FACULTY OF ENGINEERING
B.E. 2/4 (ECE) I - Semester (Main) Examination, November / December 2016

Subject: Applied Mathematics

Max. Marks: 75

Note: Answer all questions from Part-A and answer any five questions from Part-B.

PART - A (25 Marks)

1. Find a partial differential equation by eliminating the arbitrary function \( f \) from
\[ z = f(\sin x + \cos y). \]

2. Solve \( p - q = z \sin (x+y) \).

3. Determine \( \lim_{z \to a} \frac{z}{\frac{1}{z}} \), if it exists.

4. Evaluate \( \int_{C} \frac{2z+7}{(z^2+1)(z-9)} \, dz \) where \( C \) is \( |z| = \frac{1}{2} \).

5. If \( z = a \) is a simple pole of \( f(z) \), prove that the residue of \( f(z) \) at \( z = a \) is \( \lim_{z \to a} (z-a)f(z) \).

6. Find the image of the region \( |z| > 1 \) under the transformation \( w = \frac{i}{z-i} \).

7. Explain Newton-Raphson method.

8. Find the approximate value of \( y(0.1) \) for \( y' = 1 + y^2 \), \( y(0) = 1 \) by Euler's method.

9. Find the normal equations to fit a quadratic curve \( y = a + bx + cx^2 \) for the data.

<table>
<thead>
<tr>
<th>( x )</th>
<th>0</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
</tr>
</thead>
<tbody>
<tr>
<td>( y )</td>
<td>1</td>
<td>1.8</td>
<td>1.3</td>
<td>2.5</td>
<td>6.3</td>
<td></td>
</tr>
</tbody>
</table>

10. If one of the regression coefficients is greater than 1, show that the other regression coefficient is less than 1.

PART - B (50 Marks)

11. (a) Solve \( x(y^2 - z^2)p + y(z^2 - x^2)q - z(x^2 - y^2) = 0 \).
(b) Reduce the equation \( z^2 = pqxy \) to the form \( F(p, q) = 0 \) and hence solve it.

12. (a) Show that \( u(x, y) = 2x + y^3 - 3x^2y \) is harmonic and find its conjugate harmonic function.
(b) State Cauchy's integral formula and use it to evaluate
\[ \int_{C} \frac{e^z}{z^2 + 1} \, dz \]
where \( C \) is \( |z - i| = 1 \).

13. (a) Find the Laurent series expansion of \( f(z) = \frac{z}{(z-1)(z-3)} \) in the region \( 0 < |z-1| < 2 \).
(b) Evaluate \( \int_{0}^{a} \frac{x^2}{(x^2 + 9)(x^2 + 4)} \, dx \).
14 (a) Use Lagrange's interpolation formula to find \( f(10) \) from the following data.

\[
\begin{array}{cccc}
 x & 5 & 6 & 0 & 11 \\
 f(x) & 12 & 13 & 14 & 16 \\
\end{array}
\]

(b) Compute \( f'(1.5) \) by Newton's backward formula for the following data:

\[
\begin{array}{cccc}
 x & 1 & 1.2 & 1.4 & 1.6 \\
 f(x) & 1.01 & 1.18 & 1.33 & 1.56 \\
\end{array}
\]

15 (a) Fit a curve of the form \( y = ae^{bx} \) to the following data:

\[
\begin{array}{cccccc}
 x & 0.5 & 1.0 & 2.0 & 2.5 & 3.0 \\
 y & 0.57 & 1.46 & 5.10 & 7.65 & 9.20 \\
\end{array}
\]

(b) The ranks of 10 students in two subjects A and B are as follows:

\[
\begin{array}{cccccccc}
 A: & 3 & 5 & 8 & 4 & 7 & 10 & 2 & 1 & 6 & 9 \\
 B: & 6 & 4 & 9 & 8 & 1 & 2 & 3 & 10 & 5 & 7 \\
\end{array}
\]

Find the rank correlation coefficient.

16 (a) Solve \( p^2 + q^2 = 1 \) by Cauchy's method.

(b) Evaluate \( \int_0^{2\pi} \bar{z} \, dz \) along the curve \( z = t^2 + it \).

17 (a) Find the bilinear transformation which maps the points \( 0, -i, -1 \) of the \( z \)-plane into the points \( i, 1, 0 \) of the \( w \)-plane respectively.

(b) Find the regression line of \( x \) on \( y \) for the following data:

\[
\begin{array}{cccccc}
 x & 1 & 5 & 3 & 2 & 1 & 7 \\
 y & 6 & 1 & 0 & 0 & 1 & 2 & 1 & 5 \\
\end{array}
\]

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PART – A (25 Marks)

1. A current waveform is applied to a 2H inductor. Draw voltage waveform for the given figure.


3. The given figure shows a graph of the network. Show all the trees of this graph.

4. In the given network switch is closed at t=0 with zero initial current in the inductor, find $i(t) = \frac{di(t)}{dt}$ at $t=0^+$. 

