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Solved Papers

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Rajasthan Rajya Vidyut Utpadan Nigam Ltd.

Online exams for the posts of Assistant Engineer, Junior Engineer-I

S.No.	Name of the Test	New Provision		Duration
		Number of Questions	Maximum Marks	
Part- A	Professional Knowledge	60	120	**60 Minutes**
Part- B (i)	Reasoning and Mental Ability	8	8	**60 Minutes**
(ii)	General Knowledge related to Rajasthan & Everyday Science	48	48	
(iii)	General Hindi	8	8	
(iv)	General English	8	8	
(v)	Mathematics	8	8	
	Total Part- B	**80**	**80**	

10. Selection procedure and preparation of Merit

1. Computer based "common written competitive exam" shall be conducted through Online mode. The Question Paper shall be of two (2) hours duration and shall consist of Objective Type questions (Multiple Choice Questions) only.
2. The Question Paper shall consist of two parts as detailed below:-

(a) Assistant Engineer, Junior Engineer-I

Part- A : 60% weightage

The standard and syllabus of the examination will be of the level of Degree in Engineering in the respective discipline.

Part-B : 40% weightage

(i) Reasoning & Mental Ability

(ii) Mathematics

(iii) General Knowledge & Everyday Science

(iv) General Hindi

(v) General English

A brief out-line of scope of each sub-part is given here under for general guidelines of candidates, but is not intended to be exhaustive:-

(i) Reasoning & Mental Ability- Analytical Reasoning Number series, Letter series, Odd man out, Coding-Decoding, Shapes and Mirror Images, Clocks, etc.

(ii) Mathematics- Mathematics. (Class - XII level)

(iii) General Knowledge & Everyday Science- Current events including issues of State (Rajasthan), National & International importance, Persons & Places in recent news, Games & Sports, Science, Indian History, Civics, Geography, Indian Polity, etc., **with special reference to Rajasthan.**

(iv) General Hindi - Hindi Grammar and language (Class- X level).

(v) General English - English Grammar and language (Class- X level).

RPSC Lecturer (Tech. Edu.) Exam. 2020
ELECTRICAL ENGINEERING
Paper-I

[Exam Date : 16.03.2021

1. Magnetostriction is a phenomenon which occurs in

(a) paramagnetic materials
(b) antiferromagnetic materials
(c) ferrimagnetic materials
(d) ferromagnetic materials

Ans. (d) : Magnetostriction is phenomena of change in physical dimensions of ferromagnetic materials whenever it subjected to an alternating nature of magnetic force.

2. The magnetic permeability is maximum for

(a) paramagnetic materials
(b) ferromagnetic materials
(c) diamagnetic materials
(d) None of these

Ans. (b) : Permeability is maximum for ferromagnetic material because they have a large positive susceptibility to the external magnetic field, they show a very strong attraction to magnetic field and also when the external field removed they can retain their magnetic properties.

3. The material used to make strong magnets for magnetic resonance imaging (MRI) machines is-

(a) hard steel
(b) soft iron
(c) insulators
(d) superconductors

Ans. (d) : We create strong magnet for MRI so, we try to create superconductor properties in it so, ideally we use superconductor.

4. Magnetic susceptibility is

(a) inversely proportional to both temperature and magnetizing field.
(b) inversely proportional to temperature but independent of magnetizing field
(c) proportional to temperature but inversely proportional to magnetizing field
(d) proportional to temperature but independent of magnetizing field.

Ans. (a) : Magnetic susceptibility (χ) is measurement of how much a material will be magnetized in applied magnetic field.

Magnetic susceptibility (χ)

$$= \frac{M(\text{magnetization})}{H(\text{Magnetic field intensity})}$$

$$\chi \propto \frac{1}{\text{magnetizing field}}$$

$$\chi \propto \frac{1}{\text{Temperature}} \text{ (according to curie temperature)}$$

5. In an integrated circuit, the SiO_2 layer provides

(a) Electrical connection to external circuit
(b) Physical strength
(c) Isolation
(d) Conducting path

Ans. (c) : In an integrated circuit, the SiO_2 layer provides isolation.

6. When an electrical potential is applied to a piezo-electric material body, it-

(a) produces magnetic flux
(b) produces heat only
(c) changes shape of body
(d) produces electric field

Ans. (c) : When we apply voltage on piezo-electric material, it start vibrating due to inverse piezoelectric effect which means it change shape of body. Piezoelectric material- Quartz, Rochelle salt.

