

E-936

B. E. IIInd Semester Examination, May – 2019
ELEMENTS OF MECHANICAL ENGINEERING (All Branches)
(Main Exam)

Time : Three Hours]

[Maximum Marks : 60]

Note : Attempt *all* questions from *Section – A*, *four* questions from *Section – B* and *three* questions from *Section – C*.

SECTION – A

[Marks : $1 \times 10 = 10$]

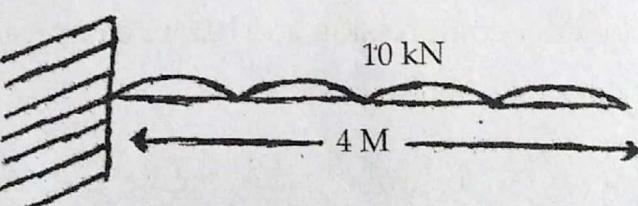
1. The moment of inertia of a square of side a about its diagonal is :

 - (a) $a^2 / 8$
 - (b) $a^3 / 12$
 - (c) $a^4 / 12$
 - (d) $a^4 / 16$

2. At the point of Contraflexure, the value of bending moment is

 - (a) Constant
 - (b) Maximum
 - (c) Changes its sign
 - (d) Minimum

3. Determine the bending moment at fixed end :



(a) 40 kNm

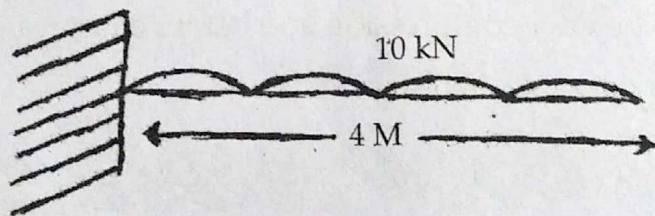
(b) 50 kNm

(c) 60 kNm

(d) 80 kNm

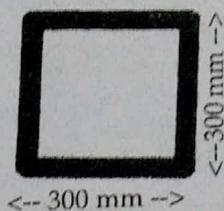
4. The state of an ideal gas is changed isothermally in a process, what is the change in the internal energy of the gas during this process ?

 - (a) $\Delta U = W$
 - (b) $\Delta U = Q$
 - (c) $\Delta U > 0$
 - (d) $\Delta U = 0$



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5. Find the modulus of section of square beam of size 300×300 mm.



- (a) $4.8 \times 10^6 \text{ mm}^3$
- (b) $4.5 \times 10^6 \text{ mm}^3$
- (c) $5.6 \times 10^6 \text{ mm}^3$
- (d) $4.2 \times 10^6 \text{ mm}^3$

6. A number of forces acting at a point will be in equilibrium if :

- (a) Their total sum is zero
- (b) Two resolved parts in two directions at right angles are equal
- (c) Sum of resolved parts in any two perpendicular directions both are zero
- (d) All of them are inclined equally

7. The coefficient of friction depends upon :

- (a) Nature of surfaces
- (b) Area of contact
- (c) Shape of the surfaces
- (d) All of the above

8. Compression ratio of I. C. engines is

- (a) The ratio of volumes of air in cylinder before compression stroke and after compression stroke
- (b) Volume displaced by piston per stroke and clearance volume in cylinder
- (c) Ratio of pressure after compression and before compression
- (d) Swept volume/cylinder volume

9. The thermal efficiency of two-stroke cycle engine is a four-stroke cycle engine.

- (a) Equal to
- (b) Less than
- (c) Greater than
- (d) None of the above

10. A container with rigid walls filled with a sample of ideal gas. The absolute temperature of the gas is doubled. What happens to the pressure of the gas ?

