



NATIONAL INSTITUTE OF TECHNOLOGY PATNA
Department of Mechanical Engineering
END SEMESTER EXAMINATION, JAN-JUNE 2024

Course Code: ME26101

B. Tech-EE: Semester-2nd

Course Name: Engineering Graphics

Maximum Time: 03:00 hours

1. Attempt any Six out of Seven Questions;
2. Assume any suitable data, if necessary
3. The Marks, CO (Course Outcome) and BL (Blooms Level) Related to question and mention on the right-hand side margin.

Marks	CO	BL
10	01	A
10	02	A,U
10	03	A
10	04	A,R
10	04	A
10	04	A
10	04	A
10	04	A,U
10	04	A

1. Construct a vernier scale of 1:2500 to read metres and long enough to measure 400 m. mark on it a distance of 276 m & 155 m.

2. Draw a parabola when the distance between its focus and directrix is 50 mm. Also draw a tangent and a normal at a point 70 mm from the directrix.

3. Draw an involute of a circle of 50 mm diameter. Also draw a normal and a tangent at a point distance 100 mm from the centre of the circle.

4. What do you mean by projection? Give its classification also differentiate between first-angle and third-angle projections.

5. Draw the projections of the following points on a common reference line, keeping the distance between their projectors 30 mm apart.
(a) Point A is 20 mm below the H.P. and 50 mm in front of the V.P.
(b) Point B is in the H.P. and 40 mm behind the V.P.
(c) Point C is 30 mm in front of the V.P. and in the H.P.
(d) Point D is 50 mm above the H.P. and 30 mm behind the V.P.
(e) Point E is 20 mm below the H.P. and 50 mm behind the V.P.

6. An 80 mm long line PQ, has the end P at a distance of 20 mm above the H.P. and 40 mm in front of the V.P. The line is inclined at 30° to the H.P. and is parallel to the V.P. Draw the projections of the line and determine its traces.

7. A hexagonal plane with a 30 mm side has its surface parallel to and 20 mm in front of V.P. Draw its projections, when
(a) A side is perpendicular to the H.P.,
(b) A side is parallel to the H.P.,
(c) A side is inclined at 45° to the H.P.

NATIONAL INSTITUTE OF TECHNOLOGY PATNA

END SEM EXAMINATION MAY - 24
Engineering Mathematics (MA26101)
ELECTRICAL BRANCH SECTION - A

ANSWER FOLLOWING QUESTIONS

MARKS 60

TIME 3HRS

ANSWER FOLLOWING QUESTIONS

Q 1 (a) Solve the differential equations $(3x^2y^3e^y + y^3 + y^2)dx + (x^3y^3e^y - xy)dy = 0$

(b) Find the general solution of the equation by variation of parameters $y''' - 6y'' + 11y' - 6y = e^{-x}$

(c) Find the general solution of the equation $16y'' + 8y' + y = 48xe^{-x}/y$

Q 2 (a) If $A = \begin{bmatrix} 1 & 0 & 0 \\ 1 & 0 & 1 \\ 0 & 1 & 0 \end{bmatrix}$ Then show that $A^n = A^{n-2} + A^2 - I$ for $n \geq 3$, Hence find A^{50} .

(b) Examine whether A is similar to B where $A = \begin{bmatrix} 5 & 5 \\ -2 & 0 \end{bmatrix}$ and $B = \begin{bmatrix} 1 & 2 \\ -3 & 4 \end{bmatrix}$

(c) Examine whether the set of vector is linearly independent. Find the dimension and the basis of the given set of vectors $(2, 3, 6, -3, 4)(4, 2, 12, -3, 6)(4, 10, 12, -9, 10)$

Q 3 (a) Find all the eigen values and the corresponding eigen vectors of the matrices and show the matrices is diagonalizable.

$$\begin{bmatrix} 1 & 2 & 2 \\ 0 & 2 & 1 \\ -1 & 2 & 2 \end{bmatrix}$$

(b) Verify the Caley- Hamilton theorem for the matrix A. Find A^{-1} , if it exist $A = \begin{bmatrix} 1 & -1 & -1 \\ 1 & -1 & 0 \\ 1 & 0 & -1 \end{bmatrix}$

(c) If A is an orthogonal matrix, Show that $|A| = \pm 1$

Q 4 (a) Show that the rectangular solid of maximum volume that can be inscribed in a given sphere is a cube.

