

CBCS Scheme

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15MAT11

First Semester B.E. Degree Examination, Dec.2017/Jan.2018
Engineering Mathematics – I

Time: 3 hrs.

Max. Marks: 80

Note: Answer FIVE full questions, choosing one full question from each module.

Module-1

- 1 a. Find the n^{th} derivative of $y = e^{-x} \sin x \cos 2x$. (06 Marks)
 b. Show that the curves $r = a(1 + \cos \theta)$ and $r = b(1 - \cos \theta)$ cut each other orthogonally. (05 Marks)
 c. Find the radius of curvature of the curve $x^2 y = a(x^2 + y^2)$ at the point $(-2a, 2a)$. (05 Marks)

OR

- 2 a. If $y = \sin(m \sin^{-1} x)$, then prove that $(1 - x^2)y_{n+2} - (2n+1)xy_{n+1} + (n^2 - m^2)y_n = 0$ (06 Marks)
 b. Find the pedal equation of $r = 2(1 + \cos \theta)$. (05 Marks)
 c. Find the radius of curvature of $r^n = a^n \sin n\theta$. (05 Marks)

Module-2

- 3 a. Expand $\tan^{-1} x$ in powers of $(x-1)$ upto the fourth degree term. (06 Marks)
 b. Evaluate $\lim_{x \rightarrow 0} \left[\frac{1}{x} - \frac{\log(1+x)}{x^2} \right]$ (05 Marks)
 c. If $z = f(x+ct) + g(x-ct)$, prove that $\frac{\partial^2 z}{\partial t^2} = C^2 \cdot \frac{\partial^2 z}{\partial x^2}$. (05 Marks)

OR

- 4 a. Obtain the Maclaurin's series expansion of $e^{\sin x}$ upto the form containing x^4 . (06 Marks)
 b. If $z = \log \left(\frac{x^4 + y^4}{x+y} \right)$, show that $x \frac{\partial u}{\partial x} + y \frac{\partial u}{\partial y} = 3$. (05 Marks)
 c. If $u = x^2 + y^2 + z^2$, $v = xy + yz + zx$, $w = x + y + z$, show that $\frac{\partial(u, v, w)}{\partial(x, y, z)} = 0$. (05 Marks)

Module-3

- 5 a. A particle moves along the curve whose parametric equations are $x = t^3 + 1$, $y = t^2$ and $z = 2t + 5$. Find the components of its velocity and acceleration at time $t = 1$ in the direction of $\vec{i} + \vec{j} + 3\vec{k}$. (06 Marks)
 b. If $\phi = 2x^3 y^2 z^4$, find $\text{Div}(\text{Grad } \phi)$. (05 Marks)
 c. Show that $\vec{F} = (y+z)\vec{i} + (z+x)\vec{j} + (x+y)\vec{k}$ is irrotational. Also find a scalar function ϕ , such that $\vec{F} = \nabla \phi$. (05 Marks)

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.

OR

- 6 a. Find the directional derivative of $\phi = x^2yz + 4xz^2$ at $P(1, -2, -1)$ in the direction of $2\mathbf{i} - \mathbf{j} - 2\mathbf{k}$. (06 Marks)
- b. If $\vec{F} = (x+y+1)\mathbf{i} + \mathbf{j} - (x+y)\mathbf{k}$. Show that $\vec{F} \cdot \text{curl } \vec{F} = 0$. (05 Marks)
- c. If $\vec{F} = \nabla(xy^3z^2)$, find $\text{div } \vec{F}$ and $\text{curl } \vec{F}$ at the point $(1, -1, 1)$. (05 Marks)

Module-4

- 7 a. Obtain the reduction formula for $\int \cos^n x dx$. (06 Marks)
- b. Solve $y e^{xy} dx + (x e^{xy} + 2y) dy = 0$. (05 Marks)
- c. Find the orthogonal trajectories of the family of curves $y^2 = Cx^3$. (05 Marks)

OR

- 8 a. Evaluate $\int_0^1 x^{3/2} (1-x)^{3/2} dx$. (06 Marks)
- b. Solve $\frac{dy}{dx} - \frac{2}{x}y = \frac{y^2}{x^3}$. (05 Marks)
- c. A body is heated to 110°C and placed in air at 10°C . After one hour its temperature becomes 60°C . How much additional time is required for it to cool to 30°C ? (05 Marks)

Module-5

- 9 a. Find the rank of the matrix $A = \begin{bmatrix} 4 & 0 & 2 & 1 \\ 2 & 1 & 3 & 4 \\ 2 & 3 & 4 & 7 \\ 2 & 3 & 1 & 4 \end{bmatrix}$. (06 Marks)
- b. Solve the following system of equations by Gauss Jordan method:
 $x + 2y + z = 3$, $2x + 3y + 3z = 10$, $3x - y + 2z = 13$ (05 Marks)
- c. Reduce the matrix $A = \begin{bmatrix} -1 & 3 \\ -2 & 4 \end{bmatrix}$ to the diagonal form. (05 Marks)

OR

- 10 a. Solve the following system of equations by Gauss-Seidal method:
 $20x + y - 2z = 17$, $3x + 20y - z = -18$, $2x - 3y + 20z = 25$. Perform three iterations. (06 Marks)
- b. Show that the transformation, $y_1 = 2x_1 - 2x_2 - x_3$, $y_2 = -4x_1 + 5x_2 + 3x_3$, $y_3 = x_1 - x_2 - x_3$ is regular and find the inverse transformation. (05 Marks)
- c. Reduce the quadratic form,
 $3x^2 + 3y^2 + 3z^2 + 2xy - 2yz + 2zx$ into the canonical form. (05 Marks)

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15PHY12/22

First/Second Semester B.E. Degree Examination, Dec.2017/Jan.2018

Engineering Physics

Time: 3 hrs.

Max. Marks: 80

Note: 1. Answer any FIVE full questions, choosing one full question from each module.

2. Physical constants: $h = 6.625 \times 10^{-34}$ JS, $M_e = 9.1 \times 10^{-31}$ kg, $K = 1.38 \times 10^{-23}$ J/K, $C = 3 \times 10^8$ m/s, $e = 1.602 \times 10^{-19}$ C, $N_A = 6.025 \times 10^{+26}$ /k mol.

Module-1

- 1 a. Explain the energy distribution in the spectrum of a blackbody. (05 Marks)
b. Set up time independent Schrödinger wave equation in one dimension. (07 Marks)
c. A particle of mass 0.5 Me V/c^2 has kinetic energy 100eV. Find its de-Broglie wavelength. (04 Marks)

OR

- 2 a. Define phase velocity and Group velocity. Show that group velocity is equal to particle velocity. (06 Marks)
b. State and explain Heisenberg's uncertainty principle. (06 Marks)
c. An electron is bound in one dimensional potential well of width 0.18nm. Find the energy value in eV of the second excited state. (04 Marks)

Module-2

- 3 a. What is superconductivity? Explain superconductivity on the basis of BCS theory. (06 Marks)
b. Explain the failures of classical free electron theory. (06 Marks)
c. Calculate the probability of an electron occupying an energy level 0.02 eV above the Fermi level at 400K in a material. (04 Marks)

