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10EE61

Sixth Semester B.E. Degree Examination, June/July 2015
Power System Analysis and Stability

Time: 3 hrs. Max. Marks:100

Note: *1. Answer any FIVE full questions, selecting atleast TWO questions from each part.*
2. Missing data, if any, may be suitably assumed.

PART – A

1 a. Define per unit quantity. Mention the advantages of per unit system. **(05 Marks)**

b. Show that the per unit reactance is same for both HV and LV side of a two winding transformer. **(05 Marks)**

c. The one line diagram of an unloaded generator is shown in Fig. Q1(c). Draw the PV reactance diagram. Choose a base of 50 MVA, 13.8 KV in the circuit of generator G_1. The ratings are an follows :

G_1 : 20 MVA, 13.8 KV, x″ = 20% T_1 : 25 MVA, 13.8/220 KV, x = 10%
G_2 : 30 MVA, 18 KV, x″ = 20% T_2 : 30 MVA, 220/18 KV, x = 10%
G_3 : 30 MVA, 20 KV, x″ = 20% T_3 : 35 MVA, 220/22 KV, x = 10%. **(10 Marks)**

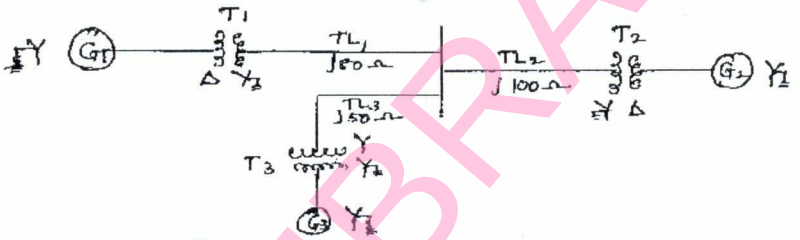

Fig.Q1(c)

2 a. With the oscillogram of the short circuit current of a synchronous machine, define sub transient reactance, transient and steady state reactances. **(10 Marks)**

b. For the system shown in the Fig. Q2(b). The ratings of the various components are :

G : 25 MVA, 12.4 KV, x''_d = 10%
M : 20 MVA, 3.8 KV, x''_d = 15%
T_1 : 25 MVA, 11/33 KV, x = 8%
T_2 : 25 MVA, 33/3.3 KV x = 10%
T line : 20 Ω reactance

The system is loaded such that, the motor is drawing 15 MW at 0.9 pf. leading, the motor terminal voltage being 3.1 KV. Find the sub-transient fault current at motor side. Choose 25 MVA as base power, 11 KV in the generator circuit. **(10 Marks)**

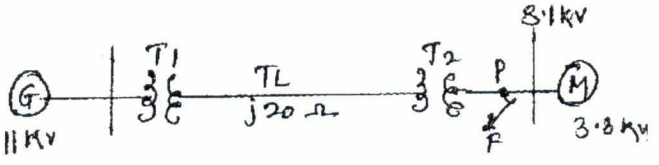

Fig.2Q(b)

3 a. Express symmetrical components interms of unbalanced phasors. **(06 Marks)**

b. Obtain an expression for the three – phase complex power in terms of sequence components. **(08 Marks)**

c. In a 3 phase, 3 wire system the line currents are $I_a = 100 \angle 0°A$ and $I_b = 100 \angle -100°A$. Determine the sequence components of a line currents. **(06 Marks)**

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10EE62

Sixth Semester B.E. Degree Examination, June/July 2015

Switchgear and Protection

Time: 3 hrs. Max. Marks:100

Note: ***Answer FIVE full questions, selecting at least TWO questions from each part.***

PART – A

1 a. Define switchgear, Distinguish between isolating and load breaking switch. **(04 Marks)**

b. Explain why silver is used as fuse material inspite of its high cost. **(06 Marks)**

c. With a neat sketch explain the construction and working principle of HRC fuse with tripping device. **(10 Marks)**

2 a. Explain the current interruption in A.C circuit breakers with neat waveforms and define the terms restriking voltage and recovery voltage. **(10 Marks)**

b. With a neat diagram and necessary waveforms, explain the phenomenon of interruption of capacitive currents in a circuit breaker. **(10 Marks)**