5. A series circuit consumes 2000 W at 0.5 leading power factor, when connected to 230 V, 50 Hz a.c supply. Calculate:
   a) Current
   b) Apparent power
   c) Reactive power

6. A series RLC circuit has the following parameter values $R=10 \, \Omega$, $L=0.01 \, H$, $C=100 \, \mu F$. Compute resonant frequency, bandwidth, lower and upper frequency of the bandwidth.
10 For the given network a sinusoidal voltage \( V = 150 \sin(200t + \phi) \) is applied at \( \phi = 30^\circ \). Determine current \( i(t) \).

11 Find the equivalent T-network for the network shown below.

12 A coil having a resistance of 20 \( \Omega \) and inductance of 200 \( \mu \text{H} \) is connected in parallel with a variable capacitor. The parallel combination is connected in series with a resistance of 8000 \( \Omega \). A voltage of 230 V, 10\(^6\) Hz is applied across the circuit. Find
   a) The value of capacitance at resonance
   b) Q factor of the circuit
   c) Dynamic impedance of the circuit
   d) Total circuit current.

13 Explain the following:
   a) Kirchhoff's laws
   b) Magnetically coupled circuits
   c) Impedance and admittance functions

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FACULTY OF ENGINEERING

B.E. 2/4 (ECE) I - Semester (Main) Examination, November / December 2016

Subject: Electronic Devices

Time : 3 Hours

Max. Marks: 75

Note: Answer all questions from Part-A and answer any five questions from Part-B.

PART - A (25 Marks)

1. Differentiate between transition capacitance and diffusion capacitance of PN junction diode.

2. The diode current is 0.6mA when the applied voltage is 400mV and 2mA when applied voltage is 500mV. Determine $\eta$. Assume $kT/q = 25mV$.

3. What are the advantages and disadvantages of bridge rectifier?

4. Explain the purpose of bleeder resistor in LC or L section filter.

5. What is Early Effect or Base Width Modulation in a transistor?

6. What is thermal runaway in transistors? Write a condition to avoid this.

7. Why $h$-parameters are preferred to analyze a circuit using BJT?

8. What are the differences in BJT and FET?

9. Sketch and explain the small signal model of JFET.

10. For a transistor find $\beta$, $\alpha$ and $I_E$ when $I_C = 5mA$, $I_B = 100\mu A$.

PART - B (50 Marks)

11. (a) What is PN junction diode? Explain the working of PN junction under forward bias and reverse bias with neat diagram.

   (b) Write the differences between Zener break down and Avalanche break down in diodes.

12. (a) Derive ripple factor of full wave rectifier with choke or inductor filter?

   (b) A 220V, 50Hz ac voltage is applied to the primary of 4:1 step down transformer which is used in full wave rectifier having a $R_L = 1K\Omega$ uses Si diode with $R_f = 600\Omega$. Determine the following. (i) DC output voltage (ii) DC power delivered to load (iii) PIV of each diode (iv) Efficiency (v) ripple frequency

13. (a) Derive the stability factor equation for a Collector to base bias circuit.

   (b) In the case of collector to base circuit if $\beta = 40$, $R_C = 4.7K\Omega$ and $R_B = 80K\Omega$. Determine the value of stability factor $S$.

14. (a) How to derive an approximate model from exact model of $h$-parameters. Draw an approximate model for CE amplifier.

   (b) A junction transistor connected in self bias has the following $h$-parameters

   $h_{ie} = 1200\Omega$, $h_{re} = 2 \times 10^{-4}$, $h_{fe} = 60$, $h_{be} = 25\mu A/V$. Determine the $A_i$, $A_v$, $Z_i$, $Z_o$ of the CE amplifier using exact analysis. The load resistance $R_L = 2K\Omega$, source resistance $R_s = 900\Omega$, $R_t = 50K\Omega$, $R_2 = 1K\Omega$ and $R_C = 1K\Omega$.  

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15 (a) Explain the construction and operation of n-channel JFET and draw drain
and transfer characteristics. (6)
(b) Differentiate between depletion and enhancement MOSFETS. (4)

16 (a) Draw and explain the circuit of Uni- Junction transistor and plot the I_V
characteristics. (5)
(b) Compare CB, CE and CC amplifier performance parameters. (5)

17 Write short notes on the following. (10)
(a) Bias compensation techniques
(b) FET as voltage variable resistor
(c) Silicon Controlled Rectifier
FACULTY OF ENGINEERING
B.E. 2/4 (ECE) I - Semester (Main) Examination, November / December 2016

Subject: Elements of Mechanical Engineering.

Time : 3 Hours
Max. Marks: 75

Note: Answer all questions from Part-A and answer any five questions from Part-B.