OR

- 4 a. What is Fermi factor? Discuss the probability of occupation of various energy states by electrons at $T = 0^\circ\text{K}$ and $T > 0^\circ\text{K}$ on the basis of Fermi factor. (06 Marks)
b. What is Meissner effect? Explain the working of maglev. (06 Marks)
c. The electron mobility and hole mobility of silicon are $0.17 \text{ m}^2/\text{volt-sec}$ and $0.035 \text{ m}^2/\text{volt-sec}$ respectively at room temperature. If the carrier density is known to be $1.1 \times 10^{16}/\text{m}^3$, calculate the resistivity of silicon semiconductor material. (04 Marks)

Module-3

- 5 a. Derive the expression for energy density of radiation in terms of Einstein's coefficients. (06 Marks)
b. With neat diagrams explain the different types of optical fibers. (06 Marks)
c. A medium in thermal equilibrium at temperature 300K has two energy levels with a wavelength separation of $1 \mu\text{m}$. Find the ratio of population densities of the upper and lower levels. (04 Marks)

OR

- 6 a. What is Holography? With a neat diagram, explain the construction, reconstruction of Hologram. (06 Marks)

- b. What is numerical aperture? Obtain an expression for numerical aperture in terms of refractive indices of core and cladding. (06 Marks)
- c. The attenuation of light in an optical fiber is 3.6dB/km, what fraction of its initial intensity remains after i) 1km ii) 3km ? (04 Marks)

Module-4

- 7 a. What are Miller indices? Derive the expression for the interplanar spacing in terms of Miller indices. (06 Marks)
- b. Describe the construction and working of Bragg's X-ray spectrometer. (06 Marks)
- c. First order Bragg reflection occurs when a monochromatic beam of X-rays of wavelength 0.675\AA is incident on a crystal at a glancing angle of $4^\circ 51'$. What is the glancing angle for third order Bragg reflection to occur? (04 Marks)

OR

- 8 a. Define coordination number and atomic packing factor. Calculate the coordination number for sc, bcc and fcc structures. (07 Marks)
- b. Derive Bragg's law. (05 Marks)
- c. Draw the crystal planes (100) (200) (001) and (011) in a cubic unit cell. (04 Marks)

Module-5

- 9 a. What is Mach number? Distinguish between acoustic, ultrasonic, subsonic and supersonic waves. (05 Marks)
- b. What are nanomaterials? Explain the Sol – Gel method of synthesis of nano-materials. (07 Marks)
- c. In a scanning electron microscope, electrons are accelerated by an anode potential difference of 60kV. Estimate the wavelength of the electron in the scanning beam. (04 Marks)

OR

- 10 a. What is a shock wave? Describe the construction and working of Reddy's shock tube. (07 Marks)
- b. What is a carbon nano tube? Explain how it is synthesized using pyrolysis method. (05 Marks)
- c. Mention the principle and three applications of SEM. (04 Marks)

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15CHE12/22

First/Second Semester B.E. Degree Examination, Dec.2017/Jan.2018 Engineering Chemistry

Time: 3 hrs.

Max. Marks: 80

Note: Answer any FIVE full questions, choosing ONE full question from each module.

Module-1

- 1 a. What is an ion selective electrode? Explain the method of determining the pH of a solution using glass electrode. (06 Marks)
- b. Discuss the construction and working of Zinc – air battery. (05 Marks)
- c. What are fuel cells? How it is different from a galvanic cell? Mention any two advantages of fuel cells. (05 Marks)

OR

- 2 a. Describe the construction and working principle of glass electrode. (06 Marks)
- b. Explain the construction and working of Ni – metal hydride batteries. (06 Marks)
- c. What are concentration cells? The emf of the cell $\text{Cu} | \text{CuSO}_4 (0.01\text{M}) || \text{CuSO}_4 (\text{XM}) | \text{Cu}$ is 0.0295V at 25°C. Find the value of X. (04 Marks)

Module-2

- 3 a. Define corrosion. Explain electrochemical theory of corrosion. (06 Marks)
- b. What is Anodization? Explain anodization of aluminium. (06 Marks)
- c. Mention the difference between electroplating and electroless plating. (04 Marks)

OR

- 4 a. Write a note on polarization and over potential. (06 Marks)
- b. What is galvanization? Describe the galvanization process for iron. (05 Marks)
- c. Explain the process of electroplating of hard chromium. (05 Marks)

Module-3

- 5 a. Define calorific value. Explain how calorific value of solid fuel is determined by bomb calorimeter. (07 Marks)
- b. Explain the synthesis of petrol by Fischer – Tropsch process. (05 Marks)
- c. Write the advantages and disadvantages of PV cells. (04 Marks)

OR

- 6 a. What is knocking in IC engines? Explain its mechanism with chemical reactions. (06 Marks)
- b. Explain the modules, panels and arrays of PV cells. (06 Marks)
- c. What is reforming of petroleum? Give any three reactions involved in reformation. (04 Marks)

Module-4

- 7 a. What are conducting polymers? Discuss the conduction mechanism in polyaniline and mention any two applications. (07 Marks)
- b. What is glass transition temperature? Explain any 3 factors influencing Tg values. (05 Marks)
- c. Explain the synthesis and applications of silicon rubber. (04 Marks)

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OR

- 8 a. A polymer has the following composition 100 molecules of molecular mass 1000g/mol, 200 molecules of molecular mass 2000g/mol and 500 molecules of molecular mass 5000g/mol. Calculate the number and weight average molecular weight. (06 Marks)
- b. Explain the synthesis and applications of : i) PMMA and ii) Epoxy resin. (06 Marks)
- c. Distinguish between addition and condensation polymerization with example. (04 Marks)

Module-5

- 9 a. Define COD. Discuss the experimental determination of COD of waste water. (06 Marks)
- b. Define desalination. Explain desalination of sea water by electro dialysis process. (06 Marks)
- c. Write a note on carbon nano tubes. Mention its applications. (04 Marks)

OR

- 10 a. Discuss the boiler corrosion due to O_2 , CO_2 and $MgCl_2$ and its control. (07 Marks)
- b. Explain the synthesis of nano materials by sol-gel process. (05 Marks)
- c. Write a note on priming and foaming. (04 Marks)

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15PCD13/23

First/Second Semester B.E. Degree Examination, Dec.2017/Jan.2018

Programming in C and Data Structures

Time: 3 hrs.

Max. Marks: 80

Note: Answer any FIVE full questions, choosing one full question from each module.

Module-1

- 1 a. What is a variable? Explain the rules for constructing variables in C language. Give examples for valid and invalid variables. (06 Marks)
- b. Write C expressions corresponding to the following (Assume all quantities are of same type):
 - i) $A = \frac{-b + \sqrt{b^2 - 4ac}}{2a}$
 - ii) $B = e^{x+y-20}$
 - iii) $C = \frac{x}{b+c} + \frac{y}{b-c}$
 - iv) $D = \sqrt{2\pi n}$
 - v) $E = \sin \theta$
 - vi) $F = \sin\left(\frac{b}{\sqrt{a^2 + b^2}}\right)$ (06 Marks)
- c. Write a C program to find area of a circle. (04 Marks)

OR

- 2 a. List all the operators supported in C. Explain relational, logical and bitwise operators. (08 Marks)
- b. Write a C program to find area of a triangle, when we know the lengths of all three of its sides. (08 Marks)

Module-2

- 3 a. List all the conditional control statements used in C. Explain if...else and nested if statements with example for each. (08 Marks)
- b. Write a C program to simulate simple calculator that performs arithmetic operations using switch statement. Error message should be displayed, if any attempt is made to divide by zero. (08 Marks)

OR

- 4 a. Explain the different types of loops used in C with syntax and example for each. (08 Marks)
- b. Write a C program to find the sum of series $1 + x + x^2 + x^3 + \dots + x^n$. (08 Marks)

Module-3

- 5 a. What is an array? Explain different methods of initialization of single dimensional array. (08 Marks)
- b. Write a C program to sort the given array elements in ascending order by using bubble sort. (08 Marks)

OR

- 6 a. Write a C program to compute the factorial of a given number 'n' using recursion. (08 Marks)
- b. Explain any four string manipulation library functions with example. (08 Marks)

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.