7. The magnetization of a superconductor is

(a) 0 (b) –B
(c) –1 (d) –H

Ans. (d) : We know that, susceptibility $(\chi) = \frac{M}{H}$

$M = \chi H$

$\because$ For superconductor $\chi = -1$

$\therefore M = -\chi$

Where $M \rightarrow$ magnetization, $\chi \rightarrow$Magnetic field

8. A good conductor should have-

1. high electrical conductivity

2. low thermal conductivity

3. low melting point

4. good oxidation resistance

Of these, the correct statements are

(a) 1, 2, 3 and 4 (b) 1 and 4

(c) 2, 3 and 4 (d) 1, 2 and 4

Ans. (d) : A good conductor property:-

(a) High conductivity

(b) High thermal conductivity

(c) Generally high melting point

(d) Free from oxidation.

9. The direction of induced voltage in a conductor can be changed by-

(a) Increasing the field strength

(b) Reversing the field direction

(c) Increasing conductor length

(d) Decreasing conductor size

Ans. (b) : The direction of induced voltage in a conductor can be changed by reversing the field direction.

$$\boxed{E = vB\ell \sin\theta}$$

Where, E = Induced emf,

v = Velocity of conductor

B = Magnetic flux density

ℓ = Active length of conductor

If we change flux in the reverse direction then induced voltage (E) will be changed the reverse direction of induced voltage.

10. Which of the following statements are true about piezoelectric crystal?

1. Their crystal structure possesses a centre of symmetry.
2. They always exhibit ferroelectricity
3. They are necessarily poor electrical conductors.
4. They exhibit a relative permittivity less than unity.

Select the correct answer using the codes given in the options:

(a) 1, 2 and 4

(b) 2, 3 and 4

(c) 1 and 3

(d) 1, 2 and 3

Ans. (d) : Piezo-electric crystal structure possesses a center of symmetry and they are ferroelectric material which is also a poor conductor of electricity.

11. Loss in a dielectric may occur due to

(a) Polarization (b) Conductivity

(c) Ionization (d) Any of these

Ans. (a) : Dielectric losses are occurs due to polarization. Dielectric loss is the dissipation of energy through the movement of charges in an alternating electromagnetic field as polarization switches direction.

12. The mail purpose of a commutator in a d.c. generator is to-

(a) increase output voltage

(b) reduce sparking at brushes

(c) provide smoother output

(d) convert the induced AC into DC

Ans. (d) : Commutator is convertor which convert A.C to D.C and D.C. to A.C. In DC generator it convert the induced AC into DC.

Commutator in DC generator called mechanical rectifier and in case of Dc motor it is called mechanical invertor.

13. The primary reason for providing compensating windings in a d.c. generator is to-

(a) compensate for decrease in main flux

(b) neutralize armature mmf

(c) neutralize cross-magnetizing flux

(d) maintain uniform flux distribution

Ans. (c) : Compensating windings in a D.C. generator is use to neutralizing the cross magnetizing effect due to armature reaction. The use of compensating winding is nullify the armature reaction.

14. The critical resistance of the d.c. generator is the resistance of

(a) armature (b) field

(c) load (d) brushes

Ans. (b) : The critical resistance is always with field resistance. Field resistance above critical resistance voltage will not build up in armature.

15. Lap winding is suitable for___ current, ____voltage d.c. generators.

(a) high, low (b) low, high

(c) low, low (d) high, high

Ans. (a) : Lap winding is suitable for low voltage and high current . In lap winding number of parallel path available for current is equal to number of pole. i.e. $\boxed{A = P}$.

16. A 6 pole generator has a lap wound with 40 slots with 20 conductors per slot. The flux per pole is 25 mWb. Calculate the speed at which the machine must be driven to generate an emf of 300V.

(a) 900 rev/min (b) 450 rev/min

(c) 1800 rev/min (d) 1000 rev/min

Ans. (a) : Given, P = 6, Z = 20 per slot

ϕ = 25 mWb Total slot = 40

E_g = 300V $Z = 20\times40$

$$E_g = \frac{P\phi ZN}{60A} \left(\text{For Lap winding } A = P = 6\right)$$

$$N = \frac{EA60}{P\phi Z} = \frac{300\times6\times60}{6\times25\times10^{-3}\times(40\times20)}$$

N = 900 rev/min

17. The normal value of the armature resistance of a d.c. motor is.

(a) 0.005 (b) 0.5

(c) 10 (d) 100

Ans. (b) : The normal value of armature resistance of a dc motor is 0.5.