(b) Find the extreme values of $u = x^3 + y^3 - 63(x + y) + 12xy$

Q 5 (a) If $u = \frac{2yz}{x}$, $v = \frac{3zx}{y}$, $w = \frac{4xy}{z}$ find $\frac{\partial(x,y,z)}{\partial(u,v,w)}$

(b) If $u = \log r$ and $r^2 = x^2 + y^2$, prove that $x^2 \frac{\partial^2 u}{\partial x^2} + 2xy \frac{\partial^2 u}{\partial x \partial y} + y^2 \frac{\partial^2 u}{\partial y^2} + 1 = 0$

(c) Solve the equations in series $\frac{d^2y}{dx^2} - y = 0$.

----- Try to best -----

NATIONAL INSTITUTE OF TECHNOLOGY PATNA
 Department of Chemistry
END SEMESTER EXAMINATION, MAY 2024

B. Tech: Semester-II, EE, Sec-A
 Course Name: Engineering Chemistry
 Maximum Time: 3 hours

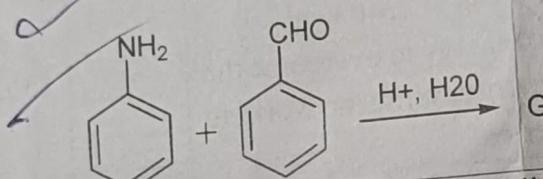
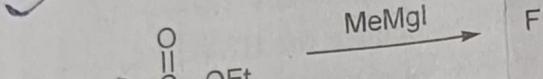
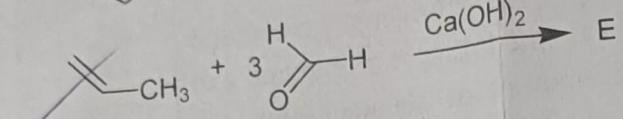
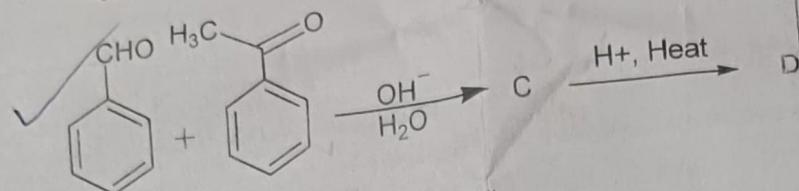
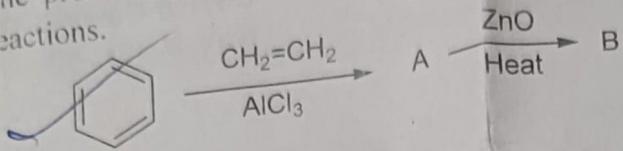
Course Code: CH26101
 Max. Marks: 60.....

Instruction:

1. Attempt All questions.
2. Assume any suitable data, if necessary.

	Marks	CO	BL
1. a). How will the knocking sound be produced in an engine? Write the detailed method to overcome the knocking problem. ✓	3	CO2	L4
b). A sample of coal was found to have the following percentage composition: C = 75%; H = 2.5%; O = 12.1%; N = 3.2%; and ash 4.5%. (i) Calculate the minimum amount of air necessary for complete combustion of 1 kg of coal. (ii) Also calculate the HCV and LCV of the coal sample. (Given: gross C.V. of carbon = 8080 kcal/kg. Hydrogen = 34500 kcal/kg and Sulphur = 2240 kcal/kg).	3	CO2	L5
c). Write and explain two alternative sources of energy to overcome the disadvantages of non-renewable forms of energy. Write the working principle of fuel cells and lithium-ion batteries.	4	CO2	L4
2. a). Write the principle underlying the moving boundary method and derive the quotation to determine the transport no. using the moving boundary method	3	CO3	L4
b). Molar ionic conductance at infinite dilution of Na^+ and Cl^- ions are 76.34×10^{-4} and $50.11 \times 10^{-4} \text{ S m}^2 \text{ mol}^{-1}$, respectively. Calculate the transport numbers of Na^+ and Cl^- ions.	2	CO3	L5
c). Write the limitations of Ostwald's dilution law of electrolyte dissociations. Deduce the Debye Huckel equation and explain how to overcome the limitations of Ostwald's dilution law.	5	CO3	L5
d). Derive and deduce the Nernst equation and its outcomes.	5	CO3	L4
3. a). Explain the spectrochemical series. Correlate the magnitude of crystal field splitting, Δ_o , and pairing energy, P with respect to filling of d-orbitals.	5	CO4	L3
b). Write and explain the isomerism observed in the following complexes i. $[\text{Co}(\text{NH}_3)_6][\text{Cr}(\text{CN})_6]$ and $[\text{Cr}(\text{NH}_3)_6][\text{Co}(\text{CN})_6]$ ii. $[\text{Co}(\text{NH}_3)_5\text{ONO}]^{+}\text{Cl}_2^-$ and $[\text{Co}(\text{NH}_3)_5\text{NO}_2]^{+}\text{Cl}_2^-$ iii. $[\text{Pt}(\text{NH}_3)_2\text{Cl}_2]^{+}$ and $[\text{Pd}(\text{NH}_3)_2(\text{NO}_2)]^{+}$. iv. $[\text{Cr}(\text{H}_2\text{O})_5\text{Cl}]^{+}\text{Cl}_2\cdot\text{H}_2\text{O}$ and $[\text{Cr}(\text{H}_2\text{O})_6]^{+}\text{Cl}_3$ v. $[\text{Co}(\text{NH}_3)_5\text{NO}_3]\text{SO}_4$ and $[\text{Co}(\text{NH}_3)_5\text{SO}_4]\text{NO}_3$	5	CO4	L4
c). Explain the structure and properties of coordination theory on the basis of Warner's theory. Write the limitation of Warner's theory.	5	CO4	L4