Module-4

- 7 a. Write a C program to input the following details of 'N' students using structure:
Roll_No: integer, Name : string, Marks : float, Grade : Char
Print the names of the students with marks ≥ 70.0 . (08 Marks)
- b. Explain the following file operations along with syntax:
i) fopen() ii) fclose() iii) fscanf() iv) fprintf() (08 Marks)

OR

- 8 a. Write a C program to maintain a record of 'n' employee detail using an array of structures with three fields (id, name, salary) and print the details of employees whose salary is above Rs.10,000. (08 Marks)
- b. Explain structure within a structure with an example. (08 Marks)

Module-5

- 9 a. Define a pointer. Explain with an example, the declaration and initialization of a pointer variable. (06 Marks)
- b. Develop a C program to read two numbers and function to swap these numbers using pointers. (06 Marks)
- c. Explain the following C functions along with syntax: i) malloc() ii) calloc() (04 Marks)

OR

- 10 a. Explain stack and queue data structures along with their applications. (08 Marks)
- b. Explain any four preprocessor directives in C language with example for each. (08 Marks)

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15CIV13/23

First/Second Semester B.E. Degree Examination, Dec.2017/Jan.2018 Elements of Civil Engineering and Engineering Mechanics

Time: 3 hrs.

Max. Marks:80

Note: Answer any FIVE full questions, choosing ONE full question from each module.

Module-1

- 1 a. Name different fields of civil engineering and explain any two of them. (06 Marks)
- b. With neat sketch, explain any two types of dams. (06 Marks)
- c. Find the moment of 500N force about points A, B, C and D as shown in Fig.Q1(C). (04 Marks)

OR

- 2 a. Explain the role of civil engineer in infrastructural development of the country. (06 Marks)
- b. Explain the Nagpur road plan classification. (06 Marks)
- c. A square ABCD has forces acting along its sides as shown in Fig.Q2(c). Find the value of P and Q, if the system reduces to a couple. Also find magnitude of the couple if the side of the square is 2m. (04 Marks)

Module-2

- 3 a. State and prove parallelogram law of forces. (06 Marks)
- b. The forces acting on the system are shown in Fig.Q2(b). Determine the magnitude and direction of the resultants. (06 Marks)
- c. With neat sketches explain angle of friction, angle of repose and cone of friction. (04 Marks)

OR

- 4 a. State laws of dry friction. (04 Marks)
- b. A chord supported at A and B carries a load of 100kN at D and a load of W at C as shown in Fig.Q4(b). Find the values of W so that CD remains horizontal. Also determine tension in each chord. (06 Marks)
- c. A block weighing 4000N is resting on horizontal surface supports another block of 2000N as shown in Fig.Q4(c). Find the horizontal force F just to move the block to the left. Take co-efficient of friction for all surfaces of contact to be 0.2. (06 Marks)

Module-3

- 5 a. State and prove Varignon's principle of moments. (06 Marks)
- b. A rigid plat is subjected to the forces as shown in Fig.Q5(b). Compute magnitude direction and position of resultant force with respect to centroid point O of the plate. (06 Marks)
- c. Determine the support reactions for the beam shown in Fig.Q5(c). (04 Marks)

OR

- 6 a. With neat sketches indicating the reactions explain types of supports. (04 Marks)
 b. The forces acting on 1m length of a dam are as shown in Fig.Q6(b). Determine the magnitude, direction and position of resultant from O. (06 Marks)
 c. A uniform beam AB hinged at A, is kept horizontal by supporting and settling a 400kN with the help of a rope tied at B and passing over smooth pulley at C. The bar weights 200kN. Determine the reactions at the supports A and C as well as the tension in the string. Refer Fig.Q6(c). (06 Marks)

Module-4

- 7 a. State and prove parallel axis theorem. (05 Marks)
 b. From first principles determine the centroid of a rectangle. (05 Marks)
 c. Determine the centroid of the area shown in Fig.A7(c) with respect to the axis shown. (06 Marks)

OR

- 8 a. From first principles determine the centroid of quarter circle. (06 Marks)
 b. Determine the moment of inertia of the symmetric I section shown in Fig.Q8(b) about its centroidal x – x axis and y – y axis. Also determine polar moment of inertia. (10 Marks)

Module-5

- 9 a. Derive the expression for maximum height attained by the projectile. (05 Marks)
 b. A car starts from rest and accelerates uniformly to a speed of 75 kmph over a distance of 1000m. Find acceleration of the car and time taken to attain this speed. If a further acceleration rises the speed to 100kmph in 10sec, find the new acceleration and the further distance moved. (05 Marks)
 c. The equation of motion of particle is given by $a = 4t^3 - 3t^2 + 6$ where a : acceleration in m/sec^2 and t : time in seconds. The velocity of the particle at $t = 1$ second is 5.0 m/sec and displacement is 10m. Determine the displacement and velocity at $t = 5$ seconds. (06 Marks)

OR

- 10 a. What is super elevation? Explain the objects of providing super elevation. (04 Marks)
 b. A ball was thrown vertically upwards from the ground with the velocity of 60m/sec. After 3 seconds another ball was thrown vertically upwards from the ground. If both the balls strike the ground at the same time, determine the velocity with which the second ball was thrown. (06 Marks)
 c. A particle is projected in air with a velocity of 120m/sec at an angle of 30° with the horizontal. Determine :
 i) The horizontal range
 ii) Maximum height attained by the particle
 iii) The time of flight. (06 Marks)

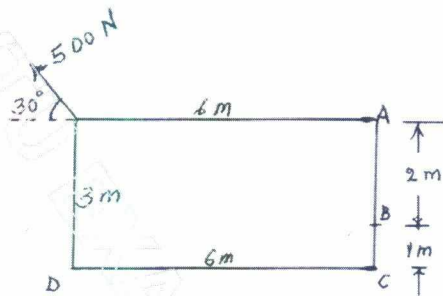


Fig.Q1(c)

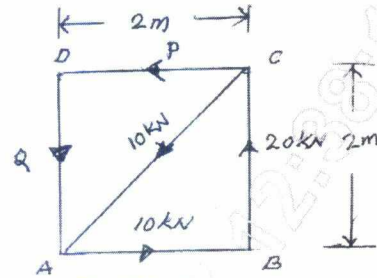


Fig.Q2(c)

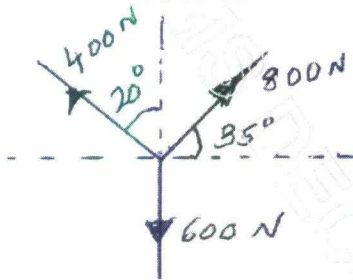


Fig.Q3(b)