18. The d.c. series motor should never be switched on at no load because-

(a) The field current is zero

(b) The machine does not pick up

(c) The speed becomes dangerously high

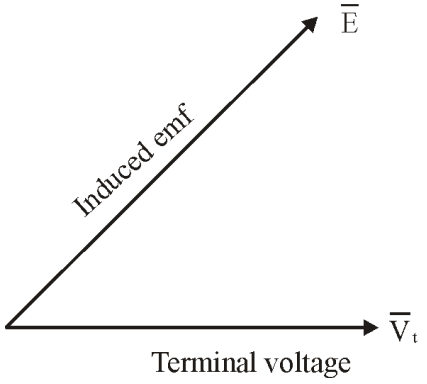
(d) It will take too long to accelerate

Ans. (c) : In DC series motor speed is given by–

$$N \propto \frac{1}{\phi}$$

At no load flux is very small hence speed is dangerously high. Remains only approximate residual flux.

19. The phasor diagram of a synchronous machine connected to an infinite bus is shown below. The machine is acting as a



(a) generator and operating at a lagging p.f.

(b) generator and operating at a leading p.f.

(c) motor and operating at a leading p.f.

(d) motor and operating at a lagging p.f.

Ans. (a) : The machine is acting as a generator and operating at a lagging p.f.

$V_t \rightarrow$bus voltage E $\rightarrow$ Synchronous machine voltage E is leading to V which means machine work as motor and operating at leading p.f. but since emf is induced so it must be a generator.

20. A synchronous motor is operating on no-load at unity power factor. If the field current is increased, the pf will become-

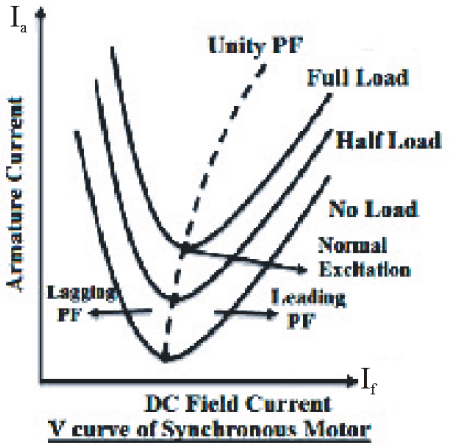
(a) leading and the current will increase

(b) lagging and the current will decrease

(c) leading and the current will decrease

(d) lagging and the current will increase

Ans. (a) : In synchronous motor field current is also known excitation if I_f increases so, power factor is going to leading and armature current will increase.



V curve of Synchronous Motor

21. When an alternator designed for operation at 60 Hz is operated at 50 Hz,

(a) operating voltage will increase in the ratio of 1/2

(b) operating voltage will reduce in the ratio of 8/6

(c) kVA rating will increase in the ratio of 1/2

(d) operating voltage will reduce in the ratio of $\left(\frac{5}{6}\right)^2$.

Ans. (*) : Generated emf = $4.44\ k_d k_c f T$

$E \propto f$

$f_1 = 60, \qquad f_2 = 50$

$$\frac{E_1}{E_2} = \frac{f_1}{f_2}$$

$$\frac{E_1}{E_2} = \frac{60}{50}$$

$$\boxed{E_2 = \frac{5}{6}E_1}$$

60 Hz designed alternator operated on 50 Hz. It generating voltage $\frac{5}{6}$ time of rated voltage.

22. When a 3-phase synchronous motor is running above synchronous speed, the damper winding produces

(a) reluctance torque

(b) damping torque

(c) induction motor torque

(d) induction generator torque

Ans. (d) : When 3-ϕ synchronous motor when the rotor speed become more than the synchronous speed during hunting the damping bar develop induction generator torque. Which reduces the speed upto synchronous speed.

23. The relative speed between the magnetic fields of stator and rotor under steady state operation is zero for

(a) a d.c. machine

(b) an induction machine

(c) a synchronous machine

(d) all of these machines

Ans. (d) : • In dc machine, field flux is stationary and armature flux is also stationary due to commutator brush arrangement. $N_{rel} = N_s - N_r = 0$ $\{\because N_s = N_r = 0\}$.

• Relative speed of stator field and rotor fields are same in induction motor $N_{rel} = N_s - N_r = 0$ $\{\because N_s = N_r\}$.

• The relative speed between stator magnetic field and rotor magnetic field speed is zero in synchronous machine be cause it works on the magnetic pole locking principle.