3 a. With a neat sketch explain the construction and working of minimum oil circuit breaker. **(10 Marks)**

b. With a neat circuit diagram explain the short circuit test layout on circuit breakers. **(10 Marks)**

4 a. Explain the working principle, disadvantages and advantages of horn – gap arrestors. **(10 Marks)**

b. What are the types of lightning strokes? Explain each of them. **(06 Marks)**

c. Distinguish between fuse and circuit breaker. **(04 Marks)**

PART – B

5 a. Explain the essential qualities of protective relaying. **(10 Marks)**

b. With a neat diagram explain the zones of protection in typical power system. **(10 Marks)**

6 a. With a neat sketch, explain the principle of three stepped distance protection of transmission line. **(10 Marks)**

b. Differentiate between IDMT overcurrent relay and extremely inverse time overcurrent relay characteristics. **(04 Marks)**

c. Determine the actual time of operation of a 5A, 3seconds overcurrent relay having a current setting of 125% and a time setting multiplier of 0.6 connected to supply circuit through a 400/5 current transformer when the circuit carries a fault current of 4000A. Time of operation is 3.5s for the estimated value of PSM. **(06 Marks)**

7 a. Explain the protection scheme for stator inter turn faults and rotor earth fault of a generator. **(10 Marks)**

b. Describe the loss of excitation protection in a generator and its characteristics. **(10 Marks)**

8 a. With a neat circuit diagram, explain the Merz – price protection scheme for star – delta transformers. **(10 Marks)**

b. With a neat circuit diagram explain single phasing preventer used for Induction motor. **(10 Marks)**

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10EE63

Sixth Semester B.E. Degree Examination, June/July 2015
Electrical Machine Design

Time: 3 hrs. Max. Marks:100

Note: ***1. Answer any FIVE full questions, selecting atleast TWO questions from each part.***
2. Missing data, if any, may be suitably assumed.
3. Design data handbook may be permitted.

PART – A

1 a. Describe how specific magnetic and electric loading play an important role in the design of electrical machines. **(08 Marks)**

b. Determine the main dimensions, number of poles, number of armature conductors, number of slots, conductors per slot and the size of armature conductors and cross sectoral area of armature conductor for a 250 KW, 400 V, 625 A, 600 rpm lap wound compound generator, assuming the following data :
Average flux density in the gap = 0.63 Tesla ; specific electric loading = 33000 amp conductors /mh ; field and armature copper losses = 5% of output ; ratio of pole arc to pole pitch = 0.7 ; pole arc = gross length of armature. Armature drop = 3% of terminal voltage, current density $\delta = 5 A/mm^2$; slot pitch = 2.6 cm. **(12 Marks)**

2 a. Obtain an expression for field ampere turns per meter height, of a DC machine in terms, permissible loss, copper space factor and depth of winding. **(10 Marks)**

b. A 50 hp, 4–pole, 480 V, 600 rpm shunt motor has a wave wound armature with 770 conductors. The leakage factor for the poles is 1.2. The poles are to be of circular in cross section the field coils are 70 mm thick and produce an mmf of 10,000 A per pole. The flux density in the poles is 1.5 Wb/m^2 calculate :
i) diameter of poles
ii) diameter of field wire
iii) length of field coil
iv) turns per pole and
v) field current. **(10 Marks)**

3 a. Determine the following for a 200 KVA, 50Hz 6600/250V, single phase, shell type, oil immersed distribution transformer, i) net cross section of core ii) gross area of core iii) core dimensions iv) window area v) dimensions of window.
Assume :

Window space factor	= 0.28
Maximum fluxdensity in core	= 1.1 Tesla
Average current density	= 2.2 A/mm^2
Window proportions	= 2.5 : 1
Rectangular core proportions	= 1.8 : 1
Stacking factor	= 0.9

Net cross – section of copper in the window is 0.2 times the net cross section of iron in the core, do not attempt the problem using emf per turn equation. **(10 Marks)**

b. Explain the procedure to determine the no-load current of transformer with relevant expressions. **(10 Marks)**

4 a. Derive the expression for leakage reactance of core type transformer. **(10 Marks)**

b. Explain the design of tank with tubes for the transformer, starting from the determination of temperature rise of transformer. **(10 Marks)**