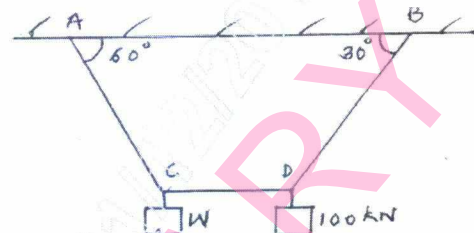


Fig.Q4(b)

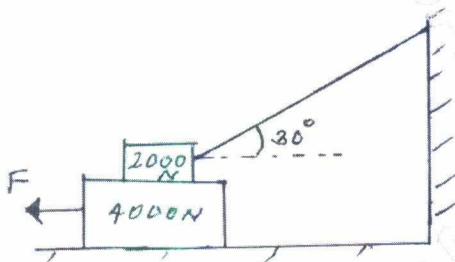


Fig.Q4(c)

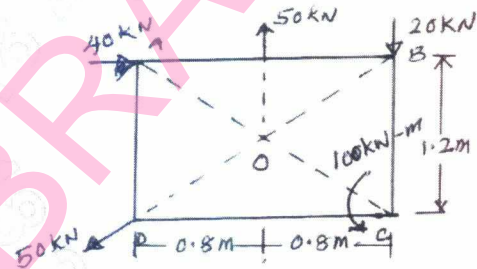


Fig.Q5(b)

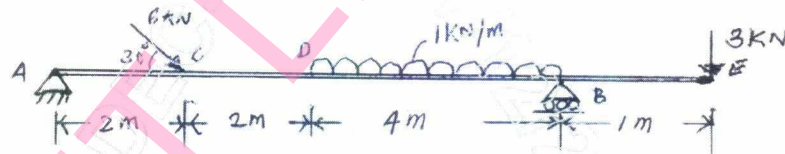


Fig.Q5(C)

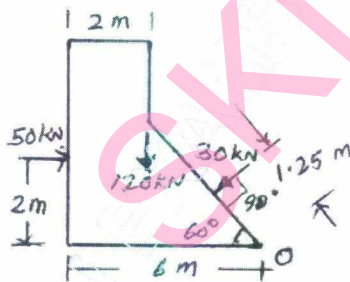


Fig.Q6(b)

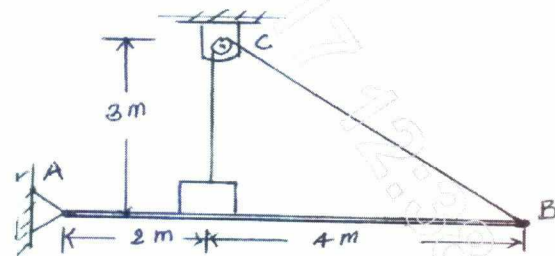


Fig.Q6(c)

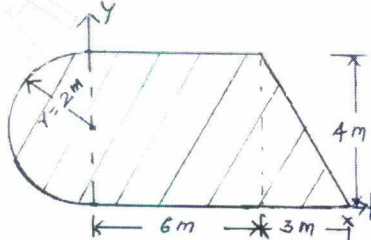


Fig.Q7(c)

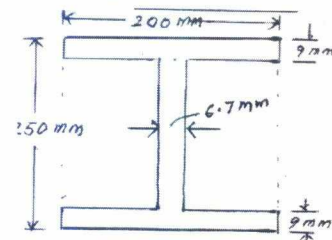


Fig.Q8(b)

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15EME14/24

First/Second Semester B.E. Degree Examination, Dec.2017/Jan.2018 Element of Mechanical Engineering

Time: 3 hrs.

Max. Marks: 80

Note: Answer any FIVE full questions, choosing one full question from each module.

Module-1

- 1 a. Differentiate between conventional and Non conventional energy sources. (04 Marks)
b. Define Higher calorific value (HCV) and lower calorific value (LCV) of a fuel. (04 Marks)
c. Explain with a neat sketch working of a wind mill. (08 Marks)

OR

- 2 a. Explain the terms:
i) Dry saturated steam
ii) Wet steam
iii) Superheated steam
iv) Degree of superheat. (04 Marks)
b. Define Boiler mountings and Boiler Accessories. (04 Marks)
c. Explain with a sketch working of Babcock and Wilcox Boiler. (08 Marks)

Module-2

- 3 a. Differentiate between working of open cycle and closed cycle Gas turbine. (04 Marks)
b. How are IC engines classified? (04 Marks)
c. Explain with a sketch working by simple impulse steam Turbine (De Laval Turbine). (08 Marks)

OR

- 4 a. Explain with a Pv diagram working of a four stroke Diesel engine. (08 Marks)
b. A fair stroke diesel engine has a piston diameter of 250mm and stroke of 400mm. Mean effective pressure is 4Bar, Speed is 500 Rpm. Diameter of the Brake drum is 1m and effective Brake load is 400N. Determine Indicated power, Brake power and Frictional power. (08 Marks)

Module-3

- 5 a. Explain with sketch following operations on Lathe
i) Knurling
ii) Thread cutting. (06 Marks)
b. Sketch and explain cylindrical co-ordinate Robot. (06 Marks)
c. With a simple Block diagram, explain the element of NC machine. (04 Marks)

OR

- 6 a. Explain with sketch the following operations a Drilling Machine
i) Counter Boring
ii) Countersinking. (06 Marks)
b. Explain with a sketch Polar configuration Robot. (06 Marks)
c. What are the objectives of Automation? (04 Marks)

Module-4

- 7 a. Explain the composites properties and Application of cast Iron (04 Marks)
 b. How are composites classified. (04 Marks)
 Explain with a sketch working of electric Arc welding. (08 Marks)

OR

- 8 a. What are the applications of composites in Automobile and Aerospace Industry? (04 Marks)
 b. Differentiate between soldering, Brazing, Welding. (04 Marks)
 c. Explain the process of
 i) Soldering
 ii) Brazing. (08 Marks)

Module-5

- 9 a. Define :
 i) Refrigeration
 ii) Air conditioning (04 Marks)
 b. List the commonly used Refrigerants. (04 Marks)
 c. Explain with a sketch working of vapour absorption Refrigerating system. (08 Marks)

OR

- 10 a. Differentiate between working of Vapour compression and vapour absorption Refrigerating system. (04 Marks)
 b. Define the terms :
 i) Refrigerant
 ii) Refrigerating effect
 iii) COP
 iv) ICE making capacity. (04 Marks)
 c. Explain with sketch working of window Air conditioner. (08 Marks)

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First/Second Semester B.E. Degree Examination, Dec.2017/Jan.2018 Basic Electrical Engineering

Time: 3 hrs.

Max. Marks: 80

Note: Answer any FIVE full questions, choosing one full question from each module.

Module-1

- 1 a. State and explain Kirchhoff's law.
b. Refer Fig Q1(b). Find I_1 , I_2 and I_3 .

(05 Marks)

(07 Marks)

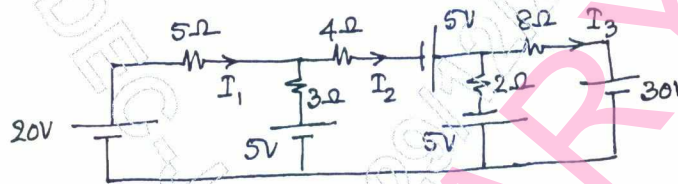


Fig. Q1(b)

- c. Coil A of 230 turns and coil B of 240 turns share a magnetic circuit of mean length 0.8m and uniform cross section area 115cm^2 . Relative permeability of the core material is 1350. Find the self inductances of the coils. Find the average emf induced in coil A when, in coil B, the current changes from 2A to 6.5A in 0.03s. Assume $k = 1.0$ between the coils.