Relative field speed

= stator field speed– rotor field speed

$\{\because N_s = N_r\}$

$N_{rel} = N_s - N_r = 0$

Where,

N_s = Synchronous speed of stator rotating magnetic field

N_r = Rotor magnetic field speed.

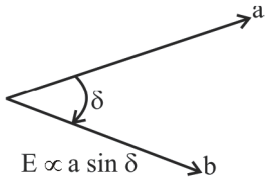
N_{rel} = Relative speed between stator magnetic field and rotor magnetic field.

24. A rotating electromechanical energy conversion device has uniform air-gap. If δ is the space angle between the axis of stator field and rotor field, then the average torque developed is proportional to (a and b are constants)

(a) $a\sin\delta + b\sin 2\delta$ (b) $a\sin\delta$

(c) $a\sin 2\delta$ (d) δ

Ans. (b) : A rotating electromechanical energy conversion device has uniform air-gap. If δ is the space angle between the axis of stator field and rotor field, then the average torque developed is proportional to (a and b are constants $a\sin\delta$.



25. A star-connected synchronous motor rated 187kVA, 3-ϕ, 2300V, 47A, 50 Hz, 187.5 rpm has an effective resistance of 1.5 Ω/phase and a synchronous reactance of 20 Ω per phase. What is the internal power developed by the motor when it is operating at rated current and 0.8 power factor leading?

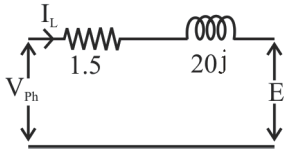
(a) 100 kW (b) 125 kW

(c) 140 kW (d) 155 kW

Ans. (*) : Machine input Power = 187 kVA

$$V_{Ph} = \frac{2300}{\sqrt{3}} = 1327.91\text{V}$$

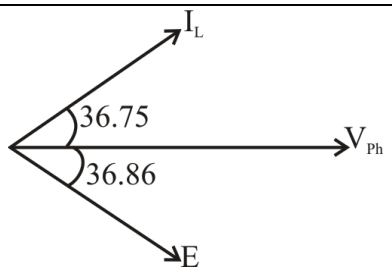
$$I_L = \frac{1870 \times 1000}{1327.9 \times 3} = 46.9\text{A}$$



$E = -I_L (R + jX_s) + V_{Ph}$

$E = 1569.39\angle -36.7499$

$\cos^{-1} 0.8 = 36.86$



$P = 3\times E \times I_L \times \cos\phi$

$= 3\times 1569.39 \times 46.94 \times \cos 73.61$

$= 62.36\text{kW}$

26. Synchronous generator is said to be overexcited when it operate at

(a) Leading power factor

(b) Unity power factor

(c) Lagging power factor

(d) Lagging to leading power factor

Ans. (c) : When motor is over exited then it work at leading p.f. when generator is under excited then it operate at lagging p.f.

27. A synchronous machine has full-pitch coils having coil-span of 12 slots. For eliminating third harmonic, the coil-span should be-

(a) 10 slots (b) 9 slots

(c) 8 slots (d) 6 slots

Ans. (c) : For a synchronous machine-

$$\text{Eliminate } r^{th} \text{ harmonic} = \frac{r-1}{r}\times \text{fullpitch}$$

$$= \frac{3-1}{3}\times 12$$

$$= \frac{2}{3}\times 12 = 8\,\text{slots}$$

28. Armature winding is one in which working

(a) flux is produced by the working emf

(b) emf is produced by the working flux

(c) flux is produced by field current

(d) emf is produced by the leakage flux

Ans. (b) : Armature winding is one in which working emf is produced by the working flux.

$$e = \frac{-N d\phi}{dt}$$

$e \rightarrow$ induced emf, $\phi \rightarrow$ working flux

-sign shows Lenz law.

29. A 6-pole machine is rotating at a speed of 1200 rpm. This speed is electrical radians per sec and mechanical radian per sec are respectively given by-

(a) $60\pi, 20\pi$

(b) $\frac{40\pi}{3}, 40\pi$

(c) $40\pi, 120\pi$

(d) $120\pi, 40\pi$

Ans. (d) : Given that, P= 6, $N_s = 1200$ rpm

$$f = \frac{NP}{120} = \frac{1200\times 6}{120}\times 60$$

$$\omega_{elect} = 2\pi f = 120\pi\,\text{rad/sec}$$

$$\omega_{mech} = \frac{2}{P}\omega_{elect}$$

$$= \frac{2}{6}\times 120\pi$$

$$\omega_{mech} = 40\pi\ \text{rad/sec}$$

30. A single phase reluctance motor

(a) has salient pole rotor structure and runs at super-synchronous speed

(b) has salient pole rotor structure and runs at sub-synchronous speed

(c) has salient pole rotor structure and runs at synchronous speed

(d) has non-salient pole rotor structure and runs at synchronous speed.