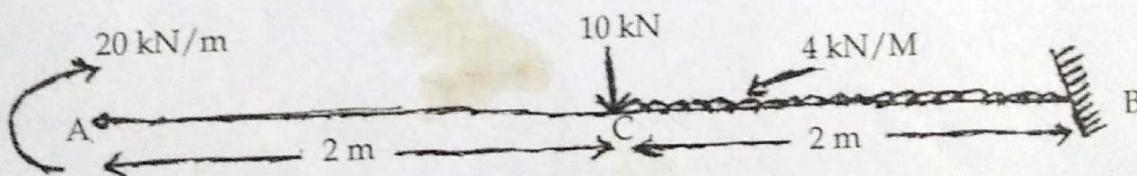
- (a) Doubles
- (b) Quadruples
- (c) Triples
- (d) Decreased to one-half

SECTION - B[Marks : $5 \times 4 = 20$]

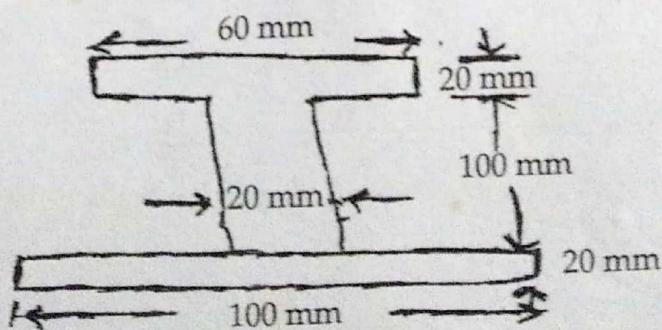
- Give the Statement and drive the expression for Varignon's theorem with help of suitable example.
- Comparison between two stroke and four-stroke petrol engine and give reason why we prefer four stroke engine in place of two stroke engine.
- Drive the expression of Moment of inertia of a rectangular section.
- Define the term thermodynamic equilibrium, thermodynamic properties and Concept of continuum.
- A body of weight 500 N is lying on a rough plane inclined at an angle of 25° with the horizontal. It is supported by an effort (P) parallel to the incline plane as shown in Fig. Determine the minimum and maximum values of P, for which the equilibrium can exist, if the angle of friction is 20° .



- Draw the shear force and bending moment diagrams of a cantilever beam as shown in figure.

**SECTION - C**[Marks : $10 \times 3 = 30$]

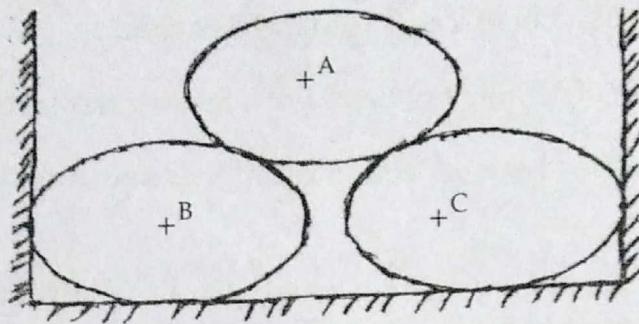
- An I-section is made up of three rectangles as shown in Figure. Find the moment of inertia of the section about the horizontal axis passing through the centre of gravity of the section.



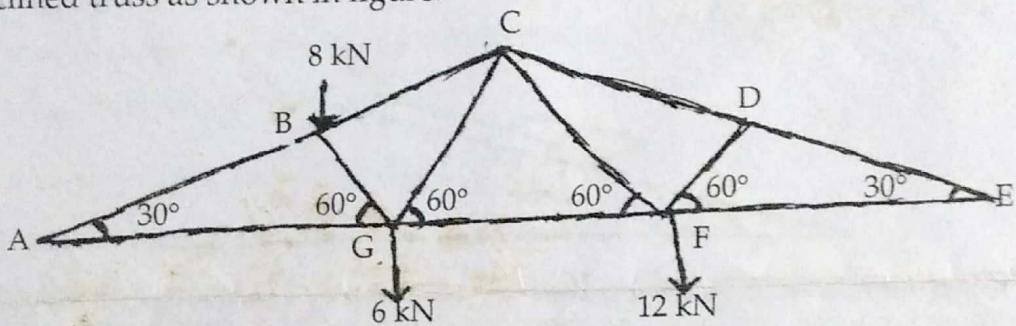
(3)

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2. Three cylinders weighting 100 N each and of 80 mm diameter are placed in a channel of 180 mm width as shown in Fig. Determine the pressure exerted by (i) the cylinder A on B at the point of contact (ii) the cylinder B on the base and (iii) the cylinder B on the wall.