(04 Marks)

OR

- 2 a. Define 'Self Inductance' of a coil. Derive an expression for the self inductance of a coil in terms of its geometry and material properties.
b. Refer Fig Q2(b) find I_1 , I_2 and the power in the 6Ω resistor.

(05 Marks)

(07 Marks)

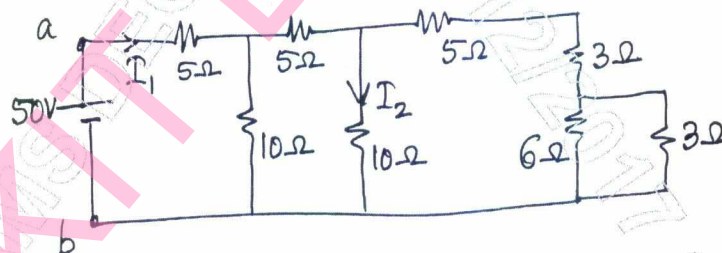


Fig. Q2(b)

- c. Coil A of 600 turns and coil B of 500 turns have $k = 0.2$. A current of 8A in coil A produces 40mWb flux in it. Find : i) Inductance of coil A with coil B open circuited ; ii) the flux linking coil B ; iii) the emf induced in coil B if the flux linking it falls to zero from its full value in 2ms ; and iv) mutual inductance between the coils.

(04 Marks)

Module-2

- 3 a. Deduce an expression for the armature torque, T_a , developed in a dc motor and hence show that $T_a \propto \phi I_a$.
b. A 100V short shunt dc generator supplies 200 lamps of 55W at 110V rating. $R_a = 0.06\Omega$; $R_{se} = 0.04\Omega$; and $R_{sh} = 25\Omega$. Sketch the circuit diagram and find the emf generated.
c. With a neat sketch, explain the working of a 1 ϕ energy meter.

(02 Marks)

(07 Marks)

(07 Marks)

(07 Marks)

(07 Marks)

OR

- 4 a. "A dc series motor should never be run on light or no load". Justify. (03 Marks)
 b. A shunt dc generator delivers 65kW at 250V and 500rpm. $R_a = 0.015\Omega$ and $R_{sh} = 85\Omega$. Find its speed when running as a motor taking 40kW from 240V supply. BCD = 1V/Brush. Sketch relevant circuit diagrams. (07 Marks)
 c. With a neat schematic, describe the construction and working of a dynamometer type wattmeter. (06 Marks)

Module-3

- 5 a. Show that a pure inductor is lossless. (03 Marks)
 b. Refer Fig. Q5 (b). Find the real power, reactive power and the apparent power supplied.

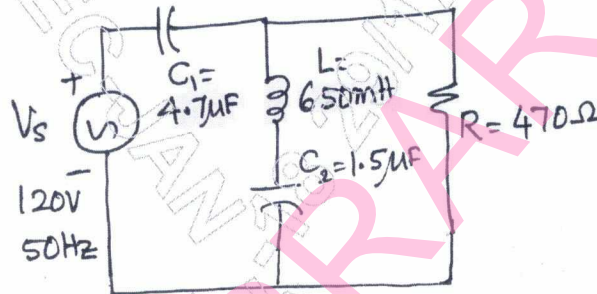


Fig. Q5(b)

(06 Marks)

- c. With a neat circuit diagram and truth table, explain the working of a 3-way control of a device. (07 Marks)

OR

- 6 a. Show that an R-C series circuit takes a leading current. Sketch a phasor diagram indicating the supply emf, the current and the two drops. (07 Marks)
 b. A resonant series circuit with $R = 5\Omega$, $L = 1\text{mH}$ and $C = 0.001\mu\text{F}$ is connected to a 100V supply. Find :
 i) the drop across L ; and
 ii) drop across C. Take the supply as the reference phasor. (05 Marks)
 c. For a fuse, define i) Rated current, ii) Fusing current ; and iii) Fusing factor. Why is the fusing factor greater than unity? (04 Marks)

Module-4

- 7 a. Sketch a 4-wire STAR supply and identify the phase and line voltages. With balanced supply taking $E_R = E_P \angle 0^\circ$, obtain the relationship between the phase and line voltages. Hence, sketch a phasor diagram indicating all phase and line voltages. (08 Marks)
 b. 2 wattmeters connected to measures 3 ϕ power of a balanced Δ load read 2.5 kW and 0.5kW. Find the load pf if i) both readings are positive; and ii) the latter reading is obtained after reversing the connections of the potential coil. (04 Marks)
 c. In a 3 ϕ alternator, why is it advantageous to have the armature on the stator and the excitation on the rotor? (04 Marks)

OR

- 8 a. With a neat circuit diagram, show how 3 ϕ power can be measured using two Wattmeters. State the NECESSARY CONDITION clearly. (07 Marks)
- b. A balanced Δ load of $(8+j6) \Omega$ /phase is connected to a 400V supply. Find i) the phase current ii) the line current. If the same impedances are connected in STAR, what is the reactive power consumed and at what pf? (04 Marks)
- c. A 4-pole, 3 ϕ alternator driven at 1800rpm has 42 slots with 4 conductors/slot. Average flux/pole is 0.36 Wb, sinusoidally distributed. $K_p = 0.956$ and $K_d = 0.952$. Find the line voltage on no-load if connected in i) Δ ; and ii) STAR. (05 Marks)

Module-5

- 9 a. Starting from expression for the efficiency of a transformer derive the condition for maximum efficiency and the expression for maximum efficiency. (05 Marks)
- b. A 135 kVA, 1 ϕ transformer has primary of 2kV, 50Hz. Primary and secondary number of turns are 162 and 48 respectively. Neglecting losses, find i) no-load secondary emf ; ii) full load primary and secondary currents; and iii) maximum core flux. (04 Marks)
- c. With a neat sketch, explain the working of a STAR - Δ starter, for a 3 ϕ induction motor. Show that the starting inrush current is reduced by 66.7%. (07 Marks)

OR

- 10 a. "A 3 ϕ induction motor can never run at N_s ". Justify. (04 Marks)
- b. A single phase transformer has a maximum efficiency of 98% at 75% load, upf. The copper loss at maximum efficiency is 314W. Find its efficiency at 50% load, 0.9 pf. (04 Marks)
- c. A 6-pole, 3 ϕ alternator running at 1200rpm feeds a 4-pole, 3 ϕ induction motor having slips of 3% at full load and 2.5% at half load. The rotor induced emf/phase at stand still is 160V. At full load and half load, find each of the following: i) the motor speed ; ii) frequency of the rotor induced emf and (iii) the rotor induced emf/phase. (08 Marks)

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CBCS Scheme

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15ELN15/25

First/Second Semester B.E. Degree Examination, Dec.2017/Jan.2018

Basic Electronics

Time: 3 hrs.

Max. Marks: 80

Note: Answer any FIVE full questions, choosing one full question from each module.