4. a.) Write the products (A-G) and their reaction mechanism for the given reactions.

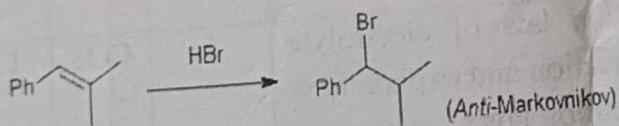
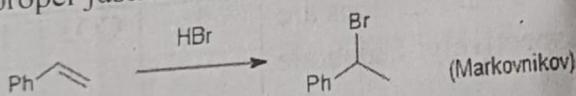


10

CO5

L5

b.) What is Markovnikov's Rule? Why free radical addition reactions do not obey Markovnikov's Rule. Explain the reaction below with proper justification.

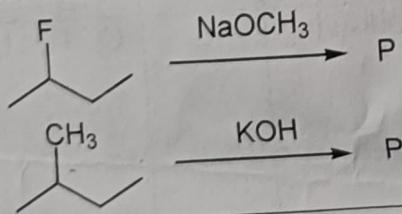


5

CO5

L4

c.) Write the general criteria of the chemical reaction which preferred Hofmann product. Explain the reaction mechanism with the major product.



5

CO5

L4

NATIONAL INSTITUTE OF TECHNOLOGY PATNA

Department of Electrical Engineering

END SEMESTER EXAMINATION (Jan-June'24)

B. Tech: Semester-II (Sec-A)

Course Name: Elements of Electrical Engineering-II

Course Code: EE26105

Maximum Time: 3 hours

Max. Marks: 60

Instructions:

1. All questions are compulsory and carries an equal marks.
2. Be precise in answering theory questions. No stories, only relevant information is required.
3. Don't skip any steps involved in both numerical problems and derivations (if any).

The Marks, CO (Course Outcome), and BL (Bloom's Level) related to questions are mentioned on the right-hand side margin.

No.	Description	CO	BL
1.	A 13.2-kV single-phase generator supplies power to a load through a transmission line. The loads Impedance is $Z_{load} = 500\angle36.87^\circ \Omega$, and the transmission line's impedance is line $Z_{line} = 60\angle53.1^\circ \Omega$. (a) If the generator is directly connected to the load, what is the ratio of the load voltage to the generated voltage? What are the transmission losses of the system? (b) If a 1:10 step-up (ideal) transformer is placed at the output of the generator and a 10:1 step down (ideal) transformer is placed at the load end of the transmission line, what is the new ratio of the load voltage to the generated voltage? What are the transmission losses of the system now? Comment on the losses in this part as compared to the previous part.	1	A(4)
2.	A 450 kVA, 460 V/7.97 kV transformer has an efficiency of 97.8% when supplying a rated load of unity power factor. If it is connected as a 7.97/8.43 kV autotransformer, calculate its rated terminal currents, rated kVA, and efficiency when supplying a unity power factor load.	2	A(3)
3	Draw the equivalent circuit of a transformer. Identify the test(s) by which the value of each circuit element can be found. Explain with the help of circuit diagrams.	2	E(5)
4.	Using EMF and torque equations, explain how a dc motor has two powerful methods of speed control through field excitation and armature voltage.	3	U(2)
5.	A 120-V, 1/3-hp 60-Hz, four-pole, split-phase induction motor has the following impedances: $R_1 = 1.80 \Omega$, $X_1 = 2.40 \Omega$, $X_M = 60 \Omega$, $R_2 = 2.50 \Omega$, $X_2 = 2.40 \Omega$ At a slip of 0.025, the motor's rotational losses are 51 W. The rotational losses may be assumed constant over the normal operating range of the motor. If the slip is 0.025, find the following quantities for this. (a) The input current (b) The air-gap power (c) The output power (d) The load torque (e) The overall efficiency (f) The stator power factor	4	A(3)