PART – A (25 Marks)

1. Define Entropy and Enthalpy.
3. State Newton’s law of cooling and write its importance.
4. Write one dimensional heat conduction equation in plane walls and explain it.
5. Define COP of Air refrigeration cycle.
6. Write applications of refrigeration in Electronic Industry.
7. Explain various rolling processes.
8. What is the principle involved in gas welding process?
9. Write the applications and classification of gears.
10. Derive the expression of length of cross belt.

PART - B (50 Marks)

11. (a) Derive the expression for the work done of an air compressor with clearance volume.
     (b) During the testing of an engine the following readings were observed; Speed=1600 rpm, net load on the brake drum=1200N, brake drum radius=0.65m. Find the torque and brake power developed by the engine.

12. (a) One face of a copper plate 4cm thickness is maintained at 500°C and the other face is maintained at 125°C. Calculate the heat loss through the plate per square metre area, take thermal conductivity of the plate as 370W/m K.
     (b) Water is heated in double pipe heat exchanger from 138°C to 305°C by gases that cools from 525°C to 250°C, determine the LMTD i) Parallel flow mode ii) Counter flow mode.

13. (a) Explain the working of Vapour absorption refrigeration system with a neat sketch.
     (b) Compare thermo electric refrigeration system with vapour compression refrigeration system.

14. (a) Describe the working of ARC Welding process with the help of neat sketch.
     (b) Explain the wire drawing process with a neat sketch.

15. (a) The diameter of the pulley on the driving shaft running at 250 rpm is 0.55m. a counter shaft is to be driven at 300 rpm by an open belt drive, having a coefficient of friction 0.25. The distance between the shafts is 3.5 m. Determine the width of the belt to transmit 6 kW power, if the safe permissible tension is 22N/mm width of the belt.
     (b) Explain slider crank mechanism with a diagram.

16. (a) Compare two stage air compressors with Internal combustion engines.
     (b) Explain classification and applications of heat exchangers.

17. Write short notes on any two of the following
    (a) Vapour compression refrigeration systems
    (b) various machining operations on Lathe machine.
    (c) Epi cyclic gear trains

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FACULTY OF ENGINEERING
B.E. 2/4 (ECE) I - Semester (Main) Examination, November / December 2016

Subject: Electrical Technology

Max. Marks: 75

Note: Answer all questions from Part-A and answer any five questions from Part-B.

PART – A (25 Marks)

1. Give the classification of DC generator based on their field excitation.

2. Define critical resistance and critical speed.

3. A 3-phase delta system has the following data:
   \[ V_L = 400 \text{ V}, \quad I_L = 40 \text{ A} \]
   Calculate phase voltage and current.

4. What is meant by 3-phase balanced system?

5. Give the basic principle of operation of 3-phase alternator.

6. Define synchronous impedance of a 3-phase alternator.

7. Explain when the regulation of transformer is negative.

8. Draw the no load phasor diagram of a transformer.


10. Give the power stages of a 3-phase induction motor.

PART – B (50 Marks)

11. (a) Derive the torque equation for a DC motor.
    (b) A DC shunt generator has the following data:
        Poles = 4; Slots = 50; Each slot having 12 conductors
        Armature resistance = 0.09 \Omega; Field resistance = 100 \Omega
        Flux per pole = 20 \text{ mWb}; Armature current = 20 \text{ A}
        Speed = 1000 RPM, Lap connected
        Calculate voltage across the load resistance.

12. (a) Explain the constructional details and principle of operation of DC generator.
    (b) Explain electrical and mechanical characteristics of DC shunt and series motors.

13. (a) Explain the operation of fluorescent lamp with the help of neat schematic diagram.
    (b) The power input to a 400 V, 50Hz, 3-phase delta system is measured by two wattmeters are 500 W and 400 W respectively. Determine total power, power factor and line current.

14. (a) Derive the emf equation of a 3-phase alternator.
    (b) A 3-phase, 10 KVA, 400 V 50Hz, star connected alternator supplied the rated load at 0.8 pf lagging. If the armature resistance and synchronous reactance are 0.6\Omega and 5\Omega respectively, determine voltage regulation.

15. (a) Explain constructional details and principle operation of 1-phase transformer.
    (b) Explain the 1-phase transformer on lagging load with help of neat phasor diagram.
16 (a) Explain the slip-torque characteristics of a 3-phase induction motor.  (5)
(b) Explain the capacitor start motor with the help of neat schematic diagram. (5)

17 (a) Explain the production of rotating magnetic field in the 3-phase induction motor.  (5)
(b) A 25 KVA, 2200 /220 V, 50 Hz, 1-phase transformer has the following test data:

OC test : 220V, 12A,  90 W (LV side)
SC test : 60 V, 7A,  300 W (HV side)

Calculate the parameters of equivalent of the transformer referred to LV side.  (5)

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