Module-1

- 1 a. Explain the V-I characteristics of p-n junction diode. (05 Marks)
- b. The input voltage applied to the primary of a 4:1 step down transformer of a full wave centre tap rectifier is 230 V, 50 Hz is the load resistance is 600 Ω and forward resistance is 20 Ω . Determine the following for circuit shown in Fig.Q1(b).
- dc power output
 - Rectification efficiency
 - PIV

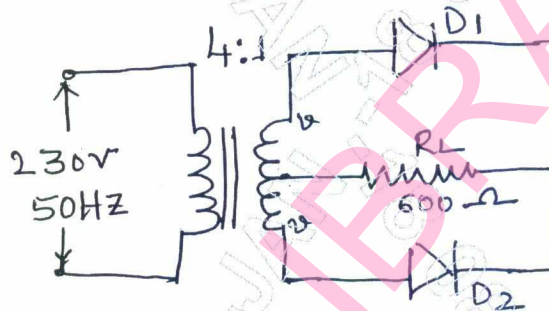


Fig.Q1(b)

- c. Explain CB configuration of BJT with characteristics. (06 Marks)

OR

- 2 a. Derive an expression for ripple factor and output dc voltage of a full wave rectifier. (06 Marks)
- b. Explain how a zener diode can be used as a voltage regulator. (05 Marks)
- c. Obtain the relationship between α and β . Calculate the value of I_C , I_E for a transistor that has $\alpha = 0.98$ and $I_B = 100 \mu A$. (05 Marks)

Module-2

- 3 a. What is DC load line? Explain collector to base biased method with necessary equation. (05 Marks)
- b. Define the following terms with respect to op-amp: (i) Slew rate, (ii) CMRR, (iii) PSRR. (05 Marks)
- c. Design an op-amp circuit that will produce an output equal to $-(4V_1 + V_2 + 0.1V_3)$. (06 Marks)

OR

- 4 a. With circuit diagram, explain the operation of voltage divider bias circuit with necessary equations. (06 Marks)
- b. Derive the expression of 3-i/p summing amplifier. (05 Marks)
- c. Draw the circuit of inverting op-amp. Derive the expression for the voltage gain. (05 Marks)

Module-3

- 5 a. Perform the following:
- Convert $(725.25)_{10} = (?)_{10} = (?)_2$
 - Subtract using 2's complement $(4 - 9)_{10}$
 - $(11010.101)_2 = (?)_8 = (?)_{16}$ (06 Marks)
- b. State and prove Demorgan's theorem. (05 Marks)
- c. Simplify the expression and realize using basic gates $\overline{A}\overline{B}\overline{C} + \overline{A}B\overline{C} + A\overline{B}\overline{C} + A\overline{B}C$. (05 Marks)

OR

- 6 a. Convert:
- $(172.625)_{10} = (?)_{16} = (?)_2$
 - $(BDCE)_{16} = (?)_2 = (?)_8$
 - $(10111101.0110)_2 = (?)_{10} = (?)_{16}$ (06 Marks)
- b. Simplify and realize the Boolean expression using two inputs NAND gates only $(A + \overline{B} + C)(\overline{A} + B + C)$. (05 Marks)
- c. Realize the full adder circuit for sum and carry using basic gates, explain the same with truth table. (05 Marks)

Module-4

- 7 a. Explain the operation of NAND and NOR latch with symbol, circuit and truth table. (08 Marks)
- b. With neat block diagram, describe the architecture of 8051 microcontroller. (08 Marks)

OR

- 8 a. What is flip-flop? Explain clocked R-S flip-flop with diagram and truth table. (08 Marks)
- b. Explain the working principle of microcontroller based stepper motor control system. (08 Marks)

Module-5

- 9 a. What are the basic elements of communication system? Explain with neat block diagram. (06 Marks)
- b. Distinguish between Amplitude Modulation (AM) and Frequency Modulation (FM). (04 Marks)
- c. Explain the construction and the principle of operation of LVDT. (06 Marks)

OR

- 10 a. With relevant waveforms, explain amplitude modulation. (06 Marks)
- b. What is a transducer? Mention four important parameters of an electrical transducer. (04 Marks)
- c. Write short notes on:
- Piezo electric transducer
 - Photo electric transducer. (06 Marks)

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CBCS Scheme

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First/Second Semester B.E Degree Examination, Dec.2017/Jan.2018 Environmental Studies

(COMMON TO ALL BRANCHES)

Time: 2 hrs.]

[Max. Marks: 40

INSTRUCTIONS TO THE CANDIDATES

1. Answer all the forty questions, each question carries **ONE** mark.
2. Use only **Black ball point pen** for writing / darkening the circles.
3. For each question, after selecting your answer, **darken** the appropriate circle corresponding to the same question number on the OMR sheet.
4. Darkening two circles for the same question makes the answer invalid.
5. **Damaging/overwriting, using whiteners** on the **OMR** sheets are strictly prohibited.

1. The objective of environmental education is
 - a) Raise consciousness about environmental conditions
 - b) To teach environmentally appropriate behaviour
 - c) Create an environmental ethic
 - d) All of the above.
2. Which of the following is a biotic component of an ecosystem?
 - a) Fungi
 - b) Solar light
 - c) Temperature
 - d) humidity.
3. In complex ecosystems the degree of species diversity is
 - a) Poor
 - b) High
 - c) Medium
 - d) None.
4. Which of the following statement is false
 - a) Inorganic nutrients are recycled in an ecosystem
 - b) Energy "flows" through the ecosystem in the form of carbon-carbon bonds
 - c) Energy is recycled in an ecosystem
 - d) Respiration process releases energy.
5. In an ecosystem biological cycling of materials is maintained by
 - a) Procedure
 - b) Consumer
 - c) Decomposer
 - d) All of the above.

6. A predator is
 - a) An animal that is fed upon
 - b) An animal that feeds upon another animal
 - c) Animal that feeds upon both plants and animals
 - d) A primary consumer.
7. Ozone concentration is relatively more in
 - a) Mesosphere
 - b) Stratosphere
 - c) Staticsphere
 - d) Atmosphere.
8. World environmental day is on
 - a) 5th May
 - b) 5th June
 - c) 15th June
 - d) 15th May.
9. EIA can be expanded as
 - a) Environment of Industrial Act
 - b) Environment Important Act
 - c) Environment Impact Assessment
 - d) Economic Industrial Act.
10. Major purpose of most of the dams are
 - a) Power generation
 - b) Drinking
 - c) Flood control
 - d) Irrigation.
11. Eutrophication is related to
 - a) Water
 - b) Soil
 - c) Air
 - d) Land.
12. Water logging is effect of modern
 - a) Industries
 - b) Agriculture
 - c) Population
 - d) Education.
13. Bioremediation means removal of contaminates by
 - a) Mining
 - b) Super bugs
 - c) Air
 - d) Water.
14. Nitrate contamination causes
 - a) White baby syndrom
 - b) Blue baby syndrom
 - c) Green baby syndrom
 - d) Black baby syndrom
15. Out of the following nutrients in fertilizers which one causes minimum water pollution
 - a) Nitrogen
 - b) Phosphorous
 - c) Potassium
 - d) Organic matter.
16. Fluorosis is caused due to
 - a) Chlorine
 - b) Fluoride
 - c) Feldspar
 - d) Farming.
17. Hepatitis is caused by
 - a) Hepata worm
 - b) Virus
 - c) Amoeba
 - d) Fungus.
18. Chernobyl disaster occurred in the year
 - a) 1986
 - b) 2006
 - c) 2011
 - d) 1947.