3. An inclined truss as shown in figure.



Determine the nature and magnitude of the forces in the members BC, GC and GF of the truss.

4. A fluid system, contained in a piston and cylinder machine, passes through a complete cycle of four processes. The sum of all heat transferred during a cycle is - 340 kJ. The system completes 200 cycles/min. Complete the following table showing the method for each item, and compute the net rate of work output in kW.

Process	Q (kJ/min)	W (kJ/min)	ΔE (kJ/min)
1-2	0	4340
2-3	42000	0
3-4	-4200	-73200
4-1

5. Explain the working of four-stroke C. I. engine with help of neet scratch and compare it with the four-stroke S.I. Engine.

E-935**B. E. IInd Semester Examination, May – 2019****CHEMISTRY**

Branch : CSE, ECE & EE

(Main Exam)

(New Course)

[Maximum Marks : 60]

Time : Three Hours]

Note : Attempt all questions from Section – A, four questions from Section – B and three questions from Section – C.

SECTION – A $1 \times 10 = 10$ **1. Fill the blanks :**

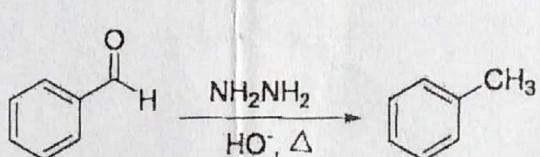
- (a) In zeolite process, calcium and magnesium ions are replaced by ions.
- (b) Bakelite is plastic.
- (c) The equivalent conductance with dilution.
- (d) Lithium ion cell is an example of cell.
- (e) Larger the potential difference between two metal, is the extent of corrosion.
- (f) Degree of freedom is zero at triple point is called as
- (g) The covalent bond between carbon and metal form compounds
- (h) According to crystal field theory, the bond between metal and ligand is
- (i) In tetrahedral complexes, orbital have lesser energy than t_2 in excited state.
- (j) UV -visible spectroscopy is also called as

SECTION – B**2. Which will occur at larger wave number in FT-IR spectra :**

5

- (a) the C–O stretch of phenol or C–O stretch of cyclohexanol ?
- (b) the C=O stretch of a ketone or the C=O stretch of an amide ?
- (c) the C–N stretch of cyclohexylamine or C–N stretch of aniline ?

P. T. O.

- (d) the C-H stretch or a C-H bend ?
 (e) the stretch or the bend of C-O bond in ethanol ?
3. (a) A solution of a compound in ethanol shows an absorbance of 0.52 at 236 nm in a cell with a 1-cm light path. Its molar absorptivity in ethanol at that wavelength is $12,600 \text{ M}^{-1}\text{cm}^{-1}$. What is the concentration of the compound ? 2
 (b) How could you use IR spectroscopy to determine whether the following reaction had occurred ? 3
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4. (a) Calculate the magnetic field (in tesla) required to flip an ^1H nucleus in an NMR spectrometer that operates at 360 MHz. 2
 (b) Why TMS is used as reference in NMR spectroscopy? Where would you expect to find the ^1H NMR signal of $(\text{CH}_3)_2\text{Mg}$ relative to the TMS signal ? 3
5. (a) 250 ml of a water sample on EDTA titration with Eriochrome Black-T consumed 13 ml of 0.022 EDTA till end point is reached. Calculated the hardness of water. 3
 (b) Explain the term reverse osmosis. How can it be used to obtain fresh water from sea water ? 2
6. (a) In a polymer sample, 30% molecules have a molecular mass 20,000, 40% have molecular mass 30,000 and rest have 60,000. Calculate mass average and number average molecular mass. 3
 (b) What do you understand by degradation of a polymer? What are the factors responsible for polymer degradation ? 2
7. (a) Define the term Auxochrome and Chromophore with suitable examples. 3
 (b) Iron corrodes faster than aluminum, even though iron is placed below aluminum in the electrochemical series, why ? 2