PART – B

5 a. Determine the main dimensions, turns per phase, number of slots, conductor cross section, and slot area, of a 250 hp, 3 – phase, 50 Hz, 400V, 1500 rpm, slip ring induction motor. Assume :

B_{avg} = 0.5 Wb/m^2
ac = 30000 A/m
Efficiency = 0.9
Power factor = 0.9
Winding factor = 0.955
Current density = 3.5 A/mm^2
Slot space factor = 0.4
Ratio of core length to pole pitch = 1.2
The number of slots per pole per phase = 5
The machine is delta connected. **(10 Marks)**

b. Describe the factors that affect the estimation of length of airgap in the design of induction motor. **(10 Marks)**

6 a. Explain the step–by–step design procedure of designing squirrel cage rotor for induction motor. **(10 Marks)**

b. Design a wound rotor for a 3–phase, 850 KW 6600V, 50Hz, 12 pole, induction motor with full load efficiency of 92% and power factors of 0.91, based on the following informations :

Gross length of stator	= 45 cm
Internal diameter of stator	= 122 cm
Number of stator slots	= 144
Number of conductors per slot	= 10
Number of rotor slots per pole per phase	= 3½
Voltage between slip rings at starting	= 600V
Current density	= 5A /mm^2

The machine is star connected. **(10 Marks)**

7 a. Derive the output equation in terms of specific loadings for a synchronous machine. **(10 Marks)**

b. Calculate : i) flux per pole, ii) specific magnetic loading, iii) specific electrical loading, iv) current density for a stator winding of 3–phase 7.5 KVA, 6.6 KV, 50 Hz, 3000 rpm, turbo generators based on following design information.

Internal diameter of stator	= 0.75 m.
Gross length of core	= 0.9 m
Number of stator slots per pole per phase	= 7
Sectional area of stator conductor	= 190 mm^2
Number conductors per slot	= 4
K_w	=0.955. The machine is star connected. **(10 Marks)**

8 a. Explain the step-by-step procedure to design field winding for salient pole alternator. **(10 Marks)**

b. Design the field coil of a 3 – phase, 16 poles 50Hz salient pole alternator, based on the following design information :

Diameter of stator at the gap surface	= 1.0 m
Gross length of stator core	= 0.3 m
Section of pole body	= 0.15 m × 0.3 m
Height of pole	= 0.15 m
Ampere turns per pole	= 6500
Exciter voltage	= 110 V

Assume ; 30 volts as reserve ; depth of field coil, d_f = 0.03 m and insulation of pole = 0.01 m ; current density = 2.6 A/mm^2. **(10 Marks)**

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10EE64

Sixth Semester B.E. Degree Examination, June/July 2015
Digital Signal Processing

Time: 3 hrs. Max. Marks:100

Note: ***Answer any FIVE full questions, selecting atleast TWO questions from each part.***

PART – A

1 a. Determine DFT of sequence $x(n) = \frac{1}{3}$ for $0 \le n \le 2$ for N = 4. Plot magnitude and phase spectrum. **(06 Marks)**

b. Compute the 4 – point DFT of the sequence x(n) = (1, 0, 1, 0). Also find y(n), if $y(k) = x((k-2))_4$. **(06 Marks)**

c. Compute circular convolution using DFT + IDFT for the following sequences.
$x_1(n) = \{2, 3, 1, 1\}$ $x_2(n) = \{1, 3, 5, 3\}$. **(08 Marks)**

2 a. Two length - 4 sequences are defined below :
$x(n) = \cos(\pi n/2)$ $n = 0, 1, 2, 3$
$h(n) = 2^n$ $n = 0, 1, 2, 3$

i) calculate $x(n) \circledast_4 h(n)$ using circular convolution directly

ii) calculate $x(n) \circledast_4 h(n)$using linear convolution. **(10 Marks)**

b. Find the output y(n) of a filter whose impulse response is h(n) = {1, 1, 1} and input signal x(n) = {3, –1, 0, 1, 3, 2, 0, 1, 2, 1} using :
i) overlap – save method
ii) overlap – add method.
Use circular convolution. **(10 Marks)**

3 a. Explain Decimation–in–time algorithm. Draw the basic butterfly diagram for DIT algorithm. **(08 Marks)**

b. Find the 8–point DFT of the sequence, x(n) = {1, 2, 3, 4, 4, 3, 2, 1}. Using DIT–FFT radix–2 algorithm. The basic computational block known as the butterfly should be as shown in Fig. Q3(b). **(12 Marks)**

