Sol. As E = 2G(1 + u)

So Putting Poisson Ratio,

G/E = 0.35

- 46. What if the stream function satisfies the Laplace equation?
- Sol. A stream function of a fluid satisfying a Laplace equation is supposed to have an irrotational flow
- 47. Device used to heat air in boiler
- Sol. The device used to preheat the air in boiler is airpreheater.
- 48. What is the Casting material of BOILER?
- Sol. The boiler is made of either steel or wrought iron.
- 49. What is the material used to make fusible plugs?
- Sol. A fusible plug is a threaded metal cylinder, often made from bronze, brass or gunmetal, which has a tapered hole drilled completely through its length. This hole is sealed with a metal of low melting point that flows away if a pre-determined, high temperature is reached. It is used to protect the boiler from overheating when the water level falls below a minimum level in boilerdrum.
- 50. Effect of reheating with heat exchanger in gas turbine?
- Reheating in gas turbines causes increased turbine work, increased net work and decrease in Sol. cycle efficiency.
- 51. Plate velocity on inclined plane given 60m/s: average velocity asked



- 52. What are the Functions of Supercharging?
- Sol. Supercharging is done to supply air with air higher density during suction in engine, so that, power output from the engine can be increased.
- 53. Two fluids given: height of mercury given above water and asked pressure at interface.
- Sol. P=pgh h=x(Sm/S-1) where x is manometric deflection Sm is specific gravity of manometric fluid and S is specific gravity of standard fluid.
- 54. Dbt 35 coil temp 50 and air 20 find BPF (All temperatures in celsius)
- Sol. Since coil temperature is maximum here so it is a heating coil Tcoil= 50 T1= 35 T2= 20 BPF= Tcoil-T2/Tcoil-T1 = (50-20)/(50-35) = 2
- 55. Carnot heat engine having 50% efficiency. find cop of refrigerator
- COP of heat pump is reciprocal of Heat engine so COP of heat pump will be 2 Sol. So COP of refrigerator will be = 2 - 1 = 1
- 56. What is the role of the Capillary tube in refrigeration?
- Sol. Capillary is a pressure reducing device used in vapor compression refrigeration systems to meter flow of refrigerant from condenser outlet to evaporator inlet.



#### **GENERAL AWARENESS**

- In which year Ghazni invaded first? 1.
- Sol. 1001
- 2. To which country India gave 75 USD million for the IT park?
- Sol. Cuba
- 3. Which state declared it as the year of artificial intelligence?
- Sol. Telangana
- 4. Name of the state where ISRO is opening space IT park?
- Sol. Kerala
- 5. Which of the following is the Jharkhand CM?
- Hemanth Soren Sol.
- 6. As of Feb 2020, how many districts are there in Gujarat?
- Sol. 33
- 7. Bank which launched a MANI app?
- Sol. RBI
- 8. What is the full form of IMF?
- Sol. International Monetary Fund
- 9. What is the full form of NABARD?
- Sol. National Bank for Agriculture and Rural Development
- 10. 1st Mughal emperor
- Sol. Babar
- 11. Number of District In Gujarat
- 33 Sol.
- 12. PALAMAU Tiger reserve located in
- Sol. **Jharkhand**



- 13. 1st General Election of India
- Sol. 1951-1952
- 14. Year of Artificial Intelligence
- Sol.
- 15. 1st Vice President of India
- Sol. Sarvepalli Radhakrishnan
- 16. Retinol Vitamin?
- Sol. Retinol, also known as vitamin A<sub>1</sub>-alcohol, is a vitamin in the vitamin A family found in food and used as a dietary supplement
- 17. Blood coagulation delays due to deficiency of which vitamin?
- Sol. Blood clotting is delayed or prevented because vitamin K is unavailable to act as an essential element
- 18. Leader of Rajya sabha?
- Sol. Vice President of India is Leader of Rajya Sabha
- 19. Splitting of white light into different colours is the process of?
- Sol. The separation of visible light into its different colors is known as dispersion.
- 20. No. of satellite launch pads at present in India?
- Sol. India presently has one rocket port at Sriharikota in Andhra Pradesh with two launch pads

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### SSC JE 2019 Mechanical Expected Cutoff

Expected Cutoff (Shift-2)					
Years	General	EWS	ОВС	SC	ST
2018	152.16	147.47	149.30	133.39	125.49
2019	152-155	149	152	134-135	128



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