6.	Show that at supersynchronous speed, the induction machine acts as a generator. Write the expression for air gap power (P_G). In which direction does it flow? How can you find the net mechanical power input and net electrical power output?	4	A(3)
7.	Give a comparison of cost of different transmission systems. Also, show that the 3-ph, 3-wire system is cheaper than the 1-ph, 2-wire system.	5	A(4)
8.	An industrial complex (INC) powered by a 400 V, 50Hz, 3-phase, supply has a total load of 50 kW. The power factor (PF) is 0.707 lagging and the INC desires to avoid the payment of penalties for this poor power factor. What should be the facility distribution company (DISCOM) suggest to the INC management to do? If an improved PF of 0.866 lagging is desired, determine the magnitude of the required reactive power (Q_C) and Capacitance (C). Draw the phasor diagram showing currents drawn from the supply in both cases.	5	E(5)
9.	What do you understand with Open Loop and Closed Loop systems? Explain them with suitable examples.	6	U(2)
10.	The impulse response of a system is given by $g(t) = e^{-2t}(1 - \sin 2t)$. (a) Determine the transfer function of the system. (b) Plot the pole-zero configurations in s-plane. (c) Evaluate the system's steady state output when unit step input is applied.	6	A(3)

NATIONAL INSTITUTE OF TECHNOLOGY PATNA

Department of Electronics and Communication Engineering

END SEMESTER EXAMINATION (May-2024)

Subject Faculty: Dr. Rajarshi Bhattacharya

B.Tech. EE (Sec. A) 2nd semester

Course Title: Electronics Workshop Course Code: EC26105

Total Time: 3 Hours Exam Date: 08-05-2024 Full Marks: 60

Instruction:

1. Attempt all 6 questions.
2. Assume any suitable data, if necessary.
3. The marks and CO (Course Outcome) related to questions are mentioned on the right-hand side.

<p>Q1. Briefly discuss the working principle of the following electronic components/devices: <i>i</i>) LDR, <i>ii</i>) potentiometer, <i>iii</i>) photo diode, and <i>iv</i>) 12V relay. Use suitable diagrams and plots wherever required.</p> <p>[CO-1] 10 marks</p>
<p>Q2. Write practical applications of the following electronic components: <i>i</i>) LDR, <i>ii</i>) photo diode, <i>iii</i>) thermistor, <i>iv</i>) IC 555, and <i>v</i>) Peltier plate module.</p> <p>[CO-1] 10 marks</p>

<p>Q4. (a) What are the two main types of solder? What is their composition? (b) Discuss the construction of desoldering pump. How does it work?</p> <p>[CO-2] 5 marks [CO-2] 5 marks</p>
<p>Q5. (a) Write the steps of wet PCB fabrication process. (b) Discuss the relative advantages and disadvantages of the CNC-based PCB prototyping process and the etching-based PCB fabrication process.</p> <p>[CO-4] 5 marks [CO-4] 5 marks</p>
<p>Q6. (a) (i) Draw the circuit of a bridge rectifier with capacitive filter. (ii) Draw the corresponding PCB layout and show the position of the components to be soldered.</p> <p>[CO-3] 5 marks</p> <p>(b) Design an LDR based system for automatic operation of streetlight. (i) Draw the circuit diagram. (ii) Enlist the components used. (iii) Explain the working principle of the product. [Hint: Use relay to operate the high voltage streetlight]</p> <p>[CO-5] 5 marks</p>

End

- Q3. How to test the following electronic components: i) condenser microphone, and ii) mobile phone battery just by using a multimeter?