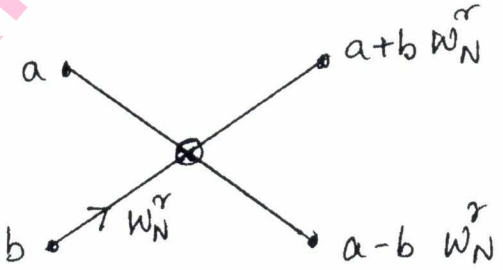

Fig.Q3(b)

4 a. Find the 4 – point DFT of the sequence, $x(n) = \cos\left(\frac{\pi}{4}n\right)$ using DIF–FFT algorithm. **(08 Marks)**

b. Using linear convolution find y(n) = x(n) * h(n) for the sequences :
x(n) = (1, 2, –1, 2, 3, –2, –3, –1, 1, 1, 2, –1) and h(n) = (1, 2).
Compare the result by solving the problem using :
i) Overlap – save method
ii) Overlap – add method. **(12 Marks)**

PART – B

5 a. Compare analog and digital filters. **(04 Marks)**

b. For the given specifications k_p = 3dB ; k_s = 15 dB; Ω_p = 1000 rad/sec; Ω_s = 500 rad/sec. Design analog Butterworth high-pass filter. **(08 Marks)**

c. Design a Chebyshev analog low-pass filter that has a –3 dB cut off frequency of 100 rad/sec and a stop-band attenuation of 25 dB or greater for all radian frequencies past 250 rad/sec. **(08 Marks)**

6 a. Design a high-pass filter H(z) to meet the specifications shown in Fig. Q6(a). The sampling rate is fixed at 1000 samples/sec. Use Bilinear transformation. **(12 Marks)**

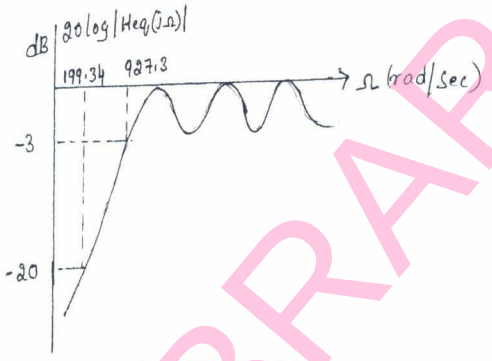

Fig.Q6(a)

b. Transform the analog filter :

$$H_a(s) = \frac{(s+1)}{s^2 + 5s + 6}$$

into H(z) using impulse invariant transformation. Take T = 0.1 sec. **(08 Marks)**

7 a. Explain why windows are necessary in FIR filter design. What are the different windows in practice? Explain in brief. **(08 Marks)**

b. A filter is to be designed with the following desired frequency response :

$$H_d(\omega) = \begin{cases} 0, & -\frac{\pi}{4} < \omega < \frac{\pi}{\omega} \\ e^{-j2\omega}, & \frac{\pi}{4} < |\omega| < \pi \end{cases}$$

Find the frequency response of the FIR filter designed using a rectangular window defined below : $\omega_R(n) = \begin{cases} 1 & 0 \le n \le 4 \\ 0 & \text{otheriwse} \end{cases}$. **(12 Marks)**

8 Realize the following transfer function using :

$$H(z) = \begin{cases} \frac{0.7 - 0.25z^{-1} - z^{-2}}{1 + 0.1z^{-1} - 0.72z^{-2}} \end{cases}$$

i) Direct form – I
ii) Direct form – II
iii) Cascade form
iv) Parallel form. **(20 Marks)**

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10EE661

Sixth Semester B.E. Degree Examination, June/July 2015

Operation Research

Time: 3 hrs. Max. Marks:100

Note: ***Answer FIVE full questions, selecting at least TWO questions from each part.***

PART – A

1 a. Solve the given LPP, using graphical method.