Ans. (c) : A reluctance motor has salient pole rotor and synchronous speed. Reluctance torque also available in reluctance machine (motor), due to saliency of pole.

31. Match List-I (Power losses) with List-II (Dependent upon) and select the correct answer using the codes given below the lists:

	List-I	**List-II**
A.	**Stray load loss**	**1. Load**
B.	**Brush constant loss**	**2. Value of flux**
C.	**Hysteresis loss**	**3. rotor rotation**
D.	**No-load rotational loss**	**4. Square of load**

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

Ans. (b) : Stray load loss $\rightarrow$ Square of load

Brush constant loss $\rightarrow$ Load

Hysteresis loss $\rightarrow$ Value of flux

No load rotational loss $\rightarrow$ Rotor rotation.

32. The magnetizing current drawn by transformers and induction motors is the cause of their___ power factor.

(a) zero (b) unity

(c) lagging (d) leading

Ans. (c) : Magnetizing current is purely inductive in nature so it cause lagging power factor.

33. Which of the following statements associated with an ac series motor is incorrect?

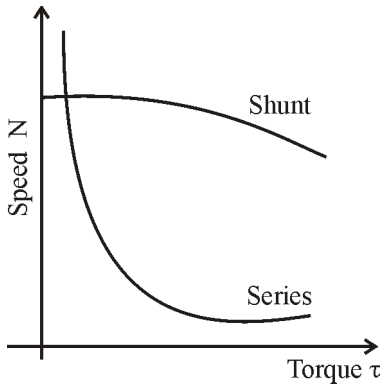
(a) Its torque-speed characteristics is similar to that of a dc series motor

(b) Its torque-speed characteristic is similar to that of a dc shunt motor

(c) Its power factor decreases with the increase in load torque

(d) Its speed falls with the increase in load torque.

Ans. (b) : Option (b) incorrect because DC shunt motor torque-speed characteristic almost constant but in series motor it is inversely proportional to each other.



34. A single phase induction motor is running at N rpm. Its synchronous speed is Ns. If its slip with respect to forward field is S. What is the slip with respect to the backward field?

(a) –S (b) (1–S)

(c) S (d) (2–S)

Ans. (d) : For $1-\phi$ induction motor forward slip

$$s_f = \frac{N_s - N_r}{N_s} = \frac{N_s - N}{N_s} \qquad [N_r = N]$$

$$s_f = \frac{N_s}{N_s} - \frac{N}{N_s}$$

$$= 1 - \frac{N}{N_s}$$

$$\frac{N}{N_s} = 1 - s$$

For backward slip-

$$[N_r = (-N)]$$

$$S_b = \frac{N_s - (N_r)}{N_s}$$

$$= \frac{N_s - (-N)}{N_s}$$

$$= 1 + \frac{N}{N_s}$$

$$= 1 + (1 - s) \qquad \left[\frac{N}{N_s} = 1 - s\right]$$

$$[S_b = 2 - s]$$

35. A single phase induction motor is

(a) self starting

(b) not self starting

(c) self starting with the help of an auxiliary winding

(d) None of these

Ans. (c) : 1-ϕ Induction motor not self started without using of an auxiliary winding.

36. In case of a 3- phase induction motor, shaft power is 2700W and mechanical losses are 180W. At a slip of 4%, the rotor ohmic loss will be-

(a) 115.2 W (b) 120 W

(c) 108 W (d) 105W

Ans. (b) : Given,

$P_{shaft} = 2700$ watt

$P_{mechanical} = 180$ watt

slip (s) = 4% = 0.04

$P_{gross} = P_{shaft} + P_{mechanical\ loss}$

$= 2700 + 180$

$P_{gross} = 2880$ watt

$\because P_{in} : P_{cu} : P_{gross} = 1 : s : 1 - s$

$$\frac{P_{cu}}{P_{gross}} = \frac{s}{1-s}$$

$$P_{cu} = \frac{0.04}{0.96} \times 2880$$

$P_{cu} = 120$ watt

37. The maximum possible speed of a 3–phase, 50 Hz squirrel cage induction motor running at a slip of 4% is-

(a) 3000 rpm (b) 960 rpm

(c) 1440 rpm (d) 2880 rpm