19. Fukushima disaster is a
 - a) Heavy metal disaster
 - b) Nuclear disaster
 - c) Atom bomb disaster
 - d) Pesticide disaster.
20. A country without a single nuclear power plant is
 - a) China
 - b) USA
 - c) Australia
 - d) France.
21. Which of the following is more ecofriendly source of producing energy
 - a) Biogas
 - b) Coal
 - c) Fuel cells
 - d) Hydel
22. Electromagnetic radiation can cause
 - a) Plague
 - b) Dengue
 - c) Cancer
 - d) Malaria.
23. Wind farms are located in
 - a) River basin
 - b) Plain areas
 - c) Hilly areas
 - d) Forest areas.
24. Natural gas contains
 - a) Methane
 - b) Oxygen
 - c) Nitrogen
 - d) Sulphur.
25. The source of electromagnetic radiation is
 - a) Magnetics
 - b) Electrons
 - c) Sun
 - d) Earth.
26. Which of the following sources is surface water
 - a) Springs
 - b) Streams
 - c) Wells
 - d) all.
27. Which of the following is an air pollutant
 - a) CO
 - b) O₂
 - c) N₂
 - d) all.
28. Smog in London was due to
 - a) SO₂ and NO₂
 - b) CO₂ and CO
 - c) Methane and ethane
 - d) Water and air.
29. Which of the following are Non-biodegradable
 - a) Plastics
 - b) Domestic sewage
 - c) Detergent
 - d) a and c
30. Endosulfan is a
 - a) Organization
 - b) Institution
 - c) Pesticide
 - d) River
31. Minamata disease is caused due to
 - a) Lead
 - b) Copper
 - c) Mercury
 - d) Arsenic.
32. World's single largest class of refugees is due to
 - a) War
 - b) Earthquake
 - c) Tsunami
 - d) Environmental degradation.

33. Noise pollution limits at airport area
a) 65dB b) 120dB c) 240dB d) 600dB.
34. Blaring sounds are known to cause
a) Metal distress b) Deafness
c) Neurological problems d) All the above.
35. Increase in asthma attacks has been linked to high levels of
a) Soil borne pesticides b) Air borne dust pesticides
c) CO₂ d) Green house gases.
36. Population explosion will cause
a) Biodiversity b) Stress on the ecosystem
c) Better communication d) Energy storage.
37. The Protocol that reduces green house gas emissions are
a) Kyoto protocol b) Cartagena protocol
c) Montreal Protocol d) Delhi protocol.
38. Global warming could affect
a) Climate b) Increase in sea level c) Melting of glaciers d) All of the above.
39. Primary cause of acid rain around the world is due to
a) CO₂ b) CO c) SO₂ d) O₃.
40. Reduction in brightness and the famous Taj Mahal is due to
a) Global warming b) Green house gases
c) Ozone deflection d) Air pollution.

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First/Second Semester B.E Degree Examination, Dec.2017/Jan.2018

Constitution of India, Professional Ethics & Human Rights

(COMMON TO ALL BRANCHES)

Time: 2 hrs.]

[Max. Marks: 40

INSTRUCTIONS TO THE CANDIDATES

1. Answer all the forty questions, each question carries one mark.
2. Use only **Black ball point pen** for writing / darkening the circles.
3. **For each question, after selecting your answer, darken the appropriate circle corresponding to the same question number on the OMR sheet.**
4. Darkening two circles for the same question makes the answer invalid.
5. **Damaging/overwriting, using whiteners on the OMR sheets are strictly prohibited.**

-
1. The Governor of the state is
a) Directly elected by the people
b) Elected by the state legislature
c) Appointed by the president
d) Nominated by the parliament
 2. The ordinances issued by the state governor are subject to approval by
a) The president of India
b) Chief minister of the state
c) Union parliament
d) State legislature concerned
 3. High court judges retire at the age of
a) 65 years
b) 63 years
c) 60 years
d) 62 years
 4. The executive of the state government comprises of
a) President, governor and chief minister
b) Governor and chief minister
c) Governor and council of ministers
d) Chief minister and council of ministers
 5. When a state assembly is dissolved, the law making power for the state concerned rests with the
a) State governor
b) Union parliament
c) President of India
d) Chief justice of India
 6. The total members in the legislature council should not be less than,
a) 250
b) 80
c) 20
d) 40

7. The number of council of ministers including the chief minister shall not exceed the total number of MLAs
 a) 25% b) 30% c) 15% d) 20%
8. To become a judge of the high court one must be a practicing advocate of high court for at least
 a) 10 years b) 20 years c) 15 years d) 5 years
9. Judicial activism is
 a) For curtailment of the power of the government
 b) For the protection of the rights of the citizens
 c) For the curtailment of the active organization
 d) For the follow up of the court directions
10. Practices derogatory to the status of women is renounced under
 a) Article 51(A)(e) b) Article 32(c)
 c) Article 51 d) None of these
11. Proclamation of national emergency must be approved within
 a) 2 months b) 1 month c) 6 months d) 1 year
12. State emergency is also called as
 a) President's rule b) Prime minister's rule
 c) Governor's rule d) Chief justice's rule
13. The removal of chief election, commissioner may be on the grounds similar to that of
 a) Judge of a high court b) Judge of a supreme court
 c) Attorney general of India d) Governor of a state
14. Procedure to amend the constitution is contained in
 a) Article 268 b) Article 368
 c) Article 338 d) Article 238
15. Article 21(A) was a gift of
 a) 81st Amendment Act b) 82nd Amendment Act
 c) 86th Amendment Act d) 89th Amendment Act
16. The date of adaption and enactment of Indian constitution is
 a) 26 – 11 – 1949 b) 26 – 12 – 1949
 c) 26 – 1 – 1950 d) 26 – 1 – 1949
17. The source of authority of the Indian constitution is
 a) The government of India b) The people of India
 c) The president d) The parliament
18. The state whose executive head is elected representative is called
 a) The Dictatorship b) The Monarchy
 c) The Anarchy d) The Republic
19. Part – III of the constitution guarantees how many categories of fundamental rights
 a) Five b) Six c) Seven d) Eight

20. Right to property is a
 a) Ordinary right
 c) Moral right
 b) Fundamental right
 d) Birth right
21. The constitution guarantees fundamental rights to
 a) Citizens
 c) Both citizens and Non – citizen
 b) Non – citizens
 d) None of these
22. Ex – post-facto-law means
 a) Law imposing penalties from previous date
 b) Law imposing penalties from future date
 c) Civil law
 d) Criminal law
23. An arrested person has how many number of rights under Article – 22
 a) Six
 b) Seven
 c) Four
 d) Five
24. There can be prohibition of religious instructions in which category of educational institution
 a) Unaided
 c) Minority
 b) State aided
 d) Independent
25. Minorities under Article – 30 are based on
 a) Religion only
 b) Language only
 c) None these
 d) Religion or language
26. Is it possible to separate professional ethics from personal ethics?
 a) No
 c) Possible to some extent
 b) Yes
 d) None of these
27. The universal declaration of human rights was done in the year
 a) 1993
 b) 1947
 c) 1948
 d) 1950
28. In Good works views focus is given on
 a) The concept of responsibility beyond the legal and moral duty
 b) The concept of skillful work
 c) The concept of legal work
 d) The concept of logical work
29. Honesty is
 a) Perfectness
 c) Truthfulness
 b) Readiness
 d) Surrendering to God
30. Trade secrete does not include
 a) Formulas
 c) Patterns
 b) Colours
 d) Devices
31. Patent right is for
 a) 10 years
 b) 40 years
 c) 50 years
 d) 20 years