SECTION – C

8. (a) Identify each of the following compounds from the ^1H NMR data and molecular formula. The number of hydrogen responsible for each signal is shown in parentheses. $2 + 2 + 2 = 6$
- (i) $\text{C}_4\text{H}_8\text{Br}_2$ 1.97 ppm (6) singlet, 3.89 ppm (2) singlet
 (ii) $\text{C}_8\text{H}_9\text{Br}$ 2.01 ppm (3) doublet, 5.14 ppm (1) quartet, 7.35 (54) broad singlet

- (iii) $C_5H_{10}O_2$ 1.15 ppm (3) triplet 1.25 ppm (3) triplet, 2.33 ppm (2) quartet, 4.13 ppm (2) quartet
- (b) Describe chemical shift. How do we measure chemical shift value in NMR Spectroscopy ? 4
9. (a) A conductance cell filled with O.OIN solution of an electrolyte offered a resistance of 280 ohms. If the electrodes of the cell are 1.82 cm apart and have an area of cross-section equal to 4.64 sq.cm, calculate (i) specific conductance and (ii) equivalent conductance of the solution. 5
- (b) Define corrosion. How can you control corrosion by modifying the environment or modifying the properties of the metal ? 5
10. (a) What is a phase diagram ? Explain the phase diagram of the water system and discuss the impotence of triple point. 5
- (b) What is hydrodynamic lubrication? Explain the phenomenon with the help of a suitable diagram. 5
11. (a) Explain the band theory. On the basis of this theory explain the conductivity in metal. Explain why the conductivity of semiconductors increases with rise in the temperature. 5
- (b) Discuss the number of possible molecular vibrations in H_2O and CO_2 . Where these vibrations occur in FT-IR spectrum ? 5
12. (a) Draw the shapes of various d -orbitals, explain why they are split into two groups t_{2g} and eg in an octahedral ligand field. 2
- (b) Why $[Ti(H_2O)_6]^{3+}$ is colored whereas $[Sc(H_2O)_6]^{3+}$ is colorless ? 2
- (c) Why $[Ni(CN)_4]^{2-}$ is diamagnetic whereas $[NiCl_4]^{2-}$ is paramagnetic ? 2
- (d) What is crystal field stabilization energy (CFSE) ? Explain which one of the following have higher CFSE value and why ? 4
- (i) $[Co^{II}(NH_3)_6]^{2+}$ Vs. $[Co^{III}(NH_3)_6]^{3+}$
- (ii) $[Co^{II}(NH_3)_4]^{2+}$ Vs. $[Co^{II}(NH_3)_6]^{2+}$
- (iii) $[Rh^{III}(NH_3)_6]^{3+}$ Vs. $[Co^{III}(NH_3)_6]^{3+}$
- (iv) $[Cr^{III}(CN)_6]^{3+}$ Vs. $[Cr^{III}(F)_6]^{3+}$

E-933**B. E. II Semester Examination, May 2019****FUNDAMENTAL OF ELECTRICAL ENGINEERING**

Branch : CSE, ECE & EE

(Main Exam)

(New Course)

Time : Three Hours]{ Maximum Marks : 60 }

Note : Attempt all questions from Section-A, Four questions from Section-B and Three questions from Section-C.