[CO-5] 10 marks

NATIONAL INSTITUTE OF TECHNOLOGY PATNA
 Department of Electronics and Communication Engineering
END SEMESTER EXAMINATION (May-2024)

Subject Faculty: Dr. DABLU KUMAR

B.Tech: EE & Dual degree (EE-B) 2nd semester, Roll No.:
Course Name: Electronics Workshop Course Code: EC26105
Maximum Time: 3 hours, Date: 08-05-2024 Max. Marks: 60 marks

Instruction:

1. Attempt all 6 questions.

2. Assume any suitable data, if necessary. (*Any other Instruction need to provide by the concerned faculty*).

3. The Marks and CO (Course Outcome) related to questions are mentioned on the right-hand side.

Q1. (a) Explain the block diagram of digital storage oscilloscope (DSO). (CO-1) 5 marks
 (b) What is soldering and de-soldering? Describe the components required for soldering and de-soldering. (CO-2) 5 marks

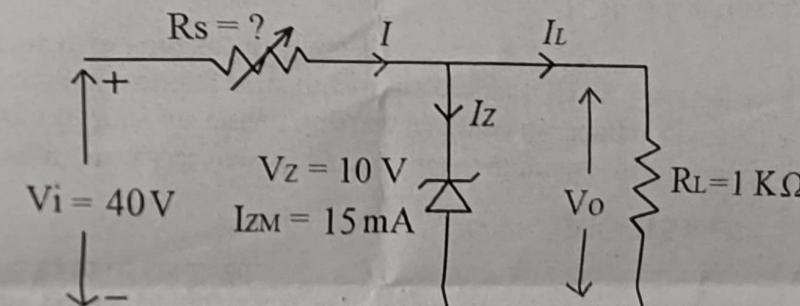
Q2. (a) Write a short note on characteristics of Photo-diode, and find the operating wavelength (λ), if current (I_P) through the photodiode is 1.8 A, input power ($P = 4$ Watt), and quantum efficiency (η) of photodiode is 90%. (CO-1) 3+3 marks
 (b) Design a Pi-type symmetrical attenuator to determine its resistance (R_1 , R_2 , and R_3) values, if voltage gain (A_{dB}) is 20 dB, and output resistance (R_o) is 1000 Ω . (CO-1) 4 marks

Q3. (a) What is the Frequency Counter? Describe with proper diagram. (CO-1) 6 marks
 (b) Design the circuit of transistorized touch control switch, and explain its working. (CO-4) 4 marks

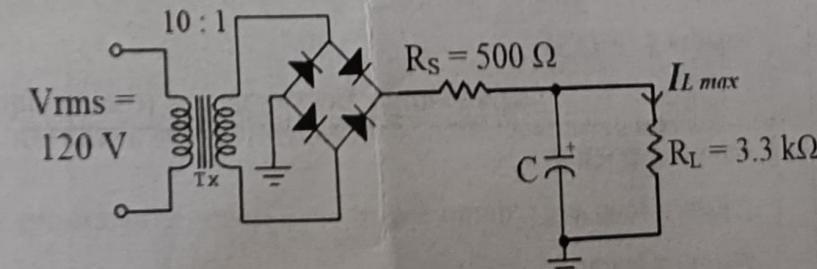
Q4. (a) Write a short note on classification of printed circuit board (PCB). (CO-3) 6 marks
 (b) What is thermal management of electronic devices? and what are the cooling methods used in thermal management industry? (CO-3) 4 marks

Q5. (a) Explain the theory of wet PCB fabrication process with proper steps. (CO-4) 5 marks
 (b) Explain the working of transistor shunt voltage regulator with proper diagram. (CO-1, CO-5) 5 marks

Q6. (a) For zener circuit shown in figure below, determine the range of series resistance R_s (minimum and maximum range) that will result in V_o being maintained at 10 V, assuming that load resistance $R_L = 1 \text{ k}\Omega$ and maximum zener current rating is 15 mA. Also determine the maximum wattage rating of the zener diode. (CO-1, CO-5) 5 marks



(b) For the given circuit below, find the maximum load current ($I_{L max}$), and maximum power dissipated at load resistance. Here, voltage rating of each diode is 0.7 V. (CO-1, CO-5) 5 marks



End