Maximize $z = 3x_1 + 5x_2$

Subject to $x_1 + 2x_2 \le 2000$

$x_1 + x_2 \le 1500$

$x_2 \le 600$

$x_1, x_2 \ge 0$ **(06 Marks)**

b. A firm manufactures two types of products P_1 and P_2 and sells them at a profit of Rs 2 on product P_1 and Rs 3 on product P_2. Each product is processed on two machines M_1 and M_2 product p_1 requires one minute of processing time on M_1 and two minutes of processing time on M_2. Product P_2 requires one minute on M_1 and one minute on M_2. Machine M_1 is available for not more than 6 hours 40 minutes while machine M_2 is available for 10 hours during any day. Formulate the problem as a LPP. **(04 Marks)**

c. Use two phase simplex method to

Minimize $z = x_1 + x_2 + x_3$

Subject to $x_1 - 3x_2 + 4x_3 = 5$

$x_1 - 2x_2 \le 3$

$2x_2 + x_3 \ge 4$

$x_1, x_2, x_3 \ge 0$ **(10 Marks)**

2 a. Solve using simplex method

Maximize $z = 3x_1 + 9x_2$

Subject to $x_1 + 4x_2 \le 8$

$x_1 + 2x_2 \le 4$

$x_1, x_2 \ge 0$ **(10 Marks)**

b. Solve using Big M method and read the solution for dual from primal optimal solution

Maximize $z = 5x_1 + 12x_2 + 4x_3$

Subject to $x_1 + 2x_2 + x_3 \ge 5$

$2x_1 - x_2 + 3x_3 = 2$

$x_1, x_2, x_3 \ge 0$ **(10 Marks)**

3 a. Define dual problem. find the dual of the following LP problem.

Maximize $z = 2x_1 + 3x_2 + x_3$

Subject to $4x_1 + 3x_2 + x_3 = 6$

$x_1 + 2x_2 + 5x_3 = 4$

$x_1, x_2, x_3 \ge 0$ **(06 Marks)**

b. Define (i) Feasible solution (ii) Optimal solution in a linear programming problem. **(04 Marks)**

c. Solve using simplex method.

Maximize $z = 3x_1 + 2x_2 + 5x_3$

Subject to $x_1 + 2x_2 + x_3 \leq 430$

$3x_1 + 2x_3 \leq 460$

$x_1 + 4x_2 \leq 420$

$x_1, x_2, x_3 \geq 0$ **(10 Marks)**

4 a. Five employees are available to do five different jobs. From the past records the time in hrs that each employee takes to do each job is known and given in the table below. How should the jobs be allotted one per person so as to minimize the total man hours? **(10 Marks)**

Employees

Jobs	I	II	III	IV	V
A	2	9	2	7	1
B	6	8	7	6	1
C	4	6	5	3	1
D	4	2	7	3	1
E	5	3	9	5	1

b. Solve the travelling sales man problem given by the following data:

$C_{12} = 20$, $C_{13} = 4$, $C_{14} = 20$, $C_{23} = 5$, $C_{34} = 6$,

$C_{25} = 10$, $C_{35} = 6$, $C_{45} = 10$ where $C_{ij} = C_{ji}$

And there is no route between cities i and j if the value of C_{ij} is not given. **(10 Marks)**

PART – B

5 a. Obtain an initial basic feasible solution for the following transportation problem using

i) North – west corner rule ii) Vogels Approximation method

	1	2	3	4	5	Supply
A	2	11	10	3	7	4
B	1	4	7	2	1	8
C	3	9	4	8	12	9
Demand	3	3	4	5	6	

(10 Marks)

b. Find the optimum solution for the transportation problem using MODI method.

	W_1	W_2	W_3	W_4	Factory capacity
F_1	19	30	50	10	7
F_2	70	30	40	60	9
F_3	40	8	70	20	18
Ware house requirement	5	8	7	14	

(10 Marks)

6 a. Solve the following game graphically and find the value of the game

Player b

Player a	b_1	b_2	b_3	b_4
a_1	8	5	-7	9
a_2	-6	6	4	-2

(10 Marks)

b. Determine the best sequencing of 6 jobs on 4 machines from the given table of processing time. The sequence of operation to be considered is $M_1 \rightarrow M_2 \rightarrow M_3 \rightarrow M_4$

Jobs	Processing Time on Machines			
	M_1	M_2	M_3	M_4
A	6	5	3	4
B	7	2	5	5
C	9	6	3	3
D	8	5	5	4
E	8	3	4	3
F	9	5	5	4