SECTION - A[Marks : $1 \times 10 = 10$]

1. If P is the power of a star connected system then what will be power of an equivalent delta connected system ?

(a) P	(b) $3P$
(c) $P/3$	(d) None of the above

2. Which of the followings is/are active element ?

(a) Voltage source	(b) Current source
(c) Both	(d) None of these

3. Power dissipation in ideal inductor is :

(a) Maximum	(b) Minimum
(c) Zero	(d) A finite value

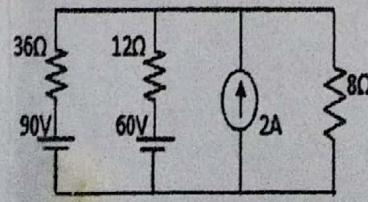
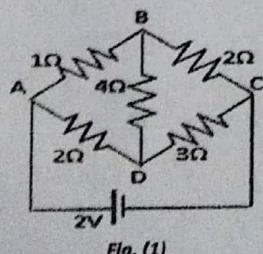
4. What is the reactive power in AC operation ?

(a) Real power $\times \sin \theta$	(b) Apparent power $\times \sin \theta$
(c) Real power $\times \cos \theta$	(d) Apparent power $\times \cos \theta$

5. The short circuit test on a transformer is conducted to obtain :
- (a) copper losses
 - (b) eddy current loss
 - (c) core losses only
 - (d) hysteresis loss
6. In which of the circuit power factor can be zero ?
- (a) capacitive
 - (b) inductive
 - (c) both (a) and (b)
 - (d) resistive
7. Permeability in magnetic circuits corresponds to in electric circuit.
- (a) resistance
 - (b) Conductivity
 - (c) Resistivity
 - (d) conductance
8. At stand still condition of induction motor, the value of slip is :
- (a) 0
 - (b) Infinity
 - (c) one
 - (d) None of the above
9. Thin laminations are used in a transformer in order to reduce :
- (a) Eddy current losses
 - (b) Hysteresis losses
 - (c) Both (a) and (b)
 - (d) Copper losses
10. Autotransformer makes effective saving on copper and copper losses, when its transformation ratio is :
- (a) very low
 - (b) less than one
 - (c) greater than one
 - (d) approx to one

SECTION - B[Marks : $5 \times 4 = 20$]

1. Find current through 4Ω resistance of the bridge shown in Fig.(1).
2. In the circuit shown in Fig.(2) Calculate the current through 8Ω resistor using Superposition theorem.



3. An ac voltage $e(t) = 141.4 \sin 120t$ is applied to a series R-C circuit. The current through the circuit is obtained as $i(t) = 14.14 \sin 120t + 7.07 \cos(120t + 300)$. Determine the value of the resistance and capacitance.
4. What is necessity and advantages of three-phase system ? Derive $V_L = \sqrt{3} V_p$ for star connected system.
5. Explain the torque-slip characteristics of three phase induction motor.
6. What is the need of ELCB ? Explain the construction and working of ELCB :

SECTION – C[Marks : $10 \times 3 = 30$]

1. (a) Explain the magnetic leakage and its effect on a transformer. Derive emf equation for a single phase transformer.
 (b) A metal filament lamp rated at 80 W, 120 V is to be connected in series with an inductor across 220 V, 50 Hz ac supply. Calculate the value of inductance required. Draw the phasor diagram.
2. (a) What are the advantages of three phase system over single phase system ? Prove that the sum of three phase voltages at an instant is always zero.
 (b) A 3-phase, slip ring, 4-pole induction motor has rotor frequency 2.0 Hz while connected to 400 V, 3-phase, 50 Hz ac supply. Determine slip and rotor speed.
3. (a) Why single phase induction motors are not self starting ? Enlist various methods of starting of single phase induction motor. Explain any one of them with neat diagram.
 (b) What is earthing ? What is its need in electrical systems ? Enlist various types of earthing systems.
4. (a) What is MCB ? Explain working of MCB. Also discuss advantages of MCB over fuses.

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- (b) An alkaline cell is discharged at a steady current of 4 A for 12 hours, the average terminal voltage being 1.2 V. To restore it to its original state of voltage, a steady current of 3 A for 20 hours is required, the average terminal voltage being 1.44. Calculate the ampere-hour and watt-hour efficiency in this particular case.
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