32. Risk in engineering means
 a) The potential that something unwanted may occur
 b) Taking risk to venture out something
 c) Without taking risk nothing can be achieved
 d) An inadvertent oversight
33. Liability means
 a) Compensation is not obligatory
 b) When a customer buys a service or product liability ceases
 c) When an act harms others it must be compensated
 d) None of these
34. It is not a kind of trade mark
 a) Good will b) Symbols c) Sounds d) Designs
35. Formula of a soft drink is an example of
 a) Patent b) Copy right c) Trade mark d) Trade secret
36. For an ethical engineer responsibility is
 a) Moral responsibility
 b) Both legal and moral responsibility
 c) Legal responsibility
 d) Social responsibility
37. One of the views on the responsibility of engineer is
 a) They are strictly liable
 b) They should do good works
 c) They are absolutely reliable
 d) They should take reasonable responsibility
38. This is not the impediment to responsibility
 a) Self respect b) Ignorance
 c) Self deception d) Fear
39. The recent fundamental duty added by 86th amendment in 2002 is,
 a) Duty to safe guard public property
 b) Duty of parent or guardian to provide education to his child
 c) Duty to protect and improve the natural environment
 d) Duty to abide by the constitution
40. How many parts does the parliament consists of? What are those?
 a) Two – Lok Sabha and Rajya Sabha
 b) Four – Lok Sabha, Rajya Sabha, speaker and President
 c) Two – President and Vice – president
 d) Three – Lok Sabha, Rajya Sabha and President

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CBCS Scheme

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15MAT21

Second Semester B.E. Degree Examination, Dec.2017/Jan.2018

Engineering Mathematics – II

Time: 3 hrs.

Max. Marks: 80

Note: Answer any FIVE full questions, choosing
ONE full question from each module.

Module-1

- 1 a. Solve $\frac{d^3y}{dx^3} - \frac{d^2y}{dx^2} + \frac{4dy}{dx} - 4y = \sinh(2x+3)$ by inverse differential operator method. (05 Marks)
- b. Solve $\frac{d^2y}{dx^2} - \frac{3dy}{dx} + 2y = xe^{3x} + \sin 2x$ by inverse differential operator method. (05 Marks)
- c. Solve $\frac{d^2y}{dx^2} + 4y = \tan 2x$ by the method of variation of parameters. (06 Marks)

OR

- 2 a. Solve $y'' - 2y' + y = x \cos x$ by inverse differential operator method. (05 Marks)
- b. Solve $\frac{d^2y}{dx^2} + 4y = x^2 + 2^{-x} + \log 2$ by inverse differential operator method. (05 Marks)
- c. Solve $\frac{d^2y}{dx^2} + \frac{2dy}{dx} + 4y = 2x^2 + 3e^{-x}$ by the method of undetermined coefficients. (06 Marks)

Module-2

- 3 a. Solve $x^3 \frac{d^3y}{dx^3} + 3x^2 \frac{d^2y}{dx^2} + x \frac{dy}{dx} + y = x + \log x$. (05 Marks)
- b. Solve $y - 2px = \tan^{-1}(x p^2)$. (05 Marks)
- c. Solve $xy \left(\frac{dy}{dx} \right)^2 - (x^2 + y^2) \frac{dy}{dx} + xy = 0$. (06 Marks)

OR

- 4 a. Solve $(2x+5)^2 y'' - 6(2x+5)y' + 8y = 6x$. (05 Marks)
- b. Solve $y = 2px + y^2 p^3$. (05 Marks)
- c. Solve the equation : $(px - y)(py + x) = a^2 p$ by reducing into Clairaut's form, taking the substitution $X = x^2$, $Y = y^2$. (06 Marks)

Module-3

- 5 a. Obtain the partial differential equation by eliminating the arbitrary function given $z = yf(x) + x\phi(y)$. (05 Marks)
- b. Solve $\frac{\partial^2 z}{\partial x^2} = xy$ subject to the conditions $\frac{\partial z}{\partial x} = \log(1+y)$ when $x = 1$, and $z = 0$ when $x = 0$. (05 Marks)
- c. Derive one dimensional heat equation in the form $\frac{\partial u}{\partial t} = c^2 \frac{\partial^2 u}{\partial x^2}$. (06 Marks)

OR

- 6 a. Obtain the partial differential equation given $f\left(\frac{xy}{z}, z\right) = 0$. (05 Marks)
- b. Solve $\frac{\partial^2 z}{\partial x^2} + 3\frac{\partial z}{\partial x} - 4z = 0$ subject to the conditions that $z = 1$ and $\frac{\partial z}{\partial x} = y$ when $x = 0$. (05 Marks)
- c. Obtain the solution of one dimensional wave equation $\frac{\partial^2 u}{\partial t^2} = c^2 \frac{\partial^2 u}{\partial x^2}$ by the method of separation of variables for the positive constant. (06 Marks)

Module-4

- 7 a. Evaluate $I = \int_0^a \int_0^{\sqrt{a^2-x^2}} \int_0^{\sqrt{a^2-x^2-y^2}} xyz \, dz \, dy \, dx$. (05 Marks)
- b. Find the area of the ellipse $\frac{x^2}{a^2} + \frac{y^2}{b^2} = 1$ by double integration. (05 Marks)
- c. Derive the relation between beta and gamma function as $\beta(m, n) = \frac{\Gamma(m)\Gamma(n)}{\Gamma(m+n)}$. (06 Marks)

OR

- 8 a. Evaluate $\int_0^a \int_0^{\frac{a}{x}} \frac{x \, dx \, dy}{x^2 + y^2}$ by changing the order of integration. (05 Marks)
- b. Evaluate $\int_0^a \int_0^{\sqrt{a^2-y^2}} y\sqrt{x^2+y^2} \, dx \, dy$ by changing into polar co-ordinates. (05 Marks)
- c. Evaluate $\int_0^{\frac{\pi}{2}} \frac{d\theta}{\sqrt{\sin \theta}} \times \int_0^{\frac{\pi}{2}} \sqrt{\sin \theta} \, d\theta$ by using Beta-Gamma functions. (06 Marks)

Module-5

- 9 a. Find the Laplace transform of $te^{2t} + \frac{\cos 2t - \cos 3t}{t} + t \sin t$. (05 Marks)
- b. Express the function $f(t) = \begin{cases} \pi - t, & 0 < t \leq \pi \\ \sin t, & t > \pi \end{cases}$ in terms of unit step function and hence find its Laplace transform. (05 Marks)
- c. Solve $y'' + 6y' + 9y = 12t^2e^{-3t}$ subject to the conditions, $y(0) = 0 = y'(0)$ by using Laplace transform. (06 Marks)

OR

- 10 a. Find the inverse Laplace form of $\frac{7s+4}{4s^2+4s+9}$. (05 Marks)
- b. Find the Laplace transform of the full wave rectifier $f(t) = E \sin \omega t$, $0 < t < \pi/\omega$ having period π/ω . (05 Marks)
- c. Obtain the inverse Laplace transform of the function $\frac{1}{(s-1)(s^2+1)}$ by using convolution theorem. (06 Marks)