(10 Marks)

7 a. Obtain the critical path and project duration for the following PERT network **(10 Marks)**

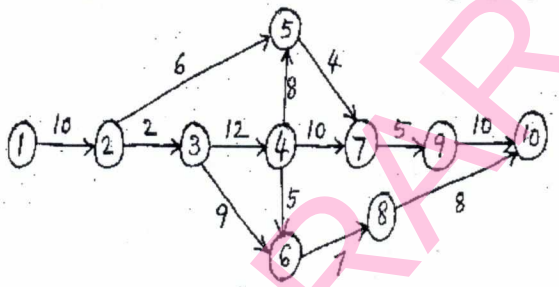

Fig. Q7 (a)

b. Explain the following terms in PERT/CPM
i) Earliest time
ii) Latest time
iii) Total activity slack
iv) Event slack
v) Critical path

(10 Marks)

8 a. In a plant we have 105 machines operating. The average preventive maintenance cost for a machine has been worked out to be Rs 35. The breakdown cost is Rs 500 and the breakdown history of the machines is given below. Decide an appropriate maintenance policy?

Month of the year	1	2	3	4	5	6	7	8	9	10	11	12
Break down Frequency	2	3	4	5	5	6	9	12	12	14	15	15

(10 Marks)

b. We have the lots of 1000 bulbs, supplied to shop cost of individual replacement is Rs 10 and the bulk replacement cost is Rs 2.50 per bulb. The failure pattern noticed is as follows :

Period in months	1	2	3	4	5
Failure rate %	0.10	0.15	0.25	0.30	0.20

Work out the optimum replacement policy. **(10 Marks)**

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10EE666

Sixth Semester B.E. Degree Examination, June/July 2015

Electrical Engineering Materials

Time: 3 hrs. Max. Marks:100

Note: ***Answer FIVE full questions, selecting at least TWO questions from each part.***

PART – A

1 a. Explain Fermi Dirac distribution by using sketches. **(10 Marks)**

b. What are the general properties of conducting materials? **(06 Marks)**

c. A copper wire and an Aluminum wire have same length and resistance. If same current passes through a copper and aluminum wires have same length and resistance, which wire will have higher temperature rise? Give justification. **(04 Marks)**

2 a. Draw a typical hysteresis loop for a ferromagnetic materials and explain. Show the residual magnetism and coercive force on a loop and define them. **(10 Marks)**

b. Define hall effect and derive an expression for the Hall voltage (V_H) by using necessary sketches. **(10 Marks)**

3 a. What is polarization? And explain the i) Ionic polarization ii) Dipolar polarization. **(10 Marks)**

b. Discuss about Dipolar relaxation. **(06 Marks)**

c. Give the reason. Why, hydrogen gas is more coolant than Nitrogen and Air? **(04 Marks)**

4 a. Classify and list the solid, liquid and gaseous insulating materials. Suggest were these insulators are used in Electrical field applications. **(06 Marks)**

b. Explain Dielectric loss with expression. **(06 Marks)**

c. Explain the procedure for testing the dielectric strength of transformer oil with neat sketch. **(08 Marks)**

PART – B

5 a. Explain with block diagram of solar photovoltaic power generating system and Give its V – I characteristics and equivalent circuit diagram. **(12 Marks)**

b. Write a note on fuel cell. **(04 Marks)**

c. List the materials used in battery. **(04 Marks)**

6 a. With suitable diagram, explain the construction and working of NMR spectrometer. **(10 Marks)**

b. Draw the neat sketch of Electronic microscopy and explain the construction and working. **(10 Marks)**

7 a. Define magnetostriction explain with graphs. **(08 Marks)**

b. What is piezo-electricity? Explain the construction and working of piezo – electric device. **(08 Marks)**

c. Write a note on smart Hydrogels. **(04 Marks)**

8 a. Explain the thermoplastic and thermosetting materials and give examples for each. **(06 Marks)**

b. What are the general properties of ceramics and how it is applicable to capacitor? **(08 Marks)**

c. Write note on rubber. **(06 Marks)**

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Important Note : 1. On completing your answers, compulsorily draw diagonal cross lines on the remaining blank pages.
2. Any revealing of identification, appeal to evaluator and /or equations written eg, 42+8 = 50, will be treated as malpractice.